# TEST REPORT

## Test Report No. : UL-RPT-RP14777092-116A

| | | |
|---|---|---|
| **Customer** | : | Cyden Limited |
| **Model No. / HVIN** | : | 6036 |
| **PMN** | : | Skin i-expert |
| **FCC ID** | : | 2BAZ9-6036 |
| **ISED Certification No.** | : | IC: 30469-6036 |
| **Technology** | : | WLAN |
| **Test Standard(s)** | : | FCC Parts 15.209(a) & 15.247<br>Innovation, Science and Economic Development Canada<br>RSS-247 Issue 2 February 2017<br>RSS-Gen Issue 5 February 2021 |
| **Test Laboratory** | : | UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH, United Kingdom |

1. This test report shall not be reproduced except in full, without the written approval of UL International (UK) Ltd.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 3.0 supersedes all previous versions.

**Date of Issue:** 26 June 2023

**Checked by:**

Ben Mercer
Lead Project Engineer, Radio Laboratory

**Company Signatory:**

Sarah Williams
RF Operations Leader, Radio Laboratory

5772

## Customer Information

| | |
|---|---|
| **Company Name:** | Cyden Limited |
| **Address:** | Office Block A,<br>Bay Studios Business Park,<br>Fabian Way,<br>Swansea,<br>SA1 8QB<br>Wales, UK |

## Report Revision History

| Version Number | Issue Date | Revision Details | Revised By |
|---|---|---|---|
| 1.0 | 22/06/2023 | Initial Version | Ben Mercer |
| 2.0 | 26/06/2023 | Antenna gain updated | Ben Mercer |
| 3.0 | 26/06/2023 | Antenna gain updated in output power section | Ben Mercer |

## Table of Contents

**Customer Information** ..... **2**

**Report Revision History** ..... **2**

**1 Attestation of Test Results** ..... **4**
1.1 Description of EUT 4
1.2 General Information 4
1.3 Summary of Test Results 4
1.4 Deviations from the Test Specification 4

**2 Summary of Testing** ..... **5**
2.1 Facilities and Accreditation 5
2.2 Methods and Procedures 5
2.3 Calibration and Uncertainty 6
2.4 Test and Measurement Equipment 7

**3 Equipment Under Test (EUT)** ..... **9**
3.1 Identification of Equipment Under Test (EUT) 9
3.2 Modifications Incorporated in the EUT 9
3.3 Additional Information Related to Testing 10
3.4 Description of Available Antenna 10
3.5 Description of Test Setup 11

**4 Antenna Port Test Results** ..... **15**
4.1 Transmitter Maximum Peak Output Power 15

**5 Radiated Test Results** ..... **17**
5.1 Transmitter Radiated Emissions <1 GHz 17
5.2 Transmitter Radiated Emissions >1 GHz 19
5.3 Transmitter Band Edge Radiated Emissions 22

# 1 Attestation of Test Results

## 1.1 Description of EUT

The equipment under test was an IPL hair removal device containing a *Bluetooth* LE and 2.4 GHz WLAN transciever.

## 1.2 General Information

| | |
|---|---|
| **Specification Reference:** | 47CFR15.247 |
| **Specification Title:** | Code of Federal Regulations Volume 47 (Telecommunications):<br>Part 15 Subpart C (Intentional Radiators) – Section 15.247 |
| **Specification Reference:** | 47CFR15.209 |
| **Specification Title:** | Code of Federal Regulations Volume 47 (Telecommunications):<br>Part 15 Subpart C (Intentional Radiators) – Section 15.209 |
| **Specification Reference:** | RSS-Gen Issue 5 February 2021 |
| **Specification Title:** | General Requirements for Compliance of Radio Apparatus |
| **Specification Reference:** | RSS-247 Issue 2 February 2017 |
| **Specification Title:** | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |
| **Site Registration:** | FCC: 685609, ISEDC: 20903 |
| **FCC Lab. Designation No.:** | UK2011 |
| **ISEDC CABID:** | UK0001 |
| **Location of Testing:** | Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom |
| **Test Dates:** | 10 May 2023 to 11 May 2023 |

## 1.3 Summary of Test Results

| FCC Reference (47CFR) | ISED Canada Reference | Measurement | Result |
|---|---|---|---|
| Part 15.247(b)(3) | RSS-Gen 6.12 / RSS-247 5.4(d) | Transmitter Maximum Peak Output Power | ✓ |
| Part 15.247(d) & 15.209(a) | RSS-Gen 6.13 / RSS-247 5.5 | Transmitter Radiated Emissions | ✓ |
| Part 15.247(d) & 15.209(a) | RSS-Gen 6.13 / RSS-247 5.5 | Transmitter Band Edge Radiated Emissions | ✓ |

**Key to Results**

✓ = Complied ✗ = Did not comply

## 1.4 Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

# 2 Summary of Testing

## 2.1 Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| | |
|---|---|
| Site 1 | X |
| Site 2 | - |
| Site 17 | - |

UL International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

## 2.2 Methods and Procedures

| | |
|---|---|
| **Reference:** | ANSI C63.10-2013 |
| **Title:** | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| **Reference:** | KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019 |
| **Title:** | 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 |

## 2.3 Calibration and Uncertainty

### Measuring Instrument Calibration

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

### Measurement Uncertainty & Decision Rule

### Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

### Decision Rule

The decision rule applied is based upon the accuracy method criteria. The measurement uncertainty is met and the result is considered in conformance with the requirement criteria if the observed value is within the prescribed limit.

### Measurement Uncertainty

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type | Range | Confidence Level (%) | Calculated Uncertainty |
|---|---|---|---|
| Conducted Maximum Peak Output Power | 2.4 GHz to 2.4835 GHz | 95% | ±0.58 dB |
| Radiated Spurious Emissions | 9 kHz to 30 MHz | 95% | ±5.32 dB |
| Radiated Spurious Emissions | 30 MHz to 1 GHz | 95% | ±3.30 dB |
| Radiated Spurious Emissions | 1 GHz to 25 GHz | 95% | ±3.16 dB |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## 2.4 Test and Measurement Equipment

### Test Equipment Used for Transmitter Maximum Peak Output Power

| Asset No. | Instrument | Manufacturer | Type No. | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|---|---|---|---|---|---|---|
| A213953 | Attenuator | Atlantic Microwave | ATT10KXP-483082-N4N5 | 21415050 | Calibrated before use | - |
| M1835 | Signal Analyzer | Rohde & Schwarz | FSV30 | 103050 | 19 Sep 2023 | 12 |
| G0615 | Signal Generator | Rohde & Schwarz | SMBV100A | 260473 | 30 Jan 2026 | 36 |
| M225502 | Power Sensor | Boonton | RTP5008 | 12323 | 12 Oct 2023 | 12 |
| M2040 | Thermohygrometer | Testo | 608-H1 | 45124934 | 09 Dec 2023 | 12 |

### Test Equipment Used for Transmitter Band Edge Radiated Emissions Tests

| Asset No. | Instrument | Manufacturer | Type No. | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|---|---|---|---|---|---|---|
| M2040 | Thermohygrometer | Testo | 608-H1 | 45124934 | 09 Dec 2023 | 12 |
| K0001 | 3m RSE Chamber | Rainford EMC | N/A | N/A | 05 Sep 2023 | 12 |
| M1874 | Test Receiver | Rohde & Schwarz | ESU26 | 100553 | 19 May 2023 | 12 |
| A3179 | Pre-Amplifier | Hewlett Packard | 8449B | 3008A00934 | 14 Sep 2023 | 12 |
| A3138 | Antenna | Schwarzbeck | BBHA 9120 B | 00702 | 22 Aug 2023 | 12 |
| A2924 | Attenuator | AtlanTecRF | AN18W5-20 | 832828#7 | 26 Jan 2024 | 12 |
| A2523 | Attenuator | AtlanTecRF | AN18W5-10 | 832827#1 | 26 Jan 2024 | 12 |

## Test and Measurement Equipment (continued)

## Test Equipment Used for Transmitter Radiated Emissions Tests

| Asset No. | Instrument | Manufacturer | Type No. | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|---|---|---|---|---|---|---|
| M2040 | Thermohygrometer | Testo | 608-H1 | 45124934 | 09 Dec 2023 | 12 |
| K0001 | 3m RSE Chamber | Rainford EMC | N/A | N/A | 05 Sep 2023 | 12 |
| M1874 | Test Receiver | Rohde & Schwarz | ESU26 | 100553 | 19 May 2023 | 12 |
| A3154 | Pre-Amplifier | Com Power | PAM-103 | 18020012 | 18 Aug 2023 | 12 |
| A3179 | Pre-Amplifier | Hewlett Packard | 8449B | 3008A00934 | 14 Sep 2023 | 12 |
| A222867 | Pre-Amplifier | Atlantic Microwave | A-LNAKX-380116-S5S5 | 220705002 | 26 Aug 2023 | 12 |
| A2896 | Pre-Amplifier | Schwarzbeck | BBV 9721 | 9721 - 023 | 01 Mar 2024 | 12 |
| A3165 | Antenna | ETS-Lindgren | 6502 | 00224383 | 13 Apr 2024 | 12 |
| A3161 | Antenna | Teseq | CBL6111D | 50859 | 04 Jun 2023 | 12 |
| A3138 | Antenna | Schwarzbeck | BBHA 9120 B | 00702 | 22 Aug 2023 | 12 |
| A3139 | Antenna | Schwarzbeck | HWRD750 | 00027 | 22 Aug 2023 | 12 |
| A2895 | Antenna | Schwarzbeck | BBHA 9170 | 9170-728 | 27 Feb 2024 | 12 |
| A2924 | Attenuator | AtlanTecRF | AN18W5-20 | 832828#7 | 26 Jan 2024 | 12 |
| A2523 | Attenuator | AtlanTecRF | AN18W5-10 | 832827#1 | 26 Jan 2024 | 12 |
| A3085 | Low Pass Filter | AtlanTecRF | AFL-02000 | 18051600014 | 26 Jan 2024 | 12 |
| A3093 | High Pass Filter | AtlanTecRF | AFH-03000 | 18051800077 | 26 Jan 2024 | 12 |
| A3095 | High Pass Filter | AtlanTecRF | AFH-07000 | 18051600012 | 26 Jan 2024 | 12 |

# 3 Equipment Under Test (EUT)

## 3.1 Identification of Equipment Under Test (EUT)

| | |
|---|---|
| **Brand Name:** | Braun |
| **Model Name or Number / HVIN:** | 6036 |
| **PMN:** | Skin i-expert |
| **Test Sample Serial Number:** | Not marked or stated *(Conducted sample #1)* |
| **Hardware Version:** | CA10-1108 v00 |
| **Software Version:** | CS02-1103 : Victoria 3.0 (WiFi) - Handset Software : (v1.01) |
| **Firmware Version:** | Test firmware provided by module manufacturer |
| **FCC ID:** | 2BAZ9-6036 |
| **ISED Canada Certification No.:** | IC: 30469-6036 |

| | |
|---|---|
| **Brand Name:** | Braun |
| **Model Name or Number / HVIN:** | 6036 |
| **PMN:** | Skin i-expert |
| **Test Sample Serial Number:** | W100C24309060 *(Radiated sample #1)* |
| **Hardware Version:** | CA10-1108 v00 |
| **Software Version:** | CS02-1103 : Victoria 3.0 (WiFi) - Handset Software : (v1.01) |
| **Firmware Version:** | Test firmware provided by module manufacturer |
| **FCC ID:** | 2BAZ9-6036 |
| **ISED Canada Certification No.:** | IC: 30469-6036 |

## 3.2 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

## 3.3 Additional Information Related to Testing

| | | | |
|---|---|---|---|
| **Technology Tested:** | WLAN (IEEE 802.11b,g,n) / Digital Transmission System | | |
| **Type of Unit:** | Transceiver | | |
| **Modulation Type:** | DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM | | |
| **Data Rates:** | 802.11b | 1 Mbps | |
| | 802.11g | 6 Mbps | |
| | 802.11n HT20 | MCS0 | |
| | 802.11n HT40 | MCS0 | |
| **Power Supply Requirement(s):** | Nominal | 120 VAC 60 Hz | |
| **Maximum Conducted Output Power:** | 802.11n HT40 | 17.3 dBm | |
| **Channel Spacing:** | 20 MHz | | |
| **Transmit Frequency Range:** | 2412 MHz to 2472 MHz | | |
| **Transmit Channels Tested:** | **Channel ID** | **Channel Number** | **Channel Frequency (MHz)** |
| | Bottom | 1 | 2412 |
| | Middle | 6 | 2437 |
| | Top | 11 | 2462 |
| **Channel Spacing:** | 40 MHz | | |
| **Transmit Frequency Range:** | 2422 MHz to 2452 MHz | | |
| **Transmit Channels Tested:** | **Channel ID** | **Channel Number** | **Channel Frequency (MHz)** |
| | Bottom | 3 | 2422 |
| | Middle | 6 | 2437 |
| | Top | 9 | 2452 |

## 3.4 Description of Available Antenna

The radio utilizes an integrated antenna, with the following maximum gain:

| Frequency Range (MHz) | Antenna Gain (dBi) |
|---|---|
| 2400-2480 | 2.5 |

## 3.5 Description of Test Setup

### Support Equipment

The following support equipment was used to exercise the EUT during testing:

| | |
|---|---|
| **Description:** | IoT Dev-Board |
| **Brand Name:** | HELTEC |
| **Model Name or Number:** | HTIT-WB32LA |
| **Serial Number:** | Not marked or stated |

| | |
|---|---|
| **Description:** | Laptop |
| **Brand Name:** | Dell |
| **Model Name or Number:** | XPS 15 |
| **Serial Number:** | 9XZMNF2 |

## Operating Modes

The EUT was tested in the following operating mode(s):

- Continuously transmitting with a modulated carrier at maximum power on the relevant channels as required using the supported data rates/modulation types.

## Configuration and Peripherals

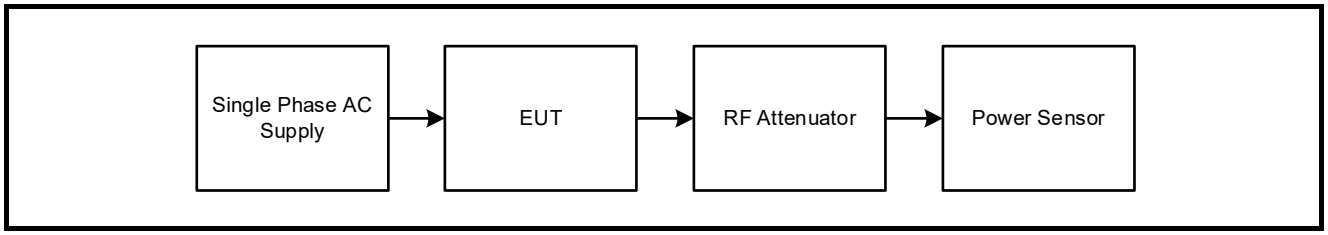
The EUT was tested in the following configuration(s):

- Controlled in test mode using a set of commands entered by the customer into a terminal application on the test laptop. The commands were used to enable a continuous transmission and to select the test channels as required. The command used for power sets an attenuation of 8 dB with respect to the maximum power of the module.
- Transmitter radiated emissions were performed with the EUT in the position that produced worst case with respect to emissions. The EUT was connected to 120 VAC 60 Hz single phase mains supply.
- The customer declared the following data rates to be used for all measurements as:
    - 802.11b – 1 Mbps
    - 802.11g – 6 Mbps
    - 802.11n HT20 – MCS0
    - 802.11n HT40 – MCS0
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 1 Mbps (802.11b). This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and as this mode emits the highest output power level, it was deemed to be the worst case.
- The customer supplied a U.FL RF cable with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.

## Test Setup Diagrams

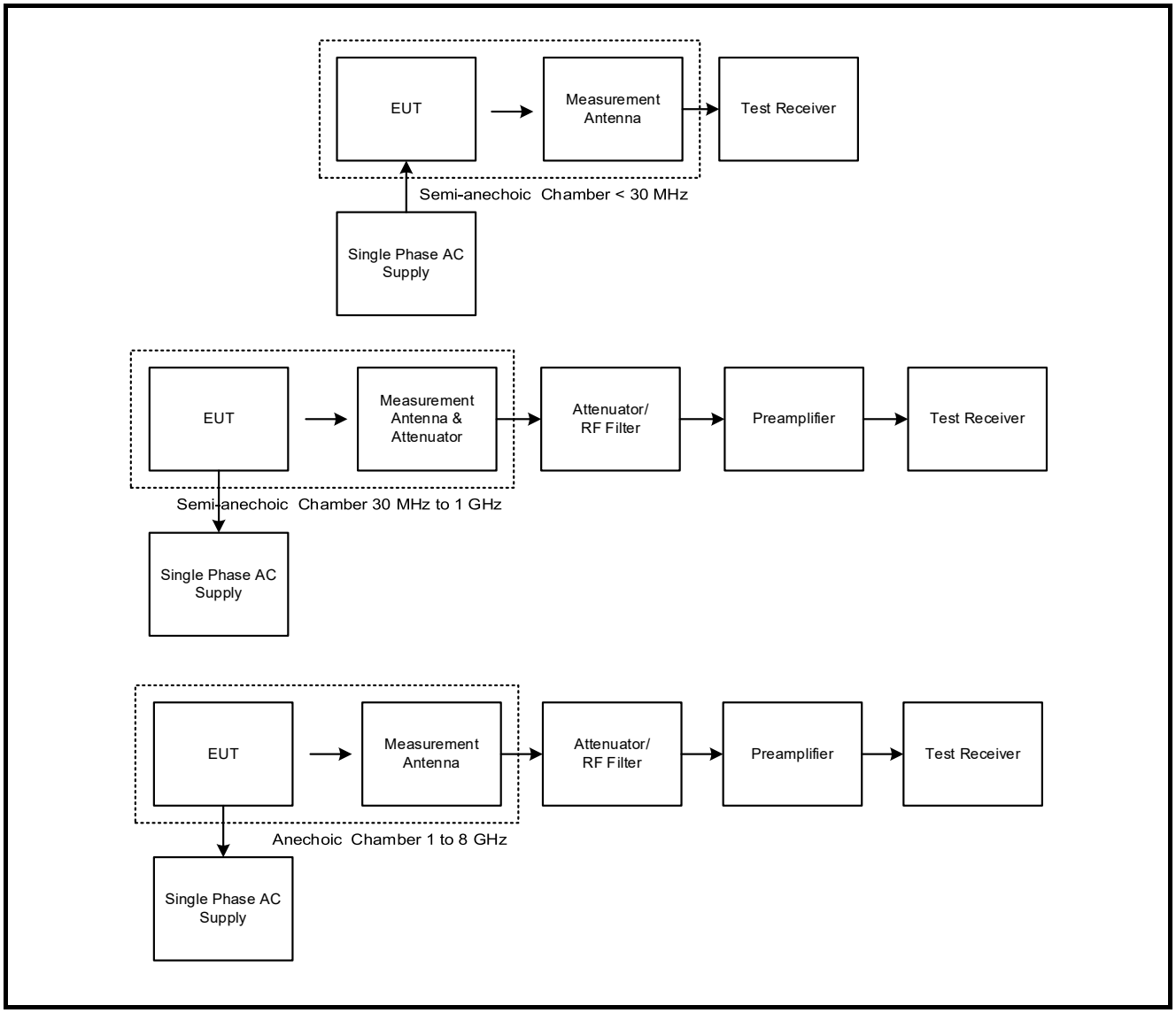
## Conducted Tests:

## Test Setup for Transmitter Maximum Peak Output Power



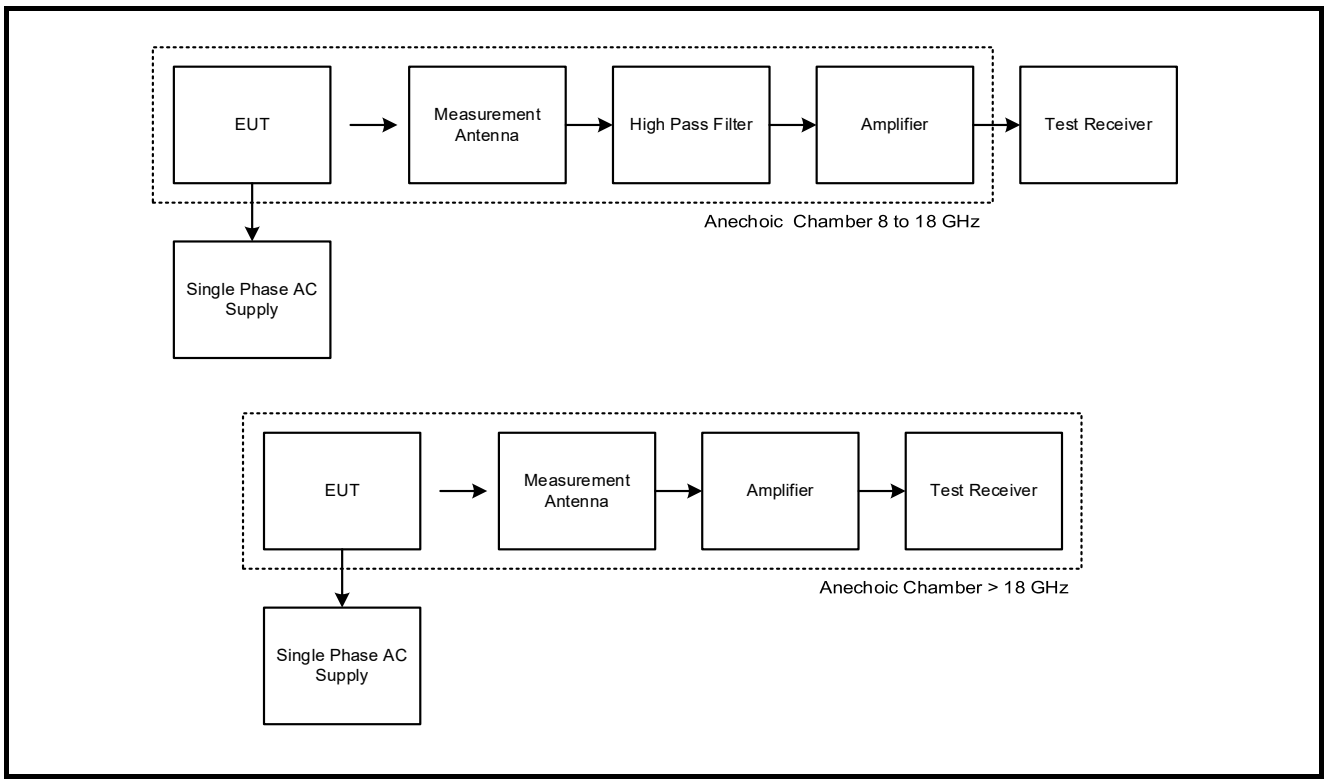

## Radiated Tests:

## Test Setup for Transmitter Radiated Emissions



## Test Setup Diagrams (continued)

## Test Setup for Transmitter Radiated Emissions



# 4 Antenna Port Test Results

## 4.1 Transmitter Maximum Peak Output Power

### Test Summary:

| | | | |
|---|---|---|---|
| **Test Engineers:** | Jose Bayona &<br>Luis Pazos Perez | **Test Date:** | 11 May 2023 |
| **Test Sample Serial Number:** | Conducted sample #1 | | |

| | |
|---|---|
| **FCC Reference:** | Part 15.247(b)(3) |
| **ISED Canada Reference:** | RSS-Gen 6.12 / RSS-247 5.4(d) |
| **Test Method Used:** | FCC KDB 558074 Section 8.3.1.3 referencing<br>ANSI C63.10 Section 11.9.1.3 |

### Environmental Conditions:

| | |
|---|---|
| **Temperature (°C):** | 23 |
| **Relative Humidity (%):** | 45 |

### Note(s):

1. Conducted power tests were performed using a power sensor in accordance with ANSI C63.10 Section 11.9.1.3 with a video bandwidth greate than the DTS bandwidth.
2. The power sensor was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered to compensate for the loss of the attenuator and RF cable.

**Transmitter Maximum Peak Output Power (continued)**

**Results: 802.11n HT40 – MCS0**

| Channel | Conducted Peak Power (dBm) | Conducted Peak Power Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| Bottom | 17.2 | 30.0 | 12.8 | Complied |
| Middle | 17.3 | 30.0 | 12.7 | Complied |
| Top | 17.3 | 30.0 | 12.7 | Complied |

| Channel | Conducted Peak Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | EIRP Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|---|
| Bottom | 17.2 | 2.5 | 19.7 | 36.0 | 16.3 | Complied |
| Middle | 17.3 | 2.5 | 19.8 | 36.0 | 16.2 | Complied |
| Top | 17.3 | 2.5 | 19.8 | 36.0 | 16.2 | Complied |

# 5 Radiated Test Results

## 5.1 Transmitter Radiated Emissions <1 GHz

### Test Summary:

| | | | |
|---|---|---|---|
| **Test Engineer:** | Jose Bayona | **Test Date:** | 11 May 2023 |
| **Test Sample Serial Number:** | W100C24309060 | | |

| | |
|---|---|
| **FCC Reference:** | Parts 15.247(d) & 15.209(a) |
| **ISED Canada Reference:** | RSS-Gen 6.13 & 8.9 / RSS-247 5.5 |
| **Test Method Used:** | ANSI C63.10 Sections 6.3, 6.4 and 6.5 |
| **Frequency Range** | 9 kHz to 1000 MHz |

### Environmental Conditions:

| | |
|---|---|
| **Temperature (°C):** | 22 |
| **Relative Humidity (%):** | 45 |

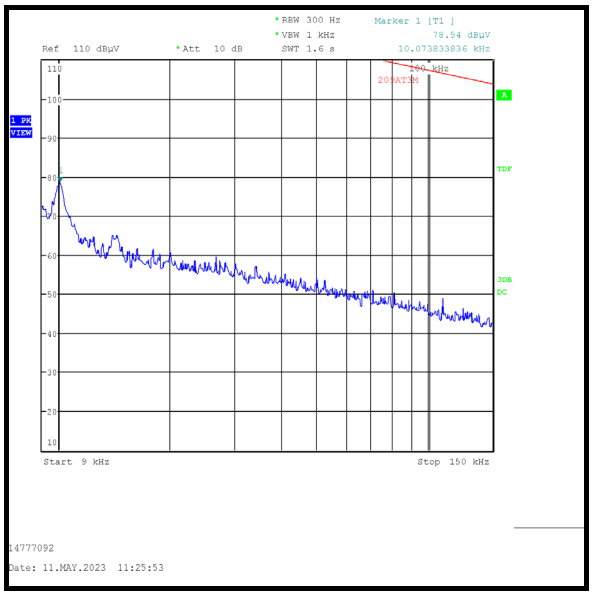
### Note(s):

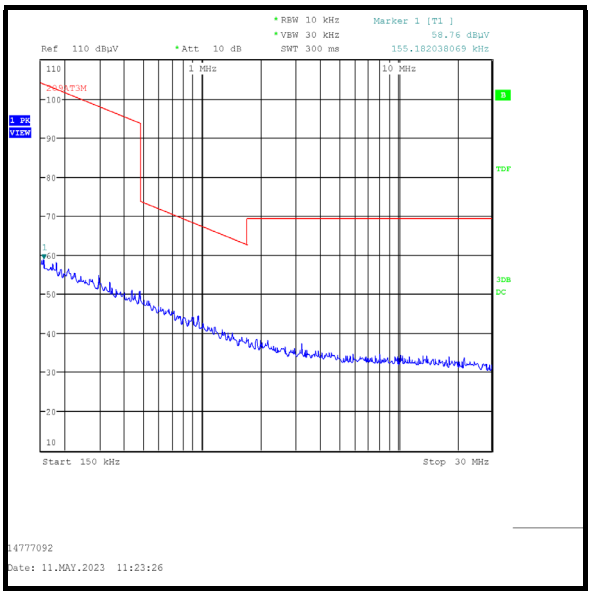
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
4. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance with ANSI C63.10 clause 6.4.3 using the method described in clause 6.4.4.2. ANSI C63.10 clause 5.2 states an alternative test site that can demonstrate equivalence to an open area test site may be used for measurements below 30 MHz. Therefore, measurements were performed in a semi-anechoic chamber. The correlation data between semi-anechoic chamber and an open field test site is available upon request.
5. Measurements from 30 MHz to 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was configured as follows: For 9 kHz to 150 kHz, the resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used and trace mode was Max Hold. For 150 kHz to 30 MHz, the resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz, trace mode was Max Hold. For 30 MHz to 1 GHz, the resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
7. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span wide enough to see the whole emission.

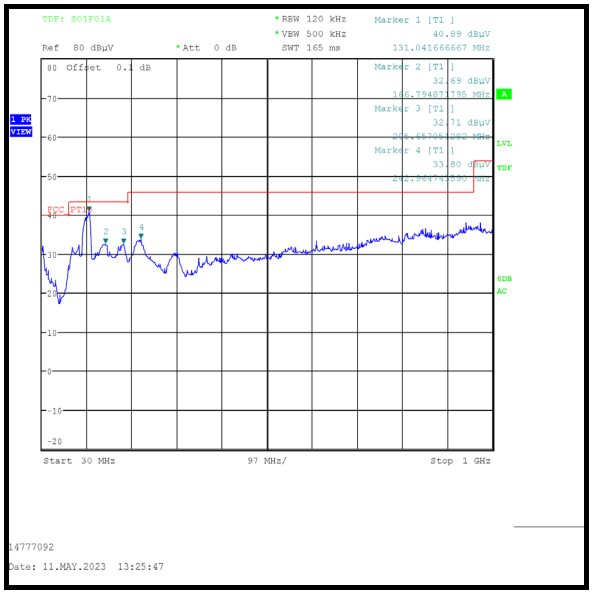
## Transmitter Radiated Emissions (continued)

## Results: Middle Channel / 802.11b / 1 Mbps

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 131.474 | Vertical | 36.5 | 43.5 | 7.0 | Complied |
| 168.398 | Vertical | 28.9 | 43.5 | 14.6 | Complied |
| 240.589 | Horizontal | 30.1 | 46.0 | 15.9 | Complied |




*Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.*

## 5.2 Transmitter Radiated Emissions >1 GHz

### Test Summary:

| | | | |
|---|---|---|---|
| **Test Engineer:** | Jose Bayona | **Test Dates:** | 11 May 2023 & 12 May 2023 |
| **Test Sample Serial Number:** | W100C24309060 | | |

| | |
|---|---|
| **FCC Reference:** | Parts 15.247(d) & 15.209(a) |
| **ISED Canada Reference:** | RSS-Gen 6.13 & 8.9 / RSS-247 5.5 |
| **Test Method Used:** | FCC KDB 558074 Sections 8.1 c)3), 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11 & 11.12 |
| **Frequency Range** | 1 GHz to 25 GHz |

### Environmental Conditions:

| | |
|---|---|
| **Temperature (°C):** | 22 to 23 |
| **Relative Humidity (%):** | 45 |

### Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
4. *In accordance with ANSI C63.10 Section 6.6.4.3, Note 1, if the peak measured value complies with the average limit, it is not necessary to perform an average measurement.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
6. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
7. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their own appropriate detectors during the pre-scan measurements.
8. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto, with and span wide enough to see the whole emission.

## Transmitter Radiated Emissions (continued)

### Results: Bottom Channel

| Frequency (MHz) | Antenna Polarity | Peak Level (dBμV/m) | Average Limit (dBμV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 4823.872 | Vertical | 49.9 | 54.0* | 4.1 | Complied |

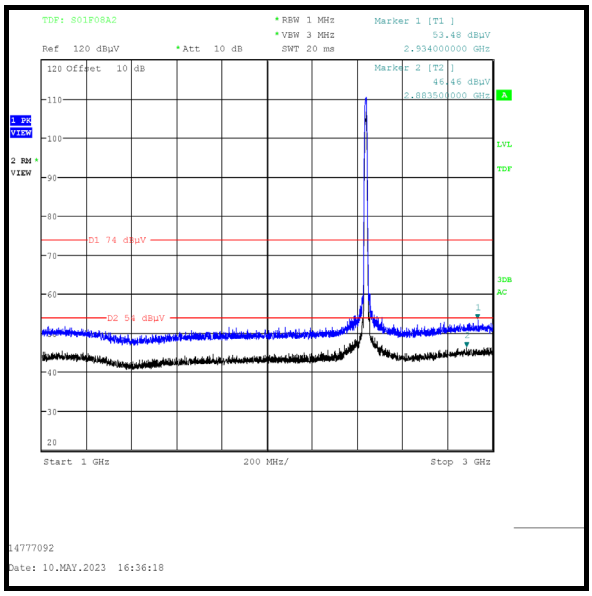
### Results: Middle Channel

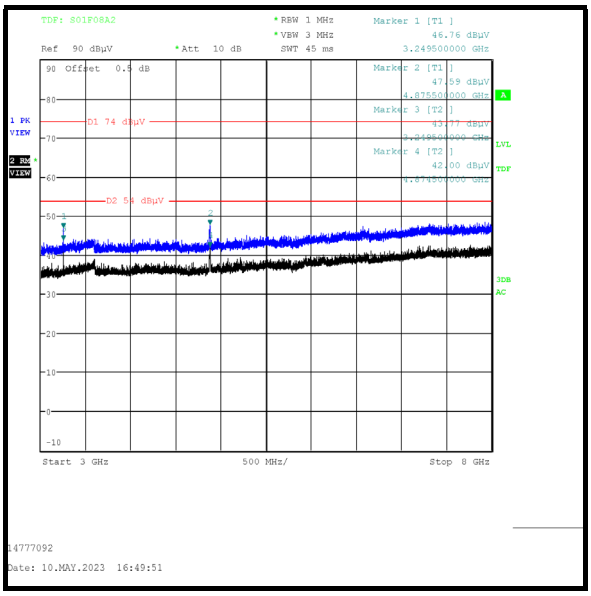
| Frequency (MHz) | Antenna Polarity | Peak Level (dBμV/m) | Average Limit (dBμV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 4873.960 | Vertical | 50.3 | 54.0* | 3.7 | Complied |

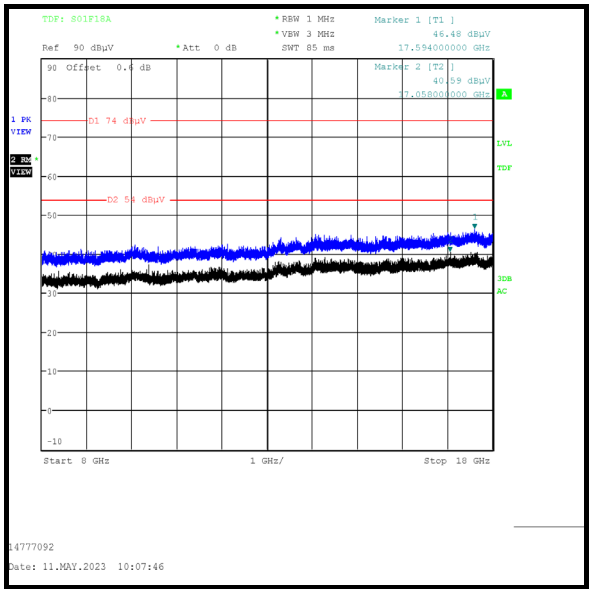
### Results: Top Channel

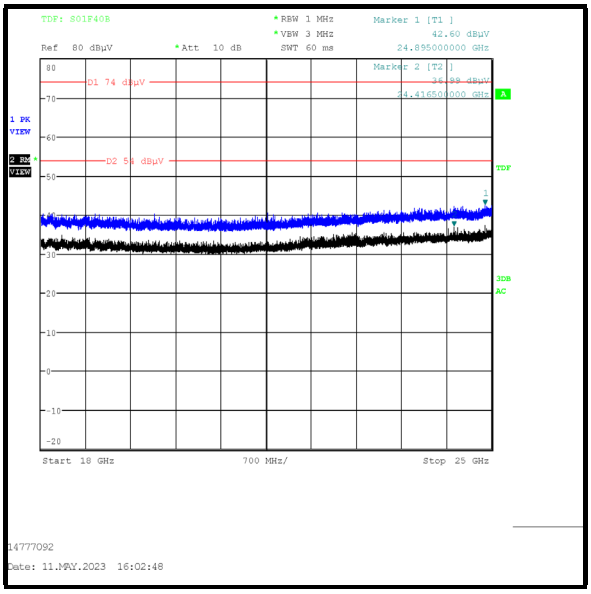
| Frequency (MHz) | Antenna Polarity | Peak Level (dBμV/m) | Average Limit (dBμV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 4924.048 | Vertical | 50.9 | 54.0* | 3.1 | Complied |

## Transmitter Radiated Emissions (continued)




*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

## 5.3 Transmitter Band Edge Radiated Emissions

### Test Summary:

| | | | |
|---|---|---|---|
| **Test Engineer:** | Jose Bayona | **Test Dates:** | 10 May 2023 &<br>11 May 2023 |
| **Test Sample Serial Number:** | W100C24309060 | | |

| | |
|---|---|
| **FCC Reference:** | Parts 15.247(d) & 15.209(a) |
| **ISED Canada Reference:** | RSS-Gen 6.13 / RSS-247 5.5 |
| **Test Method Used:** | KDB 558074 Section 8.7 referencing<br>ANSI C63.10 Sections 11.11, 11.12 & 11.13 |

### Environmental Conditions:

| | |
|---|---|
| **Temperature (°C):** | 22 to 23 |
| **Relative Humidity (%):** | 45 |

## Transmitter Band Edge Radiated Emissions (continued)

## Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. For b, g and n HT20 modes, the maximum conducted average output power was previously measured. In accordance with ANSI C63.10 Section 11.11.1(b), the lower band edge measurement should be performed with a peak detector and the -30 dBc limit applied.
3. For n HT40 mode, the maximum conducted peak output power was previously measured. In accordance with ANSI C63.10 Section 11.11.1(a), the lower band edge measurement should be performed with a peak detector and the -20 dBc limit applied.
4. As the lower band edge is adjacent to a non-restricted band, only peak measurements are required. In accordance with ANSI C63.10 Section 11.11.1, the test method in Section 11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
5. As the upper band edge is adjacent to a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. An RMS detector was used, sweep time was set to auto and trace mode was trace averaging over 300 sweeps. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
6. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.

**Transmitter Band Edge Radiated Emissions (continued)**

**Results: 802.11b / 20 MHz / 1 Mbps**

**Results: Lower Band Edge**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | -30 dBc Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2396.900 | Horizontal | 54.0 | 73.6 | 19.6 | Complied |
| 2400 | Horizontal | 53.6 | 73.6 | 20.0 | Complied |

**Results: Upper Band Edge / Peak**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 59.2 | 74.0 | 14.8 | Complied |
| 2484.690 | Horizontal | 59.5 | 74.0 | 14.5 | Complied |

**Results: Upper Band Edge / Average**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 47.1 | 54.0 | 6.9 | Complied |
| 2486.930 | Horizontal | 47.2 | 54.0 | 6.8 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

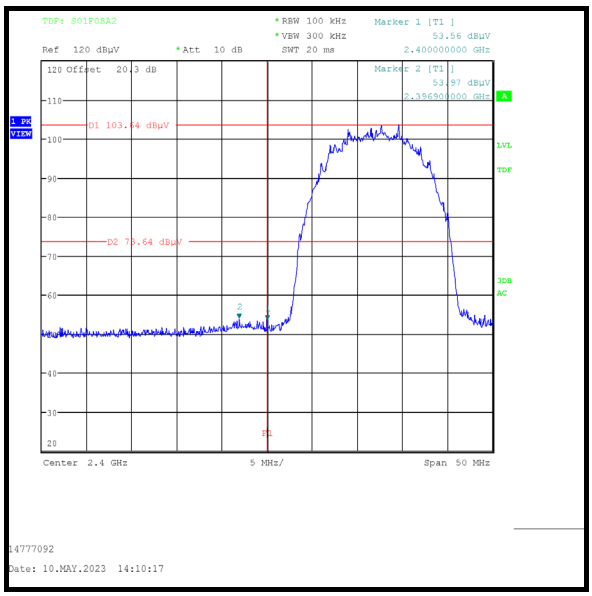
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2388.718 | Horizontal | 56.8 | 74.0 | 17.2 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

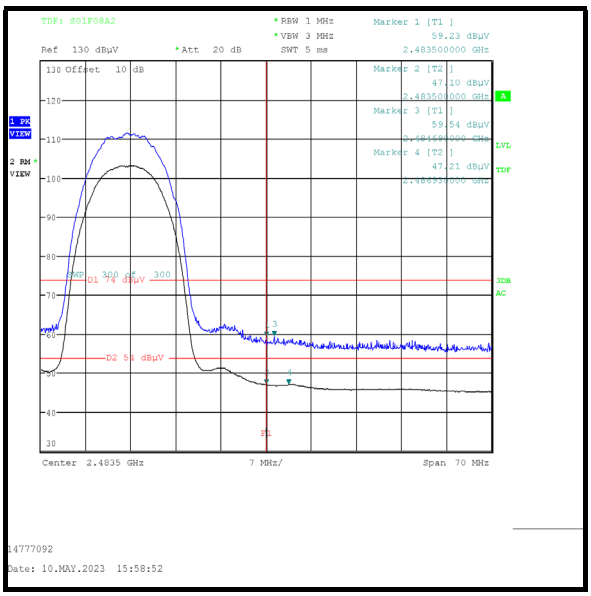
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2389.872 | Horizontal | 44.6 | 54.0 | 9.4 | Complied |

## Transmitter Band Edge Radiated Emissions (continued)

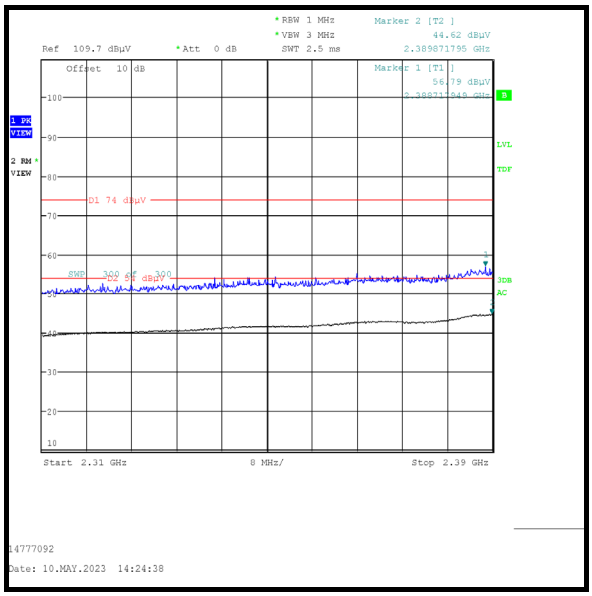
## Results: 802.11b / 20 MHz / 1 Mbps




Lower Band Edge




Upper Band Edge




2310 MHz to 2390 MHz Restricted Band

**Transmitter Band Edge Radiated Emissions (continued)**

**Results: 802.11g / 20 MHz / 6 Mbps**

**Results: Lower Band Edge**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | -30 dBc Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2399.900 | Horizontal | 59.8 | 67.6 | 7.8 | Complied |
| 2400 | Horizontal | 59.5 | 67.6 | 8.1 | Complied |

**Results: Upper Band Edge / Peak**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 60.6 | 74.0 | 13.4 | Complied |
| 2484.550 | Horizontal | 61.9 | 74.0 | 12.1 | Complied |

**Results: Upper Band Edge / Average**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 49.0 | 54.0 | 5.0 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

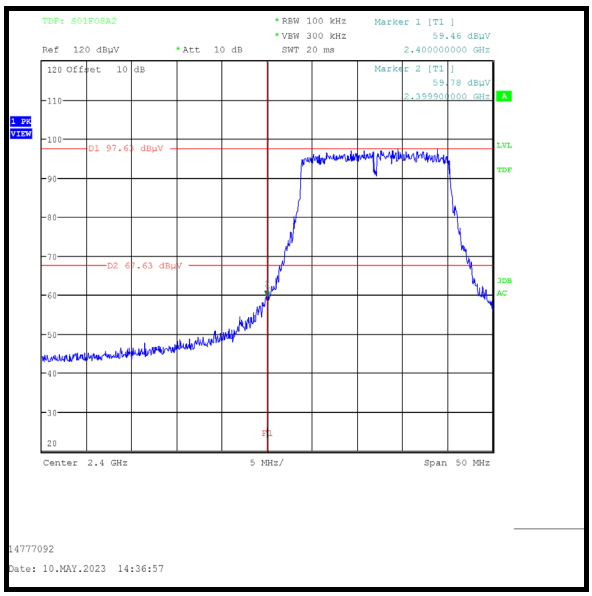
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2387.821 | Horizontal | 58.6 | 74.0 | 15.4 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

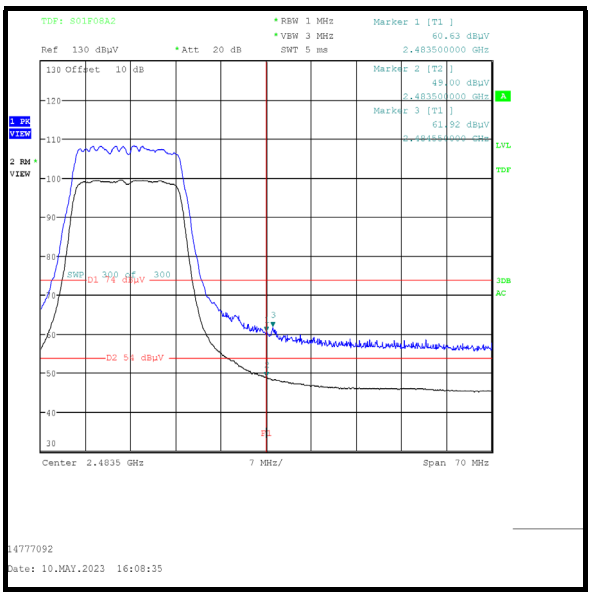
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2389.872 | Horizontal | 46.4 | 54.0 | 7.6 | Complied |

## Transmitter Band Edge Radiated Emissions (continued)

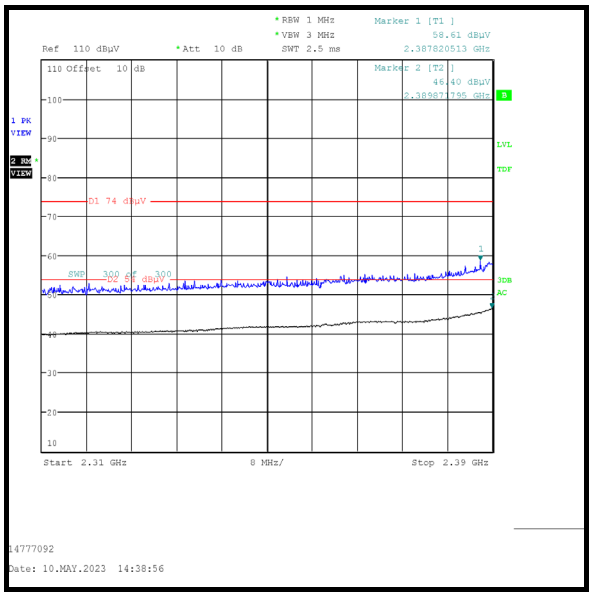
## Results: 802.11g / 20 MHz / 6 Mbps




Lower Band Edge




Upper Band Edge




2310 MHz to 2390 MHz Restricted Band

**Transmitter Band Edge Radiated Emissions (continued)**

**Results: 802.11n HT20 / MCS0**

**Results: Lower Band Edge**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | -30 dBc Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2399.800 | Horizontal | 60.0 | 67.8 | 7.8 | Complied |
| 2400 | Horizontal | 58.2 | 67.8 | 9.6 | Complied |

**Results: Upper Band Edge / Peak**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 61.8 | 74.0 | 12.2 | Complied |
| 2483.780 | Horizontal | 62.3 | 74.0 | 11.7 | Complied |

**Results: Upper Band Edge / Average**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 49.6 | 54.0 | 4.4 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

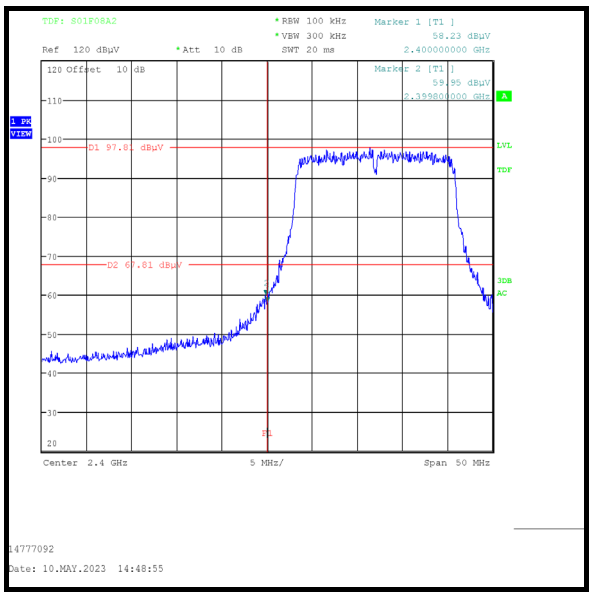
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2389.487 | Horizontal | 59.5 | 74.0 | 14.5 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

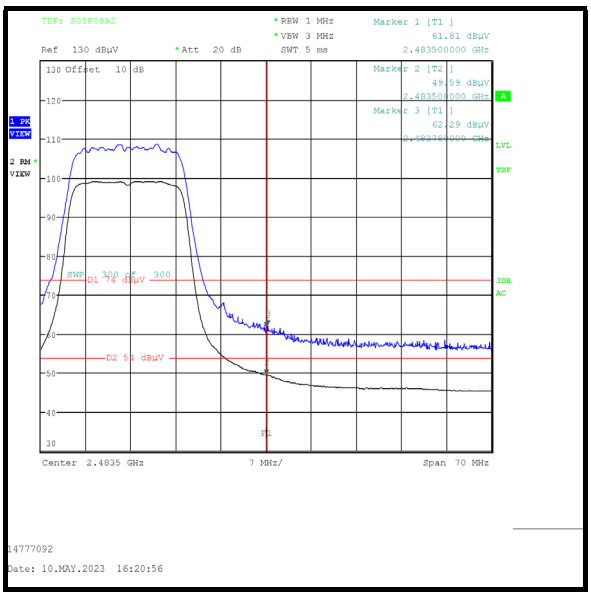
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2389.872 | Horizontal | 47.0 | 54.0 | 7.0 | Complied |

## Transmitter Band Edge Radiated Emissions (continued)

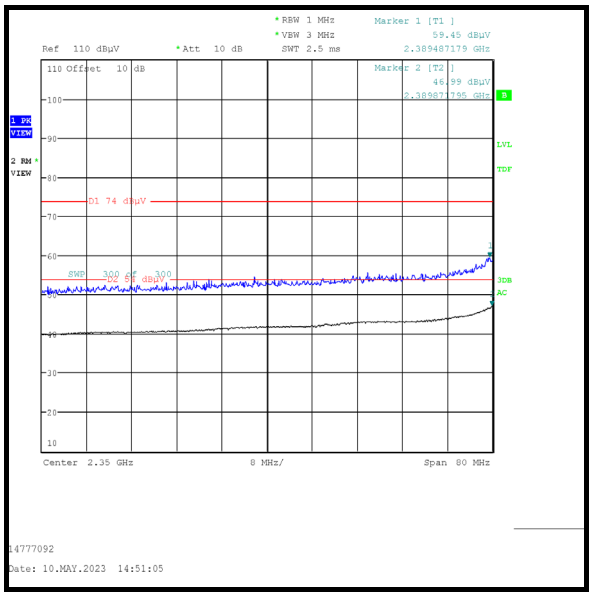
## Results: 802.11n HT20 / MCS0




Lower Band Edge




Upper Band Edge




2310 MHz to 2390 MHz Restricted Band

**Transmitter Band Edge Radiated Emissions (continued)**

**Results: 802.11n HT40 / MCS0**

**Results: Lower Band Edge**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | -20 dBc Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2400 | Horizontal | 67.2 | 74.8 | 7.6 | Complied |

**Results: Upper Band Edge / Peak**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 62.7 | 74.0 | 11.3 | Complied |
| 2485.038 | Horizontal | 63.1 | 74.0 | 10.9 | Complied |

**Results: Upper Band Edge / Average**

| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2483.5 | Horizontal | 52.3 | 54.0 | 1.7 | Complied |
| 2483.692 | Horizontal | 52.5 | 54.0 | 1.5 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

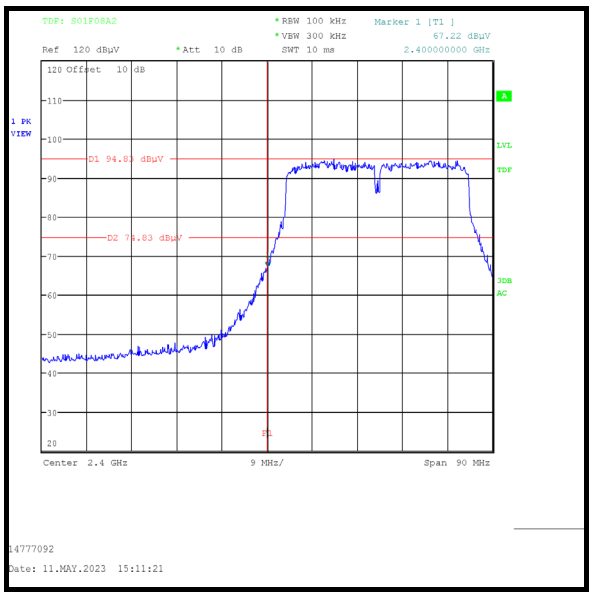
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2389.539 | Horizontal | 59.6 | 74.0 | 14.4 | Complied |

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

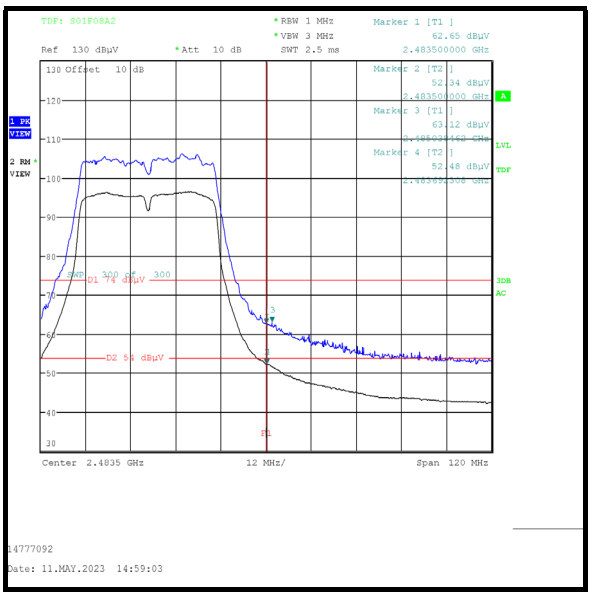
| Frequency (MHz) | Antenna Polarity | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2390.000 | Horizontal | 48.4 | 54.0 | 5.6 | Complied |

## Transmitter Band Edge Radiated Emissions (continued)

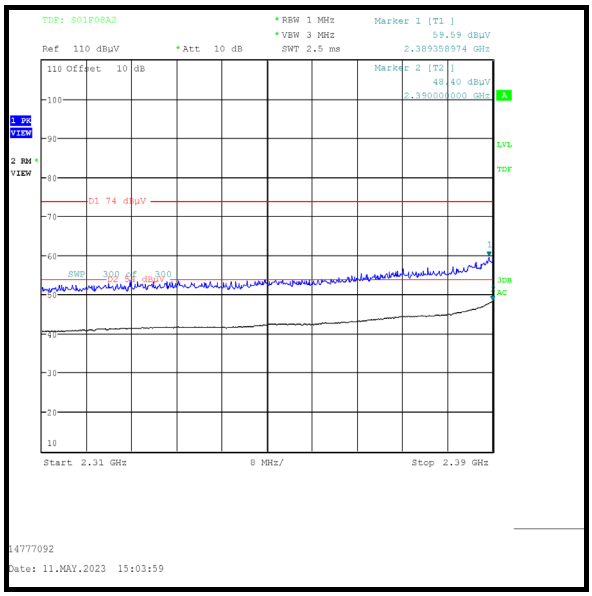
## Results: 802.11n HT40 / HT40 / MCS0




Lower Band Edge




Upper Band Edge




2310 MHz to 2390 MHz Restricted Band

**--- END OF REPORT ---**