N° 1-6736
Scope available
on www.cofrac.fr

CERTIFICATE #3478.01

# TEST REPORT

| | |
|---|---|
| EUT Description | **WLAN and BT, 2x2 PCIe M.2 1216 SD adapter card** |
| Brand Name | **Intel® Wi-Fi 6E AX211** |
| Model Name | **AX211D2WH** |
| FCC/IC ID | **FCC ID: PD9AX211D2H; IC ID 1000M-AX211D2H** |
| Date of Test Start/End | **2022-02-14 / 2023-10-25** |
| Features | **802.11ax, Tri Band, 2x2 Wi-Fi 6E + Bluetooth® 5.2**<br>(see section 5) |

| | |
|---|---|
| Applicant | **Intel Corporation SAS** |
| Address | **425 Rue de Goa – Le Cargo B6 – 06600 Antibes, FRANCE** |
| Contact Person | **Benjamin Lavenant** |
| Telephone/Fax/ Email | **Benjamin.lavenant@intel.com** |

| | |
|---|---|
| Reference Standards | **FCC CFR Title 47 Part 15 C**<br>**RSS-247 issue 3, RSS-Gen issue 5 A1**<br>(see section 1) |

| | |
|---|---|
| Test Report identification | **220117-04.TR63** |
| Revision Control | **Rev. 02**<br>**This test report revision replaces any previous test report revision**<br>(see section 8) |

The test results relate only to the samples tested.
Reference to accreditation shall be used only by full reproduction of test report.

Issued by

Digitally signed by Requin
Date: 2023.10.26 12:08:19 +02'00'

Cedric REQUIN
(Test Engineer Lead)

Reviewed by

Digitally signed by Chei el IN
Date: 2023.10.26 17:23:08 +02'00'

Cheiel IN
(Technical Lead)

**Intel Corporation S.A.S – WRF Lab**
**425 rue de Goa – Le Cargo B6 - 06600, Antibes, France**
**Tel. +33493001400 / Fax +33493001401**

# Table of Contents

## 1. Standards, reference documents and applicable test methods

| | |
|---|---|
| FCC | 1. FCC Title 47 CFR part 15 - Subpart C – §15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz. 2021-10-01 edition<br>2. FCC Title 47 CFR part 15 - Subpart C – §15.209 Radiated emission limits; general requirements. 2021-10-01 edition<br>3. FCC OET KDB 558074 D01 v05r02 - Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.<br>4. FCC OET KDB 662911 D01 v02r01 - Emissions Testing of Transmitters with Multiple Outputs in the Same Band.<br>5. ANSI C63.10-2013 - American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| ISED | 1. RSS-247 Issue 3 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices.<br>2. RSS-Gen Issue 5 A1- General Requirements for Compliance of Radio Apparatus.<br>3. FCC OET KDB 558074 D01 v05r02 - Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.<br>4. FCC OET KDB 662911 D01 v02r01 - Emissions Testing of Transmitters with Multiple Outputs in the Same Band.<br>5. ANSI C63.10-2013 - American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |

## 2. General conditions, competences and guarantees

- ✓ Tests performed under FCC standards identified in section 1 are covered by A2LA accreditation.
- ✓ Tests performed under ISED standards identified in section 1 are covered by Cofrac accreditation.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 testing laboratory accredited by the French Committee for Accreditation (Cofrac) with the certificate number 1-6736.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is a Registered Test Site listed by ISED, with ISED #1000Y and CAB identifier FR0005.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.

## 3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

| | |
|---|---|
| Temperature | 21.5ºC ± 3.6ºC |
| Humidity | 37.15% ± 8.95% |

## 4. Test samples

| Sample | Control # | Description | Model | Serial # | Date of receipt | Note |
|---|---|---|---|---|---|---|
| #1 | 220117-04.S01 | WiFi 6E Module | AX211D2WH | 7C0DA7F5B6AD | 2022-01-19 | Used for 30 MHz-1 GHz Spurious Emissions tests |
| | 180001-01.S21 | Socket | WsP/ThP /GfP/HrP | - | 2021-06-07 | |
| | 200803-01.S01 | Extender | ADEXELEC | 139245 | 2020-08-31 | |
| | 200611-01.S09 | adaptor | PowerBy SNJ A4 | - | 2020-11-30 | |
| | 200602-03.S06 | Absorber | - | - | 2020-07-03 | |
| | 220117-04.S16 | Laptop | Latitude 5401 | 7GJLK13 | 2022-02-11 | |
| | 220117-04.S10 | Antenna 2.4G | WRF-6dBi-PIFA-2.4G | - | 2022-02-09 | |
| | 220117-04.S13 | Antenna 2.4G | WRF-6dBi-PIFA-2.4G | - | 2022-02-09 | |
| #2 | 220117-04.S01 | WiFi 6E Module | AX211D2WH | 7C0DA7F5B6AD | 2022-01-19 | Used for 1-26 GHz Spurious Emissions tests |
| | 180001-01.S21 | Socket | WsP/ThP /GfP/HrP | - | 2021-06-07 | |
| | 200611-03.S31 | Extender | ADEXELEC | | 2020-08-19 | |
| | 200611-01.S09 | Adaptor | PowerBy SNJ A4 | - | 2020-11-30 | |
| | 200602-03.S06 | Absorber | - | - | 2020-07-03 | |
| | 200615-05.S09 | Laptop | Latitude 5401 | GVGLK13 | 2020-06-12 | |
| | 220117-04.S10 | Antenna 2.4G | WRF-6dBi-PIFA-2.4G | - | 2022-02-09 | |
| | 220117-04.S13 | Antenna 2.4G | WRF-6dBi-PIFA-2.4G | - | 2022-02-09 | |
| #3 | 220117-04.S05 | WiFi 6E Module | AX211D2WH | 2C0DA7F5B9B4 | 2022-01-19 | RF Conducted |
| | 220117-04.S08 | WiFi 6E Module | AX211D2WH | 2C0DA7F5B8CE | 2022-01-19 | |
| | 180000-01.S01 | Adapter 1216SD to M.2 | Adapter M2 | N/A | 2017-08-09 | |
| | 170000-01.S02 | Laptop | Latitude E5450 | 21HTPF2 | 2017-03-28 | |
| | 200611-01.S12 | Extender | XVT EXTENDER SNJ A4 | - | 2020-11-30 | |

## 5. EUT Features

The herein information is provided by the customer.

Intel WRF Lab declines any responsibility for the accuracy of the stated customer provided information, especially if it has any impact on the correctness of test results presented in this report.

| | |
|---|---|
| Brand Name | Intel® Wi-Fi 6E AX211 |
| Model Name | AX211D2WH |
| Software Version | DRTU_00699_99.0.69C (RSE tests)<br>DRTU_11195_99_2100_51G<br>DRTU.05236.99.0.84 |
| Driver Version | 22.110.0.2 / 22.180.0.2 |
| Prototype / Production | Production |
| Supported Radios | 802.11b/g/n/ax: 2.4GHz (2400.0 – 2483.5 MHz)<br>802.11a/n/ac/ax: 5.2GHz (5150.0 – 5350.0 MHz)<br>5.6GHz (5470.0 – 5725.0 MHz)<br>5.8GHz (5725.0 – 5895.0 MHz)<br>6.0GHz (5925.0 - 7125.0MHz)<br>Bluetooth 5.2: 2.4GHz (2400.0 – 2483.5 MHz) |

Antenna Information

| Transmitter | Aux – port 1 (chain A) | Main – port 2 (chain B) |
|---|---|---|
| Manufacturer | Intel | Intel |
| Antenna type | PIFA | PIFA |
| Part number | WRF-6dBi-PIFA-2.4G | WRF-6dBi-PIFA-2.4G |
| Declared antenna gain (dBi) 2.4 GHz | + 6.4 dBi | +6.4 dBi |

## 6. Remarks and comments

1. No deviations were made from the test methods listed in section 1 of this report

## 7. Test Verdicts summary

The statement of conformity to applicable standards in the table below are based on the measured values, without taking into account the measurement uncertainties.

### 7.1. BLE

| FCC part | RSS part | Test name | Verdict |
|---|---|---|---|
| 15.247 (a) (2) | RSS-247 Clause 5.2 (a) | 6dB Bandwidth | P |
| 15.247 (b) (3) | RSS-247 Clause 5.4 (d) | Maximum output power and E.I.R.P. | P |
| 15.247 (e) | RSS-247 Clause 5.2 (b) | Power spectral density | P |
| 15.247 (d)<br>15.209 | RSS-247 Clause 5.5<br>RSS-Gen A1 Clause 8.9 | Out-of-band Emissions (conducted) | P |
| 15.247 (d)<br>15.209 | RSS-247 Clause 5.5<br>RSS-Gen A1 Clause 8.9 | Spurious Emissions (radiated) | P |

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

## 8. Document Revision History

| Revision # | Modified by | Revision Details |
|---|---|---|
| Rev. 00 | K.KHATIB, V.KACULINI | First Issue |
| Rev. 01 | C. REQUIN | Antenna reference of the 2.4 GHz updated |
| Rev. 02 | C. REQUIN | Front page, section 1 and 2 updated. According to customer request, results in section B.1. have been updated using new DRTu and driver version. A typo on duty cycle value has been noticed and corresponding RMS TX output power levels were updated accordingly with correct values. |

# Annex A. Test & System Description

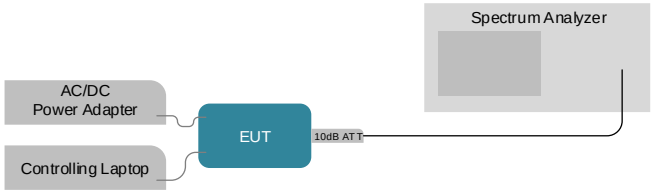
## A.1 Measurement System

Measurements were performed using the following setups, made in accordance to the general provisions of FCC OET KDB 558074 D01 DTS Meas Guidance.

The DUT was installed in a test fixture and this test fixture is connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using all different modes and modulation schemes, using the Intel proprietary tool DRTU.

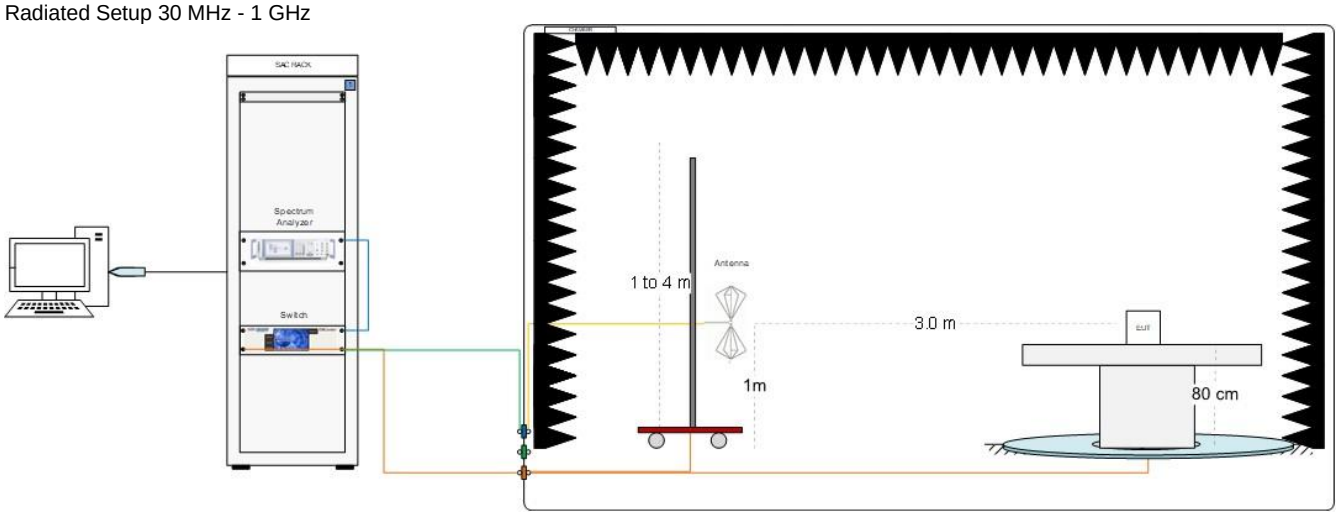
Conducted test setup

General setup

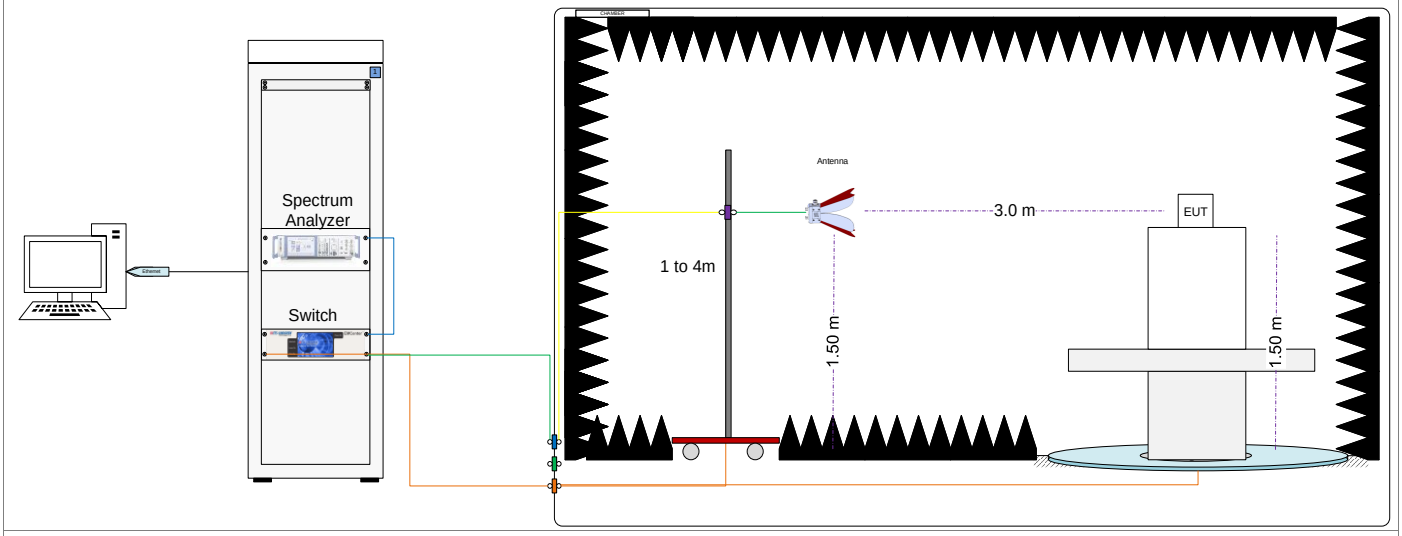



Radiated test setup

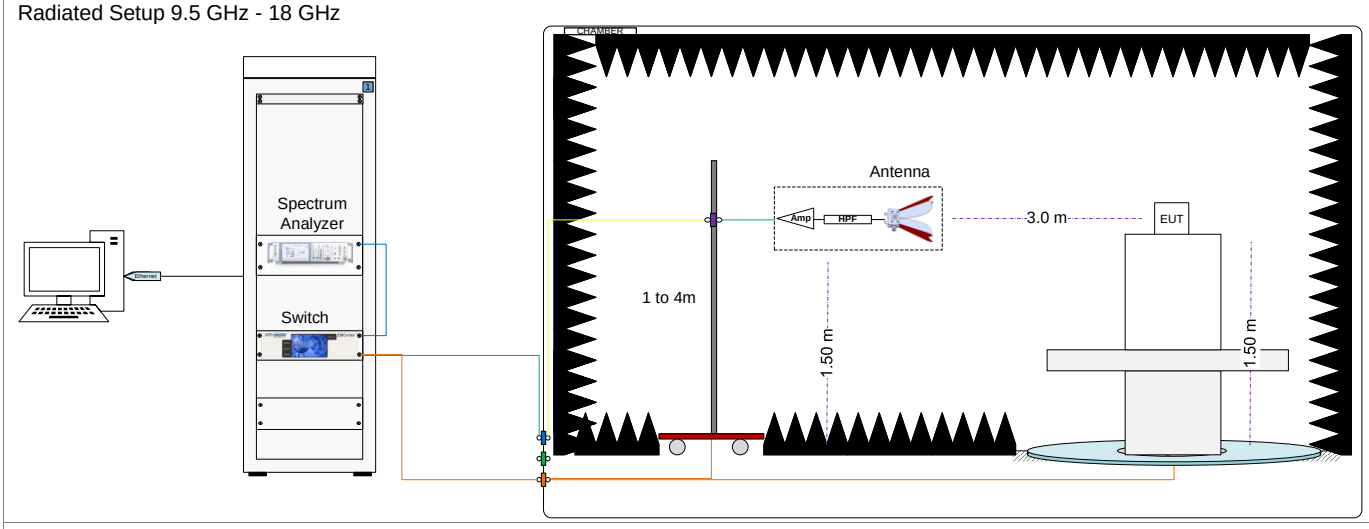
Radiated Setup 30 MHz - 1 GHz



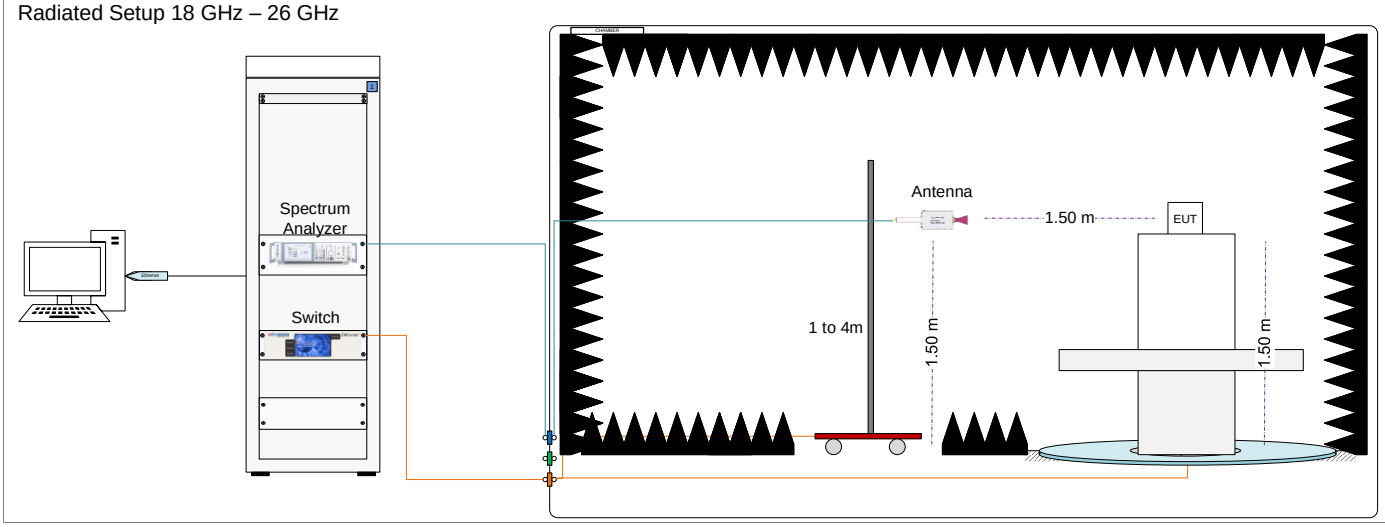
Radiated Setup 1 GHz – 9.5 GHz




Radiated Setup 9.5 GHz - 18 GHz




Radiated Setup 18 GHz – 26 GHz



Sample Calculation

The spurious received voltage V(dBµV) in the spectrum Analyzer is converted to Electric field strength using the transducer factor F corresponding to the Rx path Loss:

**F (dB/m)=** Rx Antenna Factor (dB/m) + Cable losses (dB) – Amplifiers Gain (dBi)
**E (dBµV) =** V(dBµV) + F (dB/m)

For field strength measurements made at other than the distance at which the applicable limit is specified, the field strength of the emission at the distance specified by the limit is deduced as follows:

$$E_{SpecLimit} = E_{Meas} + 20*\log(D_{Meas}/D_{SpecLimit})$$

where

*$E_{SpecLimit}$ is the field strength of the emission at the distance specified by the limit, in dBµV/m*
*$E_{Meas}$ is the field strength of the emission at the measurement distance, in dBµV/m*
*$D_{Meas}$ is the measurement distance, in m*
*$D_{SpecLimit}$ is the distance specified by the limit, in m*

## A.2 Test Equipment List

Conducted setup

| ID# | Device | Type/Model | Serial # | Manufacturer | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|---|
| 265-000* | Spectrum Analyzer | FSV30 | 101318 | Rohde & Schwarz | 2020-05-28 | 2022-05-28 |
| 134-000 | Spectrum Analyzer | FSV30 | 103308 | Rohde & Schwarz | 2023-07-26 | 2025-07-26 |
| 018-002* | Peak Power Meter | MA24406A | 11138 | ANRITSU | 2021-11-24 | 2023-11-24 |
| 019-000* | RF cable 100cm | PE360-100CM | N/A | PASTERNACK | 2022-02-04 | 2022-08-04 |
| 019-002* | 10dB Attenuator + MH4 | N/A | N/A | N/A | 2022-02-04 | 2022-08-04 |
| 322-000* | Temp & Humidity Logger | RA12E-TH1-RAS | RA12-B89702 | AVTECH | 2021-09-02 | 2023-09-02 |
| 413-000 | Measurement SW v1.5.4.2 | Octopi | N/A | Step AT | N/A | N/A |
| 280-000 | Spectrum Analyzer | FSV30 | 103310 | Rohde & Schwarz | 2023-06-22 | 2025-06-22 |
| 019-003 | SMA-SMA 100cm Cable | FLC-1M-SMSM+ | 21112742 | Mini-Circuits | 2023-06-02 | 2024-06-02 |
| 019-004 | Attenuator 6dB + SMA-MH4 | 3M-6 | 3M-6 | WEINSCHEL | 2023-06-02 | 2024-06-02 |
| 322-000 * | Temp & Humidity Logger | RA12E-TH1-RAS | RA12-B89702 | AVITECH | 2021-09-02 | 2023-09-02 |
| 407-000 | Temp & Humidity Logger | RA12E-TH1-RAS | RA12-E16EDA | AVITECH | 2023-07-12 | 2025-07-12 |

* Equipment not used during out of calibration period

Radiated Setup #1

| ID# | Device | Type/Model | Serial # | Manufacturer | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|---|
| 006-000* | Anechoic chamber | FACT 3 | 5720 | ETS Lindgren | 2022-01-12 | 2024-01-12 |
| 006-001 | Turntable | - | - | ETS Lindgren | NA | NA |
| 006-008 | Measurement Software v11.30.00 | EMC32 | 100623 | Rohde & Schwarz | N/A | N/A |
| 147-000* | Spectrum analyzer | FSW43 | 101847 | Rohde & Schwarz | 2020-11-02 | 2022-11-02 |
| 006-002 | Switch & Positioning | EMC center | 00159757 | ETS Lindgren | N/A | N/A |
| 006-011 | Boresight antenna mast | BAM4.0-P | P/278/2890.01 | Maturo | N/A | N/A |
| 006-019* | Biconical antenna 30 MHz – 1 GHz | UBAA9115 + BBVU9135 + DGA9552N | 0286 + CH 9044 | Schwarzbeck | 2022-02-01 | 2024-02-01 |
| 006-020* | Double Ridged Horn Antenna 1 GHz – 18 GHz | 3117 | 00157734 | ETS Lindgren | 2021-08-05 | 2023-08-05 |
| 057-000* | Horn Antenna 3117 + Amplifier + HPF9.5 | 3117 | 00167062+00169546 | ETS-Lindgren | 2020-06-15 | 2022-06-15 |
| 007-008* | Double Horn Ridged antenna | 3116C-PA | 00169308bis + 00196308 | ETS-Lindgren | 2021-08-05 | 2023-08-05 |
| 006-058* | RF Cable 7.5m | TestPro5 | 20 50 162 | Radiall | 2022-02-08 | 2022-08-08 |
| 006-051* | RF Cable 1.0m | CBL-1.5M-SMSM+ | 202879 | Mini-Circuits | 2022-02-02 | 2022-08-02 |
| 006-030* | RF Cable 1.2m | UFA147A-0-0480-200200 | MFR 64639223720-003 | Micro-coax | 2022-02-02 | 2022-08-02 |
| 006-034* | RF Cable 1.0m | UFA147A | - | Utilflex | 2022-02-02 | 2022-08-02 |
| 006-036* | RF Cable 1.0m | UFB311A-0-0590-50U50U | MFR 64639 223230-001 | Micro-coax | 2022-02-02 | 2022-08-02 |
| 006-038* | RF Cable 7.0m | R286304009 | - | Radiall | 2022-02-02 | 2022-08-02 |
| 006-039* | RF Cable 2.5m | 0500990992500KE | 19.23.395 | Radiall | 2022-02-02 | 2022-08-02 |
| 365-000* | Temperature & Humidity logger | RA12E-TH1-RAS | 00-80-A3-E1-6E-55 | Avtech | 2021-03-08 | 2023-03-08 |

* Equipment not used during out of calibration period
N/A: Not Applicable

Radiated Setup #2

| ID# | Device | Type/Model | Serial # | Manufacturer | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|---|
| 007-000* | Anechoic chamber | RFD-FA-100 | 5996 | ETS Lindgren | 2021-09-14 | 2023-09-14 |
| 007-002 | Turntable | - | - | ETS Lindgren | N/A | N/A |
| 007-003 | Antenna Tower | 2171B-3.0M | 00150123 | ETS Lindgren | N/A | N/A |
| 007-006 | Switch & Positioner | EMCenter | 00151232 | ETS Lindgren | N/A | N/A |
| 007-005 | Measurement SW, V11.20.00 | EMC32 | 100401 | Rohde & Schwarz | N/A | N/A |
| 127-000* | Spectrum Analyzer | FSV40 | 101358 | Rohde & Schwarz | 2021-01-15 | 2023-01-15 |
| 007-007* | Double Ridge Horn (1-18GHz) | 3117 | 00152266 | ETS Lindgren | 2020-03-18 | 2022-03-18 |
| 057-000* | Horn Antenna 3117 + Amplifier + HPF9.5 | 3117 | 00167062+00169546 | ETS-Lindgren | 2020-06-15 | 2022-06-15 |
| 007-008* | Double Horn Ridged antenna | 3116C-PA | 00169308bis + 00196308 | ETS-Lindgren | 2021-08-05 | 2023-08-05 |
| 007-022* | RF Cable 1-18GHz, 1.5m | 0501050991200GX | 19.23.493 | Radiall | 2022-02-03 | 2022-08-03 |
| 007-020* | RF Cable 1-18GHz, 1.2 m | 2301761761200PJ | 12.22.1104 | Radiall | 2022-02-03 | 2022-08-03 |
| 007-011* | RF Cable 1-18GHz – 6.5m | 140-8500-11-51 | 001 | Spectrum | 2022-02-03 | 2022-08-03 |
| 007-015* | RF Cable 1GHz-18GHz 1.5m | - | - | Spirent | 2022-02-03 | 2022-08-03 |
| 007-014* | RF Cable 18-40 GHz 6m | R286304009 | 1747364 | Radiall | 2022-02-03 | 2022-08-03 |
| 007-023* | RF Cable 1m DC-40GHz | PE360-100CM | - | Pasternack | 2022-02-03 | 2022-08-03 |
| 007-018* | RF Cable 1-9.5GHz 1.2m | 0500990991200KE | - | Radiall | 2022-02-03 | 2022-08-03 |
| 325-000* | Temp & Humidity Logger | RA12E-TH1-RAS | RA12-B9B7C6 | Avtech | 2022-01-17 | 2024-01-17 |

* Equipment not used during out of calibration period

N/A: Not Applicable

Shared Radiated Equipment

| ID# | Device | Type/Model | Serial # | Manufacturer | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|---|
| 412-000 | DRTU Power finder V2.0 | - | - | Intel | NA | NA |
| 139-000* | Power Sensor | NRP-Z81 | 104383 | Rohde & Schwarz | 2021-04-07 | 2023-04-07 |
| 140-000* | Power Sensor | NRP-Z81 | 104382 | Rohde & Schwarz | 2020-04-08 | 2022-04-08 |

* Equipment not used during out of calibration period

N/A: Not Applicable

## A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the table below with a coverage factor of k = 2 to indicate a 95% level of confidence:

| Measurement type | Uncertainty | Unit |
|---|---|---|
| Timing | ±0.12 | % |
| Power Spectral density | ±1.47 | dB |
| Occupied bandwidth | ±2.07 | % |
| Conducted Power | ±1.03 | dB |
| Conducted Out of band Emission <7 GHz | ±1.67 | dB |
| Radiated tests <1GHz | ±6.07 | dB |
| Radiated tests 1GHz – 26.5 GHz | ±5.92 | dB |

# Annex B. Test Results

The herein test results were performed by:

| Test case measurement | Test Personnel |
|---|---|
| 6dB Bandwidth | C.Requin, V.Kaculini, T. Mathieu |
| Maximum output power and E.I.R.P. | C.Requin, V.Kaculini, T. Mathieu |
| Power spectral density | C.Requin, V.Kaculini, T. Mathieu |
| Out-of-band Emissions (conducted) | C.Requin, V.Kaculini, T. Mathieu |
| Out-of-band Emissions (radiated) | K.Khatib, R.Simonini, N.Bui |

## B.1 Test Results BLE

### B.1.1 6dB & 99% Bandwidth

Test limits

| FCC part | RSS part | Limits |
|---|---|---|
| 15.247 (a) (2) | RSS-247 Clause 5.2 (a) | Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. |

Test procedure

The conducted setup shown in section *Test & System Description* was used to measure the 6dB & 99% Bandwidth. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

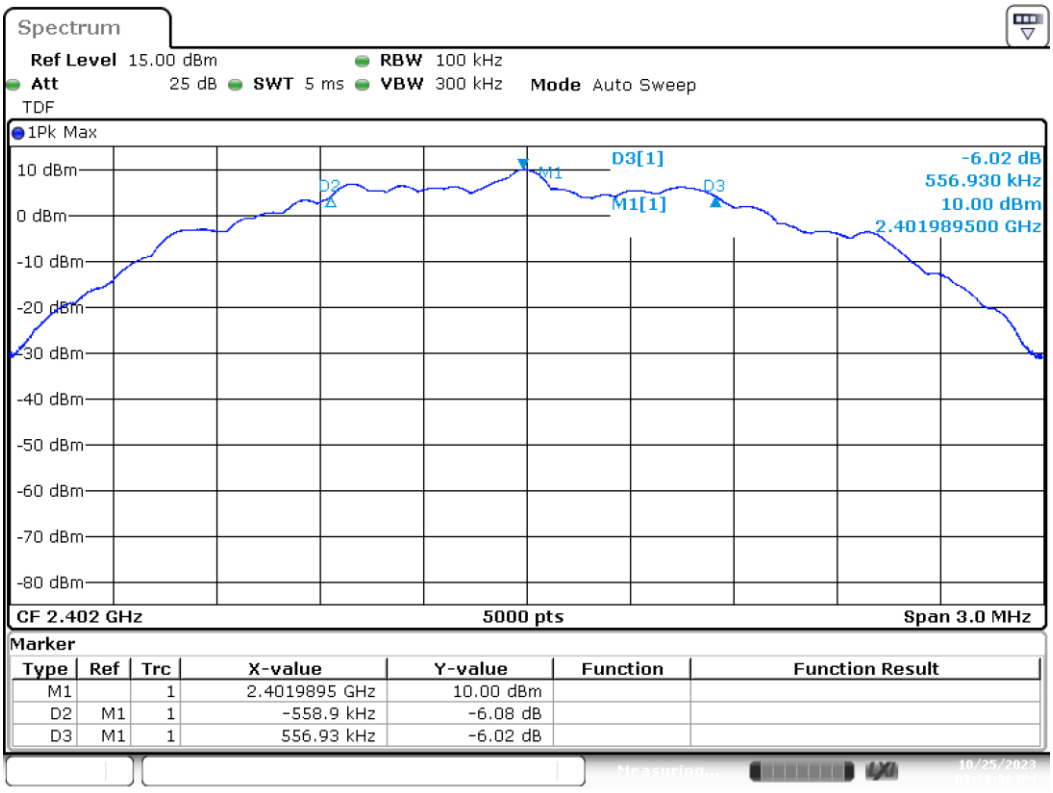
Results tables

| Mode | Frequency [MHz] | 6dB BW [MHz] | 99% BW [MHz] |
|---|---|---|---|
| BLE | 2402 | 1.116 | 2.088 |
| | 2440 | 1.123 | 2.082 |
| | 2480 | 1.135 | 2.088 |

**Results screenshot**

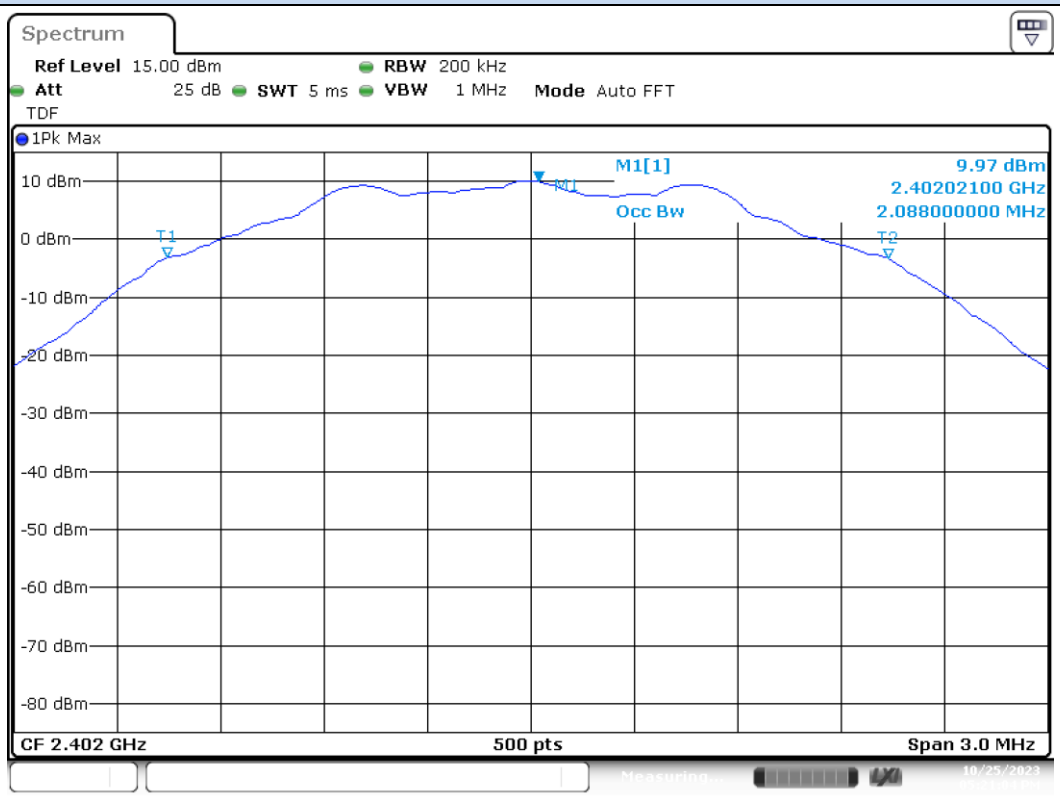
# BLE

## 6dB BW – 2402 MHz



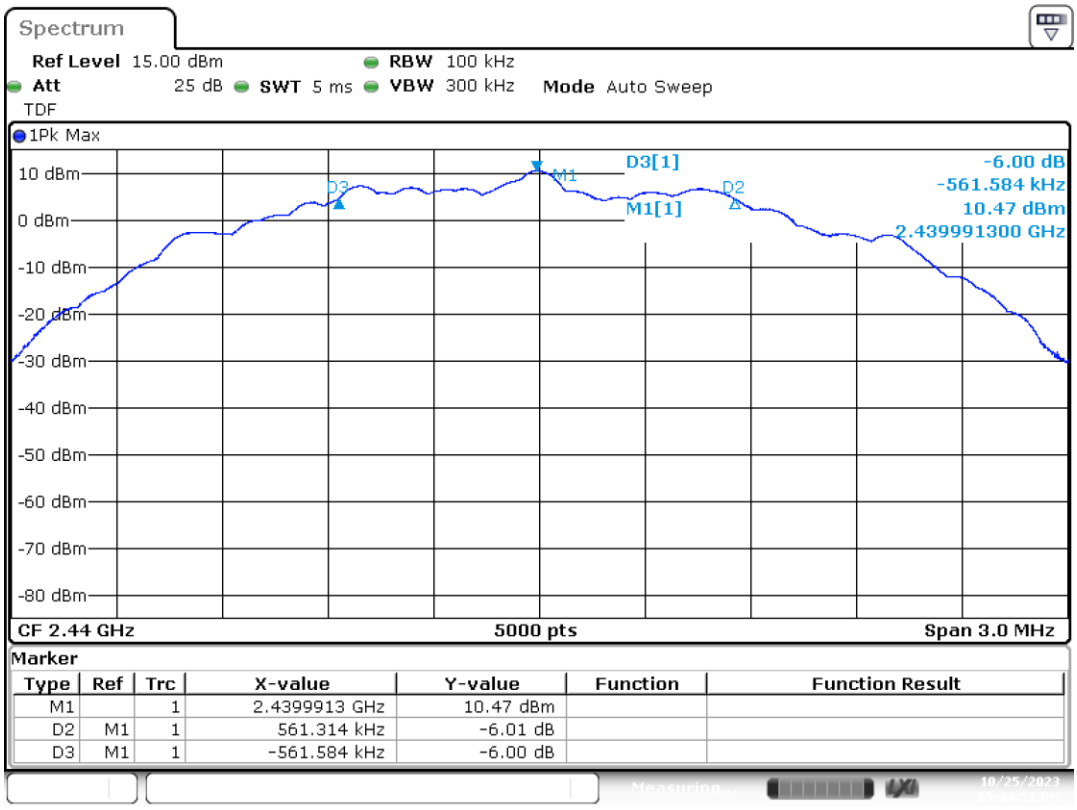

Date: 25.OCT.2023 17:18:07

## 99% BW – 2402 MHz



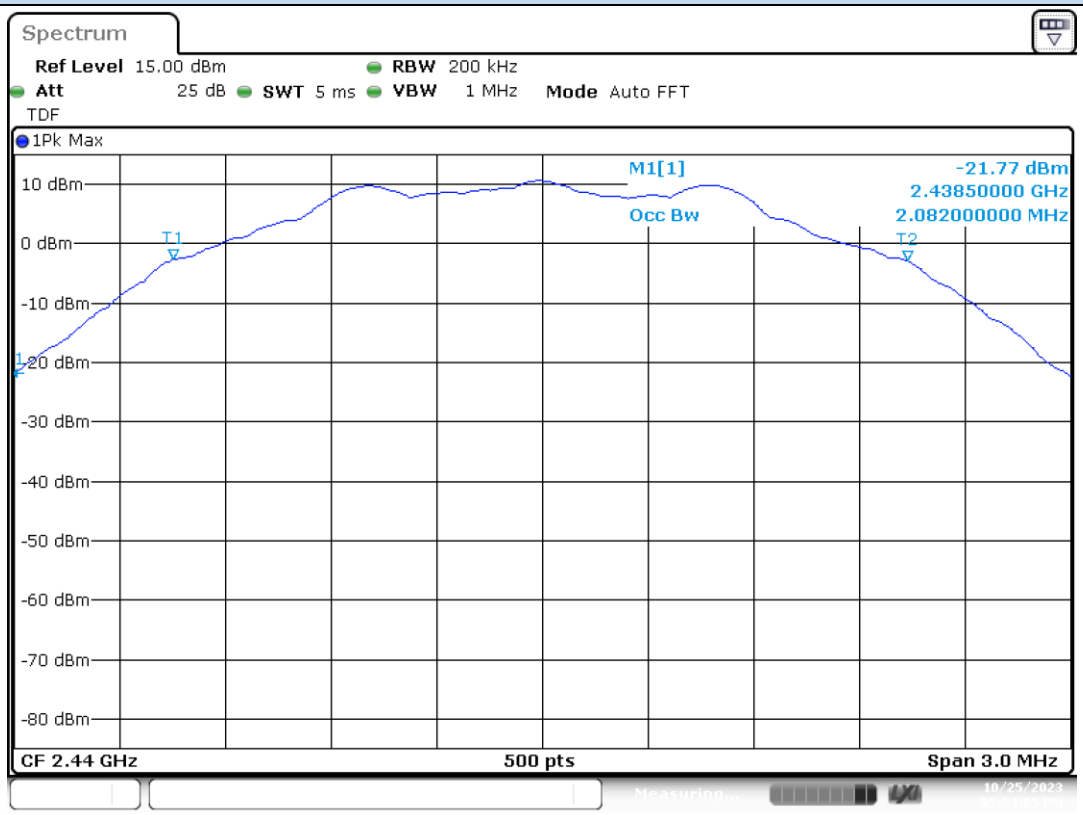

Date: 25.OCT.2023 17:21:04

## 6dB BW – 2440 MHz



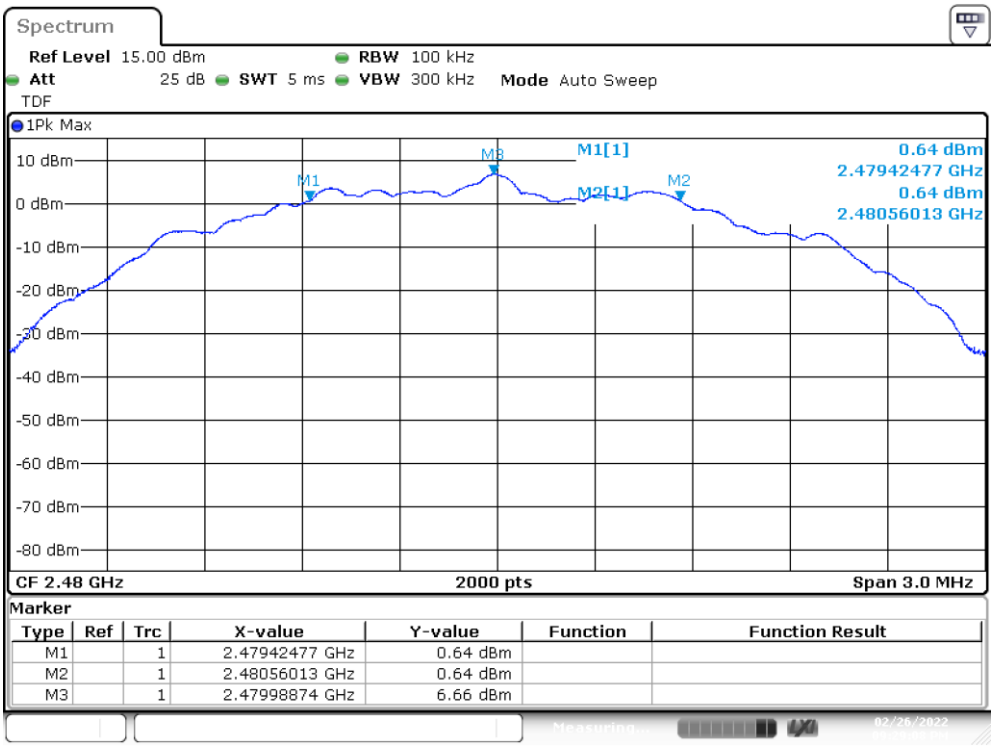

Date: 25.OCT.2023 17:44:52

## 99% BW – 2440 MHz

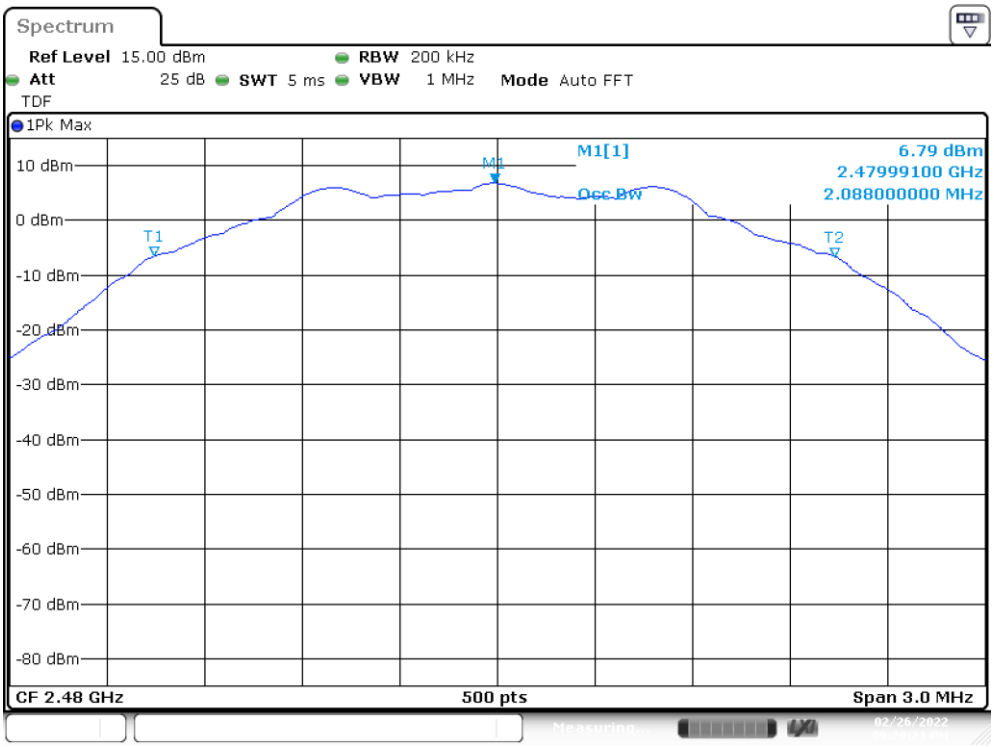



Date: 25.OCT.2023 17:24:06

6dB BW – 2480 MHz




99% BW – 2480 MHz



### B.1.2 Maximum Output Power and antenna gain

Test limits

| | Limits |
|---|---|
| FCC Part 15.247 (b) (3) | (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:<br><br>(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level.<br>(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. |
| RSS-247 Clause 5.4 (d) | For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).<br>As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode |

**Test procedure:**

The Maximum peak conducted output power was measured using the *RBW ≥ DTS bandwidth* method defined in paragraph 11.9.1.1 of ANSI C63.10-2013.

The Maximum conducted average output power was measured using the channel integration method according to Method AVGSA-2, defined in paragraph 11.9.2.2.4 of ANSI C63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

The conducted setup shown in section *Test & System Description* was used to measure the maximum conducted output power. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

Results tables

| Mode | Meas. Duty Cycle [%] | Frequency [MHz] | Peak Power [dBm] | | |
|---|---|---|---|---|---|
| | | | Measured Conducted Output Power | EIRP | Peak Output Power [mW] |
| BLE | 31.50 | 2402 | 10.19 | 16.59 | 10.45 |
| | | 2440 | 10.65 | 17.05 | 11.61 |
| | | 2480 | 6.78 | 13.18 | 4.76 |

Max Value
Min Value

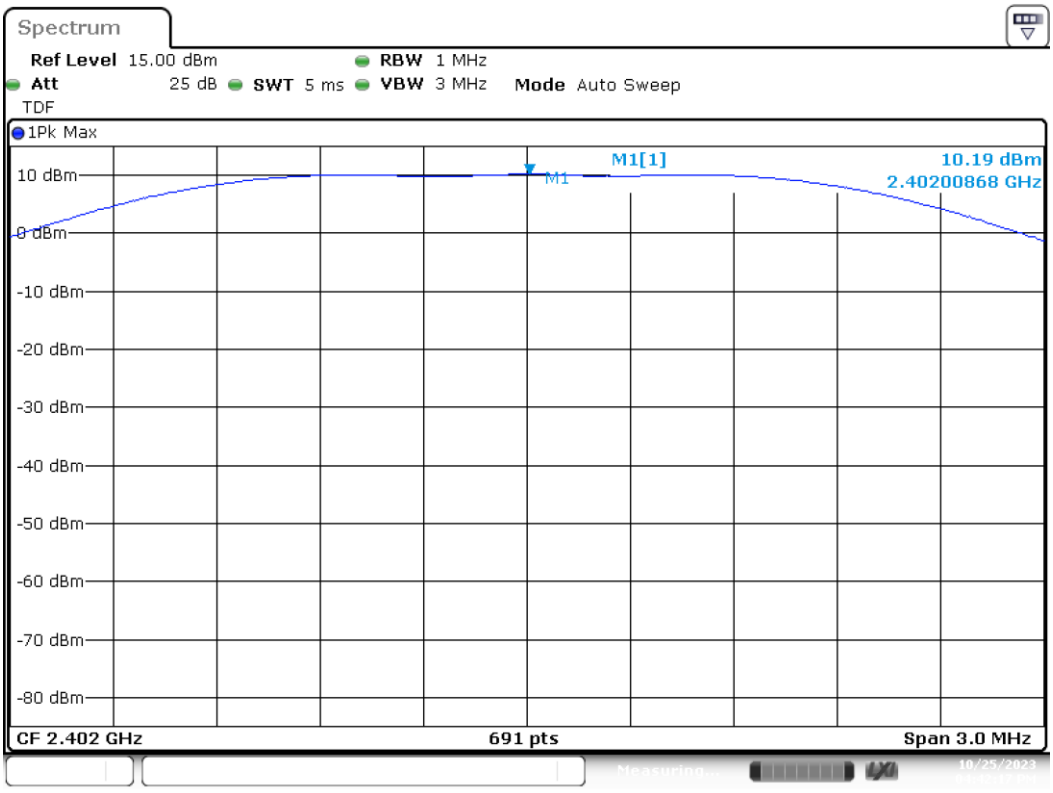
| Mode | Meas. Duty Cycle [%] | Frequency [MHz] | Average Output Power* [dBm] | | | |
|---|---|---|---|---|---|---|
| | | | Maximum Conducted Output Power | Maximum Conducted Output Power Duty cycle Compensated | EIRP | Average Output Power [mW] |
| BLE | 31.50 | 2402 | 5.22 | 10.24 | 16.64 | 10.56 |
| | | 2440 | 5.70 | 10.72 | 17.12 | 11.79 |
| | | 2480 | 1.89 | 6.91 | 13.31 | 4.91 |

* Output Power RMS values are shown for indicative purpose only

Results screenshot

# BLE

## Max Power Peak – 2402 MHz

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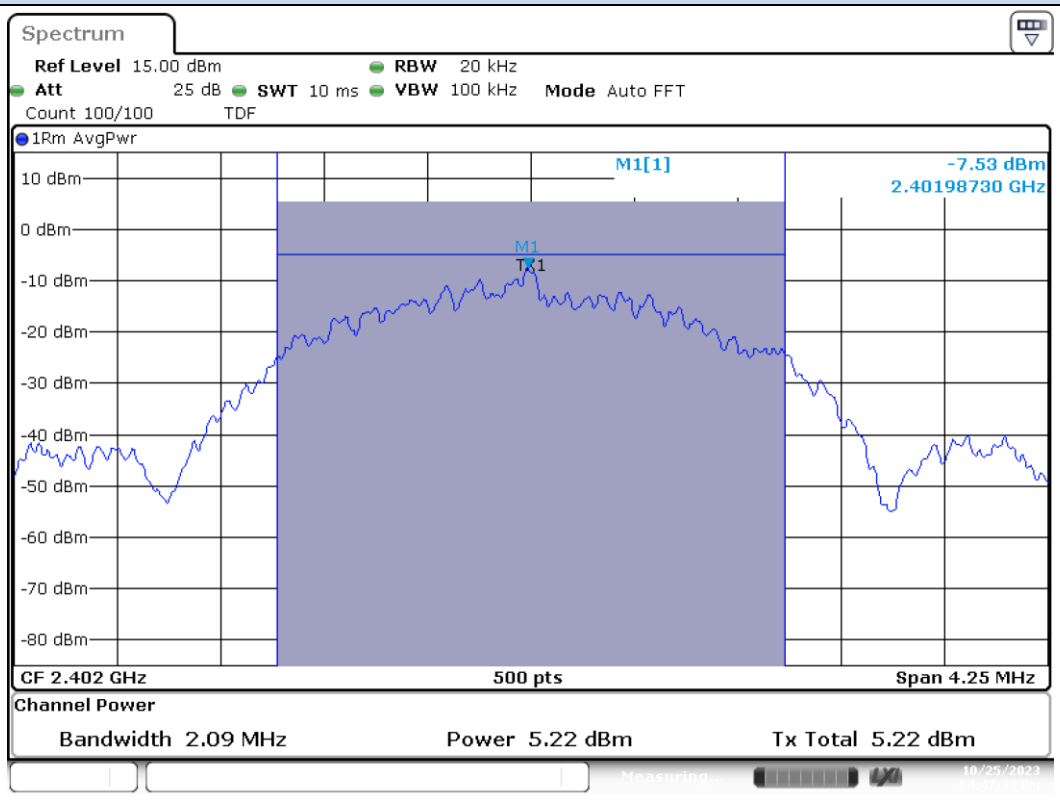
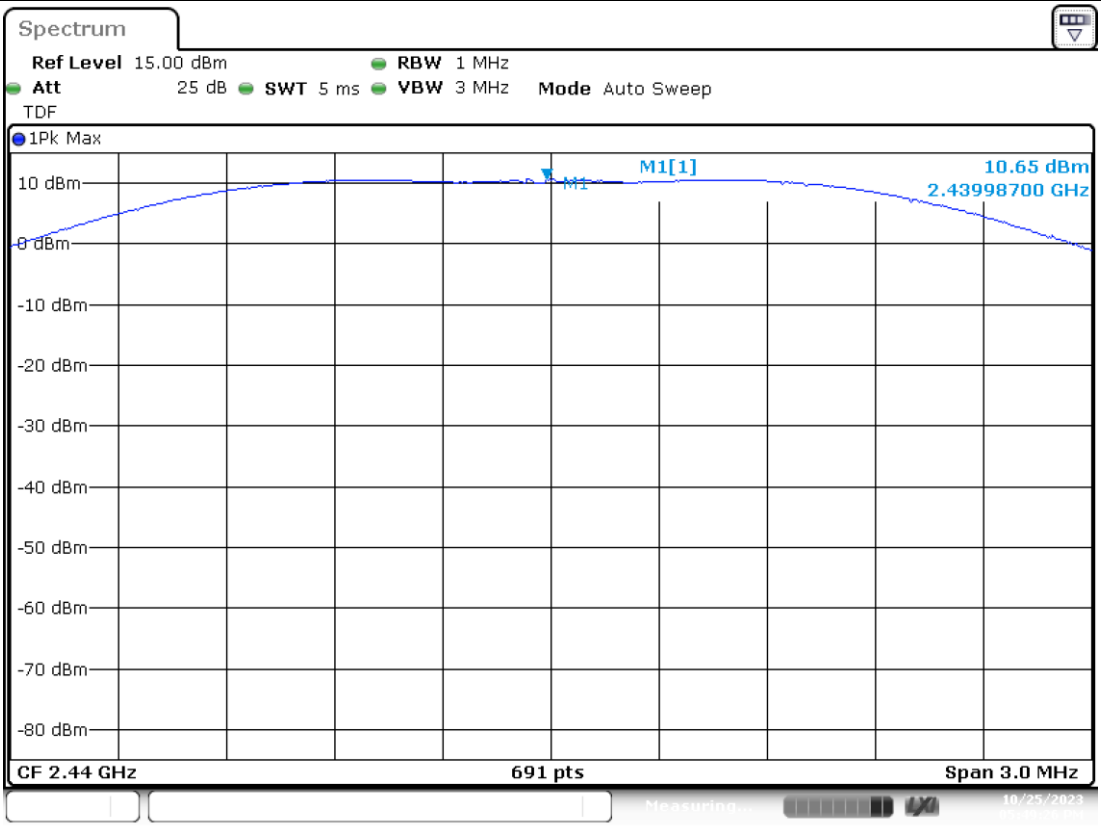
## Max Power RMS – 2402 MHz




Date: 25.OCT.2023 16:47:39

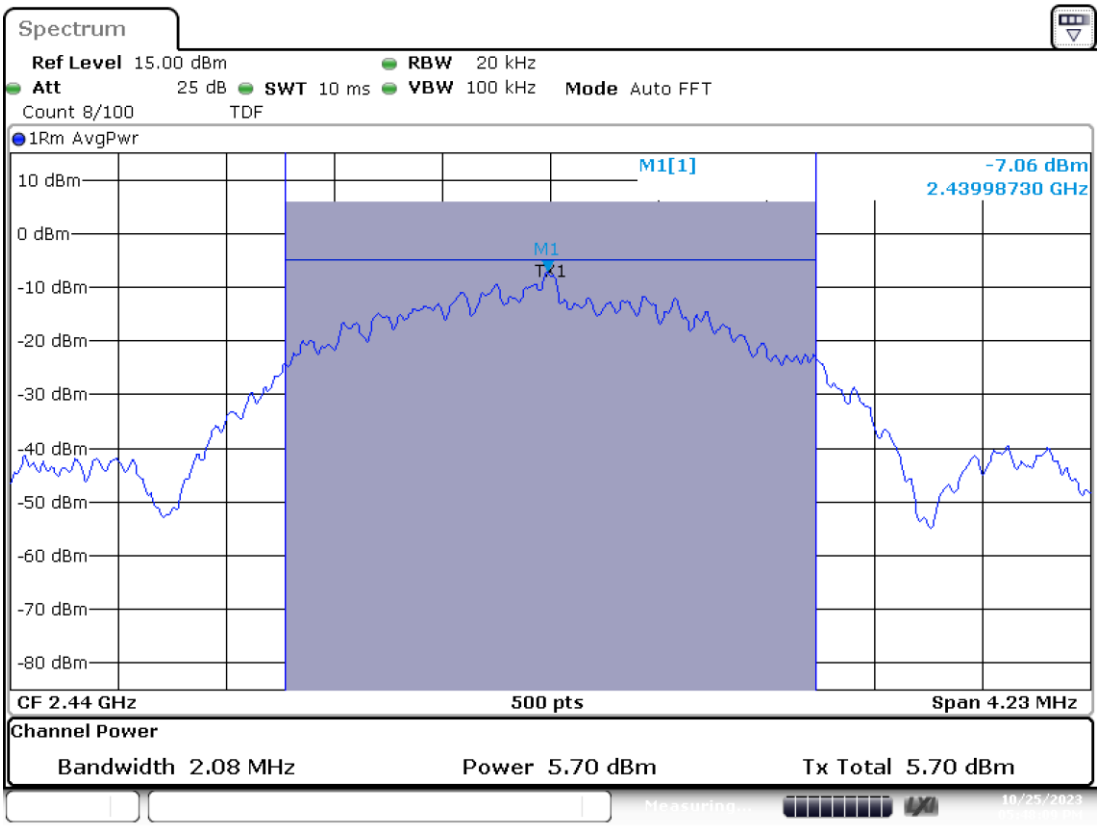
# BLE

## Max Power Peak – 2440 MHz




Date: 25.OCT.2023 17:49:27

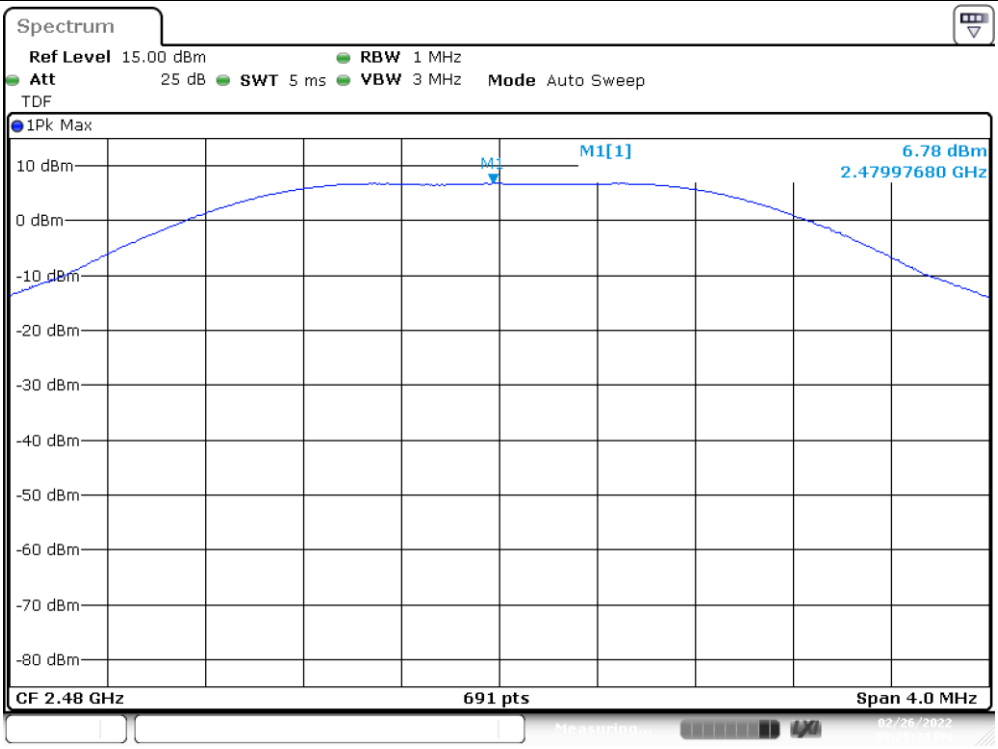
## Max Power RMS – 2440 MHz



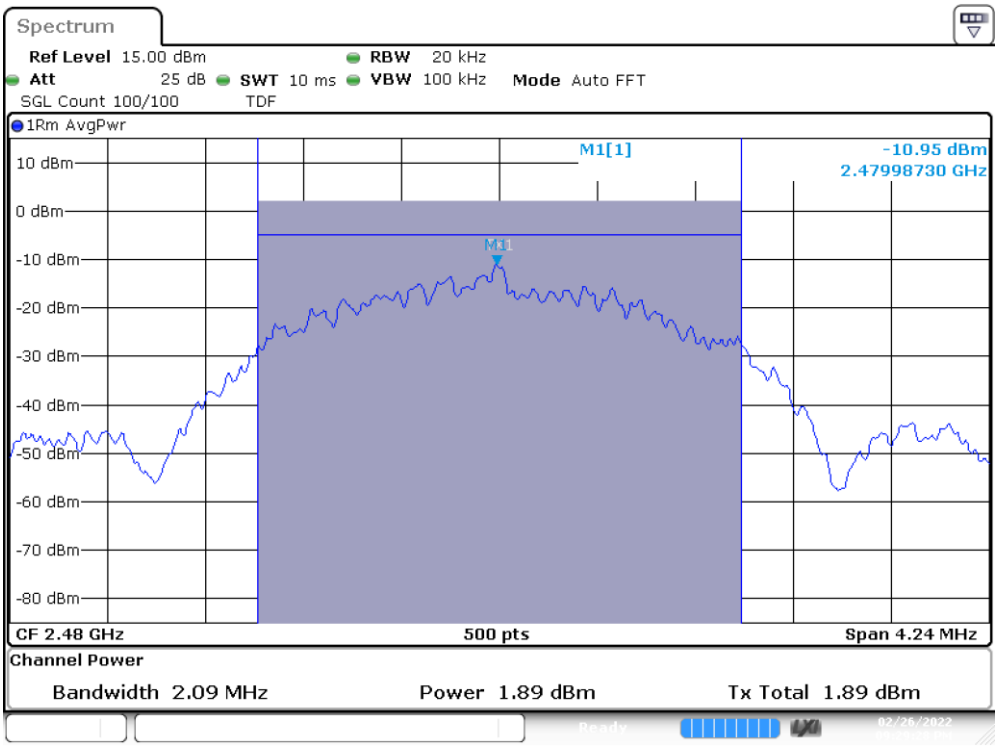

Date: 25.OCT.2023 17:48:10

# BLE

## Max Power Peak – 2480 MHz




## Max Power RMS – 2480 MHz



### B.1.3 Power Spectral Density

Test limits

| FCC part | RSS part | Limits |
|---|---|---|
| 15.247 (e) | RSS-247 Clause 5.2 (b) | For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density. |

Test procedure

The maximum peak power spectral density level of the fundamental emission was measured using the method PKPSD, defined in paragraph 11.10.2 of ANSI C63.10-2013.

The conducted setup shown in section *Test & System Description* was used to measure the power spectral density. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

Results tables

| Mode | CH | Frequency [MHz] | PSD Peak [dBm/3kHz] |
|---|---|---|---|
| BLE | 0 | 2402 | -6.99 |
| | 19 | 2440 | -7.66 |
| | 39 | 2480 | -10.61 |

### B.1.4 Out-of-band emission (Conducted)

Test Limits

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.247 (d)</td><td>RSS-247<br>Clause 5.5</td><td>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.</td></tr>
<tr><td>15.209</td><td>RSS-Gen A1<br>Clause 8.9</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):
<table>
<tr><th>Freq Range (MHz)</th><th>Field Stregth (µV/m)</th><th>Field Stregth (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>
The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.<br>For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

Test procedure

In case of band edge measurements falling in restricted bands, the declared Antenna Gain is also compensated in the graph.

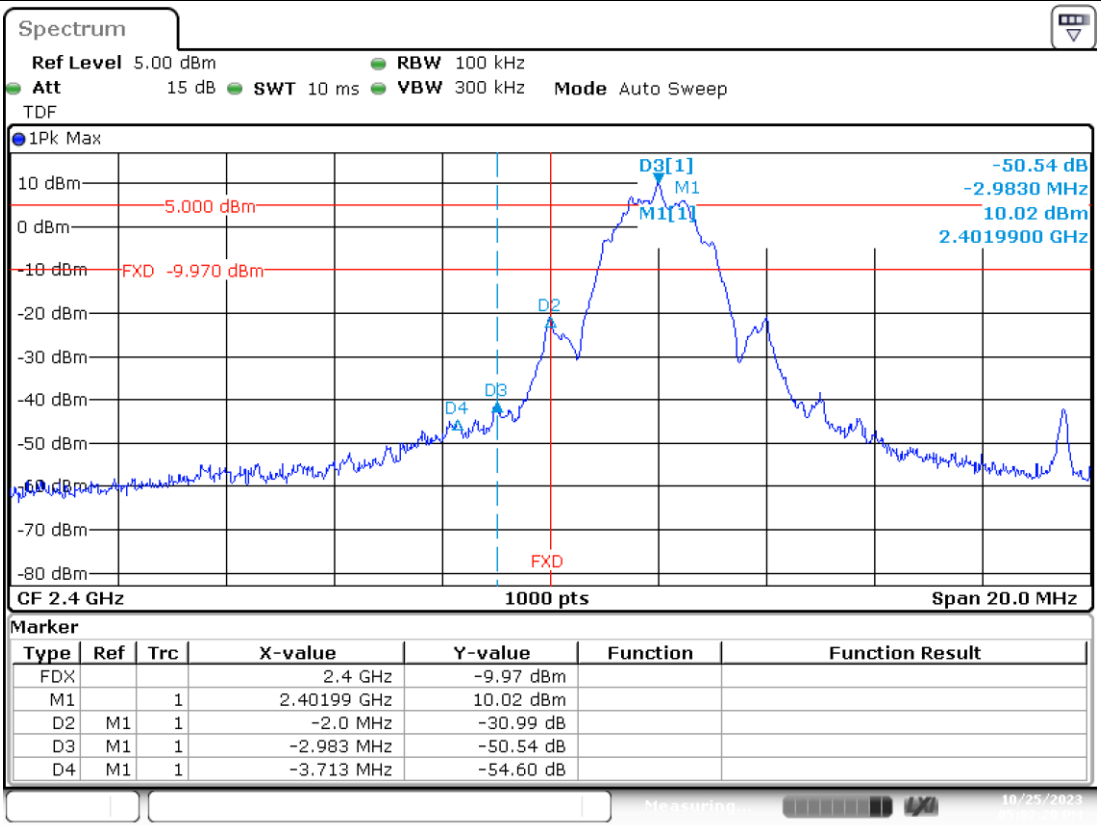
For band edge measurements falling in restricted bands, the following limits in dBm were applied for the average detector after the conversion from the limits detailed above in dBµV/m, according to FCC 47 CFR part 15 - Subpart C – §15.209(a). The limits in dBm for peak detector are 20dB above the indicated values in the table.

| §15.209(a) | | | Converted values | |
|---|---|---|---|---|
| Freq Range (MHz) | Distance (m) | Field strength (microvolts/meter) | Field strength (dB microvolts/meter) | Power (dBm) |
| Above 960 | 3 | 500 | 54.0 | -41.2 |

The conducted setup shown in section *Test & System Description* was used to measure the out-of-band emissions. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

# BLE

## BE Low Freq Section – 2402 MHz

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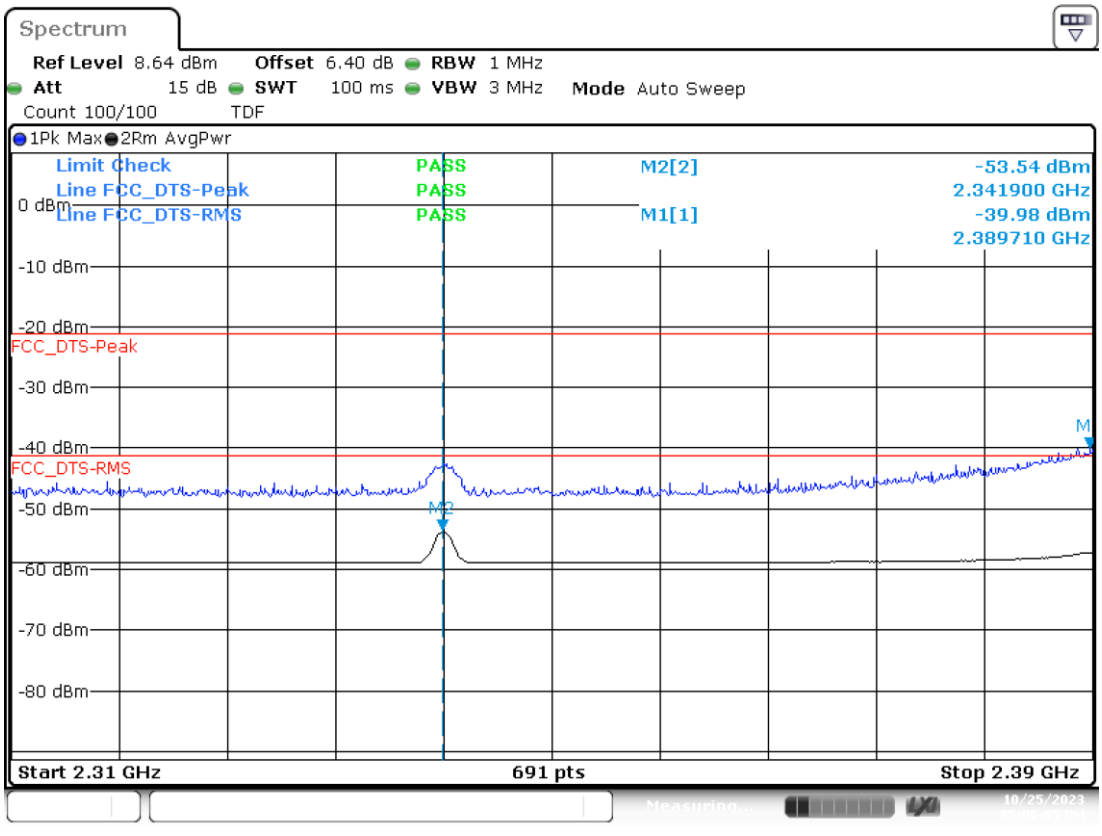
## BE Low (Restricted) – 2402 MHz

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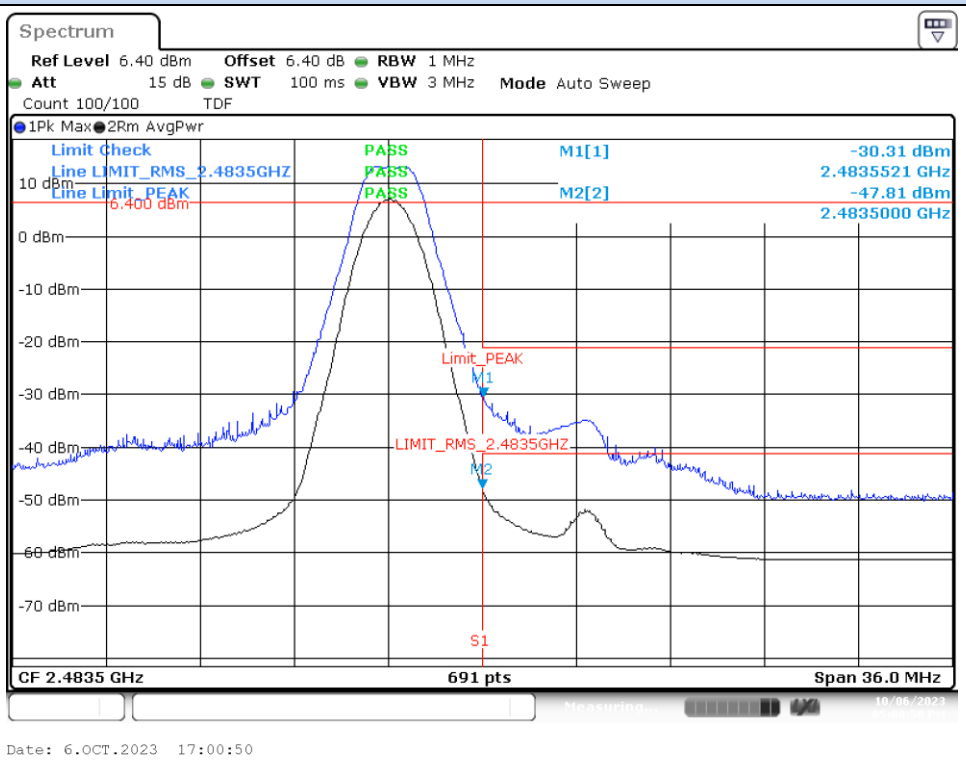
| BE High Freq Section (Restricted) – 2480 MHz |
|---|



### B.1.5 Radiated spurious emission

Standards references

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.247 (d)<br>15.209</td><td>RSS-247<br>Clause 5.5<br>RSS-Gen A1<br>Clause 8.9</td><td>Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a):
<table>
<tr><th>Freq Range (MHz)</th><th>Field Stregth (µV/m)</th><th>Field Stregth (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>54</td><td>3</td></tr>
</table>
The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.<br>For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

Test procedure

The radiated setups shown in section *Test & System Description* were used to measure the radiated spurious emissions. were used to measure the radiated spurious emissions.
Depending of the frequency range and bands being tested, different antennas and filters were used.
The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.
The radiated spurious emissions were measured on the lowest, middle and highest channels.

Test Results

# Radiated Spurious - 30 MHz – 1 GHz

## All modes

| Frequency | Level | Detector | Limit | Margin | Polar |
|---|---|---|---|---|---|
| MHz | dBµV/m | --- | dBµV/m | dB | --- |
| 50.2 | 23.7 | Quasi-Peak | 40.0 | 16.3 | V |

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

# Radiated Spurious - 1 GHz – 26 GHz

## BLE – 2402 MHz

| Frequency | Level | Detector | Limit | Margin | Polar |
|---|---|---|---|---|---|
| MHz | dBµV/m | --- | dBµV/m | dB | --- |
| 2342.0 | 55.3 | Peak | 74.0 | 18.7 | V |
| 2342.0 | 43.5 | Average | 54.0 | 10.4 | V |
| 9607.0 | 51.7 | Peak | 74.0 | 22.3 | V |
| 9608.5 | 40.2 | Average | 54.0 | 13.8 | V |
| 25850.5 | 50.6 | Peak | 74.0 | 23.4 | H |
| 25852.0 | 38.7 | Average | 54.0 | 15.3 | H |

## BLE – 2440 MHz

| Frequency | Level | Detector | Limit | Margin | Polar |
|---|---|---|---|---|---|
| MHz | dBµV/m | --- | dBµV/m | dB | --- |
| 2380.0 | 48.0 | Average | 54.0 | **6.0** | V |
| 2380.5 | 55.9 | Peak | 74.0 | 18.1 | V |
| 2500.0 | 44.0 | Average | 54.0 | 10.0 | V |
| 2500.5 | 56.3 | Peak | 74.0 | 17.7 | V |
| 9758.5 | 50.9 | Peak | 74.0 | 23.1 | V |
| 9759.0 | 40.0 | Average | 54.0 | 14.0 | V |
| 25838.5 | 50.5 | Peak | 74.0 | 23.5 | H |
| 25838.5 | 38.7 | Average | 54.0 | 15.3 | H |

## BLE – 2480 MHz

| Frequency | Level | Detector | Limit | Margin | Polar |
|---|---|---|---|---|---|
| MHz | dBµV/m | --- | dBµV/m | dB | --- |
| 2540.0 | 44.8 | Average | 54.0 | 9.2 | V |
| 2542.5 | 56.1 | Peak | 74.0 | 17.9 | V |
| 17804.0 | 43.7 | Average | 54.0 | 10.3 | H |
| 17805.5 | 56.0 | Peak | 74.0 | 18.0 | H |
| 25835.0 | 38.7 | Average | 54.0 | 15.3 | H |
| 25835.5 | 51.8 | Peak | 74.0 | 22.2 | V |