No discernible emissions detected from18GHz – 26GHz.

# 8 Emissions in Restricted Frequency Bands (Band Edge)

## 8.1 *Test Result*

| Test Description | Test Specification | | Test Result |
|---|---|---|---|
| Restricted Band Emissions | 15.205 / 15.209 | RSS-GEN S8.9 / 8.10 | Compliant |

## 8.2 *Test Method*

Measurements were made using the conducted methods defined in ANSI C63.10, Section 11.12.2.

The test system reported the following duty-cycles used for correcting the average measurements:

- SISO
  - 802.11b – 65.9% (1.8dB) – WF2
  - 802.11g – 59.2% (2.3dB) – WF2
  - 802.11n(HT20) – 18.2% (7.4dB) – WF2
  - 802.11n(HT40) – 18.7% (7.3dB) – WF2
  - 802.11n(HT20) – 42.2% (3.7dB) – WF1
- MIMO
  - 802.11n(HT20) – 13.1% (8.8dB) – WF2+WF1

## 8.3 *Test Site*

EMC Laboratory, Suwanee, GA

Environmental Conditions

| | |
|---|---|
| Temperature: | 22.6 °C |
| Relative Humidity: | 48.4 % |
| Atmospheric Pressure: | 98.98 kPa |

## 8.4 *Test Equipment*

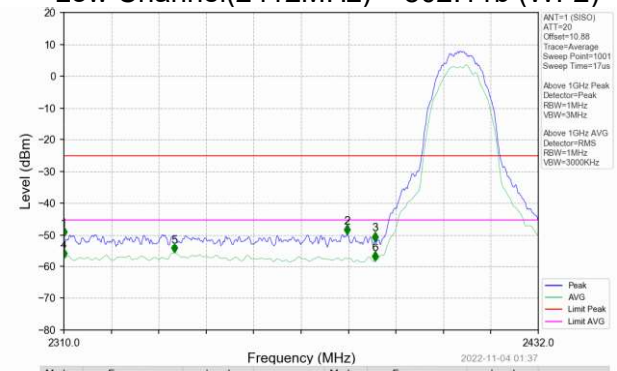
Test End Date: 4-Nov-2022 Tester: AB

| Equipment | Model | Manufacturer | Asset | Cal Date | Cal Due Date |
|---|---|---|---|---|---|
| ATTENUATOR, 10DB | BW-S10W2 | MINI-CIRCUITS | 15031 | 3-Oct-2022 | 3-Oct-2023 |
| RF CABLE SMA TO SMA, 0.01-40GHZ | 084-0505-059 | TELEDYNE STORM MICROWAVE | 20108 | 16-Mar-2022 | 16-Mar-2023 |
| USB WIDEBAND POWER SENSOR | U2021XA | TSTPASS (KEYSIGHT TECHNOLOGIES) | 20168C | 24-Aug-2022 | 24-Aug-2023 |
| USB WIDEBAND POWER SENSOR | U2021XA | TSTPASS (KEYSIGHT TECHNOLOGIES) | 20168D | 24-Sep-2022 | 24-Sep-2023 |
| SIGNAL ANALYZER (TS8997) | FSV30 | ROHDE & SCHWARZ | B085749 | 7-Dec-2022 | 7-Dec-2023 |
| ATTENUATOR, 10DB | BW-S10W2 | MINI-CIRCUITS | 15032 | 3-Oct-2022 | 3-Oct-2023 |
| RF CABLE SMA TO SMA, 0.01-40GHZ | 084-0505-059 | TELEDYNE STORM MICROWAVE | 20107 | 16-Mar-2022 | 16-Mar-2023 |
| RF CABLE (TS8997) | 141 | HUBER & SUHNER | B095588 | 5-Jul-2022 | 5-Jul-2023 |
| ATTENUATOR, 10DB (TS8997) | 10DB | ROHDE & SCHWARZ | B095593 | 12-May-2022 | 12-May-2023 |
| DC POWER SUPPLY, PROGRAMMABLE | DP711 | RIGOL | 18027 | CNR | CNR |
| TSTPASS SWITCHBOX | SB1 | TSTPASS | 20168 | CNR | CNR |

Software Profile:
TSTPASS Version: 1.1.0, build 2020.11.15.01

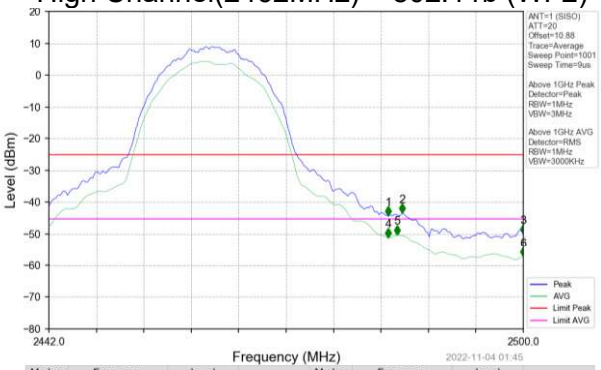
## 8.5 *Test Data – Restricted Band Edges - SISO*

Low Channel(2412MHz) – 802.11b (WF2)



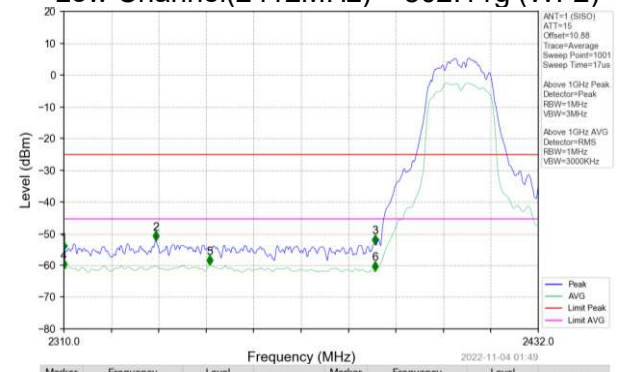

| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -50.554 | Peak | 4 | 2310.000 | -57.611 | AVG |
| 2 | 2382.834 | -49.850 | Peak | 5 | 2338.426 | -55.892 | AVG |
| 3 | 2390.000 | -52.051 | Peak | 6 | 2390.000 | -58.488 | AVG |

High Channel(2462MHz) – 802.11b (WF2)



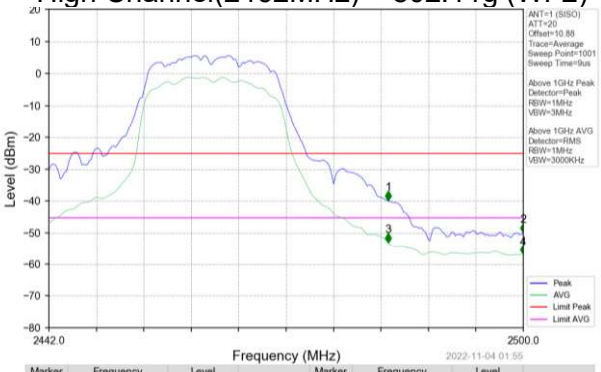

| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -44.322 | Peak | 4 | 2483.500 | -51.176 | AVG |
| 2 | 2485.210 | -43.564 | Peak | 5 | 2484.572 | -50.293 | AVG |
| 3 | 2500.000 | -50.044 | Peak | 6 | 2500.000 | -57.333 | AVG |

Low Channel(2412MHz) – 802.11g (WF2)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -55.428 | Peak | 4 | 2310.000 | -61.324 | AVG |
| 2 | 2333.668 | -52.121 | Peak | 5 | 2347.454 | -60.081 | AVG |
| 3 | 2390.000 | -53.291 | Peak | 6 | 2390.000 | -61.932 | AVG |

High Channel(2462MHz) – 802.11g (WF2)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -39.982 | Peak | 3 | 2483.500 | -53.159 | AVG |
| 2 | 2500.000 | -50.097 | Peak | 4 | 2500.000 | -57.029 | AVG |

Low Channel(2412MHz) – 802.11b (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -57.61 | 4 | 41.59 | 54 | -12.41 | AVG |
| | -50.55 | 4 | 48.65 | 74 | -25.35 | Peak |
| 2338.426 | -55.89 | 4 | 43.31 | 54 | -10.69 | AVG |
| 2382.834 | -49.85 | 4 | 49.35 | 74 | -24.65 | Peak |
| 2390 | -58.49 | 4 | 40.71 | 54 | -13.29 | AVG |
| | -52.05 | 4 | 47.15 | 74 | -26.85 | Peak |

High Channel(2462MHz) – 802.11b (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -51.18 | 4 | 48.02 | 54 | -5.98 | AVG |
| | -44.32 | 4 | 54.88 | 74 | -19.12 | Peak |
| 2484.572 | -50.29 | 4 | 48.91 | 54 | -5.09 | AVG |
| 2485.21 | -43.56 | 4 | 55.64 | 74 | -18.36 | Peak |
| 2500 | -57.33 | 4 | 41.87 | 54 | -12.13 | AVG |
| | -50.04 | 4 | 49.16 | 74 | -24.84 | Peak |

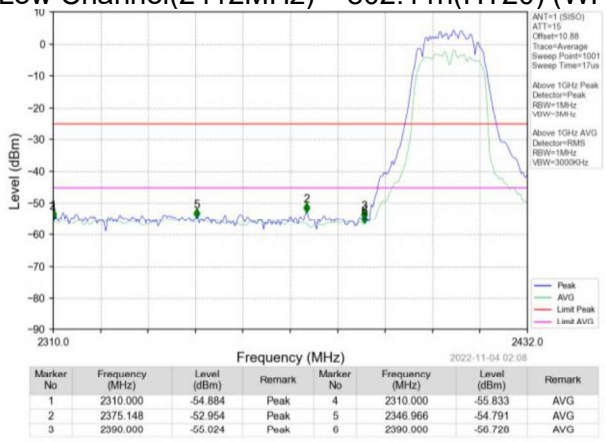
Low Channel(2412MHz) – 802.11g (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -61.32 | 4 | 37.88 | 54 | -16.12 | AVG |
| | -55.43 | 4 | 43.77 | 74 | -30.23 | Peak |
| 2333.668 | -52.12 | 4 | 47.08 | 74 | -26.92 | Peak |
| 2347.454 | -60.08 | 4 | 39.12 | 54 | -14.88 | AVG |
| 2390 | -61.93 | 4 | 37.27 | 54 | -16.73 | AVG |
| | -53.29 | 4 | 45.91 | 74 | -28.09 | Peak |

High Channel(2462MHz) – 802.11g (WF2)

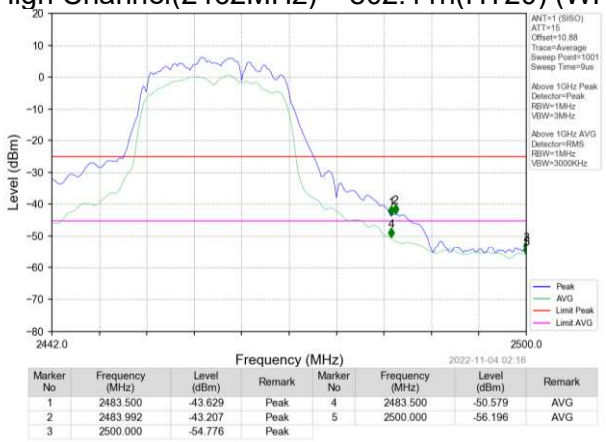
| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -53.16 | 4 | 46.04 | 54 | -7.96 | AVG |
| | -39.98 | 4 | 59.22 | 74 | -14.78 | Peak |
| 2500 | -57.03 | 4 | 42.17 | 54 | -11.83 | AVG |
| | -50.1 | 4 | 49.1 | 74 | -24.9 | Peak |

## Low Channel(2412MHz) – 802.11n(HT20) (WF2)



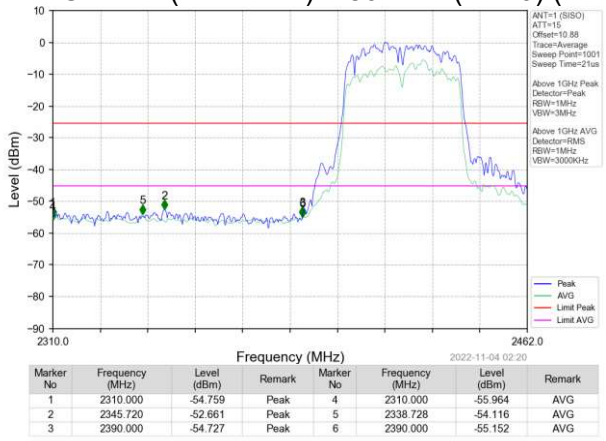

| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -54.884 | Peak | 4 | 2310.000 | -55.833 | AVG |
| 2 | 2375.148 | -52.954 | Peak | 5 | 2346.966 | -54.791 | AVG |
| 3 | 2390.000 | -55.024 | Peak | 6 | 2390.000 | -56.726 | AVG |

## High Channel(2462MHz) – 802.11n(HT20) (WF2)



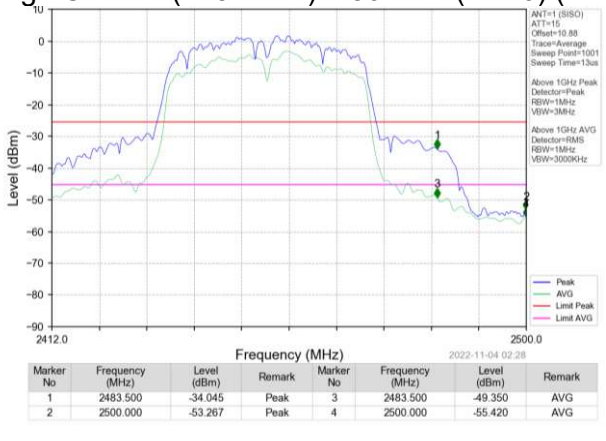

| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -43.629 | Peak | 4 | 2483.500 | -50.579 | AVG |
| 2 | 2483.992 | -43.207 | Peak | 5 | 2500.000 | -56.196 | AVG |
| 3 | 2500.000 | -54.776 | Peak | | | | |

## Low Channel(2422MHz) – 802.11n(HT40) (WF2)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -54.759 | Peak | 4 | 2310.000 | -55.964 | AVG |
| 2 | 2345.720 | -52.661 | Peak | 5 | 2338.728 | -54.116 | AVG |
| 3 | 2390.000 | -54.727 | Peak | 6 | 2390.000 | -55.152 | AVG |

## High Channel(2452MHz) – 802.11n(HT40) (WF2)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -34.045 | Peak | 3 | 2483.500 | -49.350 | AVG |
| 2 | 2500.000 | -53.267 | Peak | 4 | 2500.000 | -55.420 | AVG |

Low Channel(2412MHz) – 802.11n(HT20) (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -55.83 | 4 | 43.37 | 54 | -10.63 | AVG |
| | -54.88 | 4 | 44.32 | 74 | -29.68 | Peak |
| 2346.966 | -54.79 | 4 | 44.41 | 54 | -9.59 | AVG |
| 2375.148 | -52.95 | 4 | 46.25 | 74 | -27.75 | Peak |
| 2390 | -56.73 | 4 | 42.47 | 54 | -11.53 | AVG |
| | -55.02 | 4 | 44.18 | 74 | -29.82 | Peak |

High Channel(2462MHz) – 802.11n(HT20) (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -50.58 | 4 | 48.62 | 54 | -5.38 | AVG |
| | -43.63 | 4 | 55.57 | 74 | -18.43 | Peak |
| 2483.992 | -43.21 | 4 | 55.99 | 74 | -18.01 | Peak |
| 2500 | -56.2 | 4 | 43 | 54 | -11 | AVG |

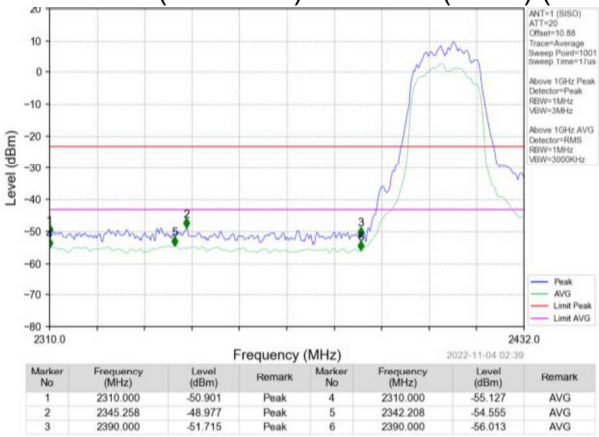
Low Channel(2422MHz) – 802.11n(HT40) (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -55.96 | 4 | 43.24 | 54 | -10.76 | AVG |
| | -54.76 | 4 | 44.44 | 74 | -29.56 | Peak |
| 2338.728 | -54.12 | 4 | 45.08 | 54 | -8.92 | AVG |
| 2345.72 | -52.66 | 4 | 46.54 | 74 | -27.46 | Peak |
| 2390 | -55.15 | 4 | 44.05 | 54 | -9.95 | AVG |
| | -54.73 | 4 | 44.47 | 74 | -29.53 | Peak |

High Channel(2452MHz) – 802.11n(HT40) (WF2)

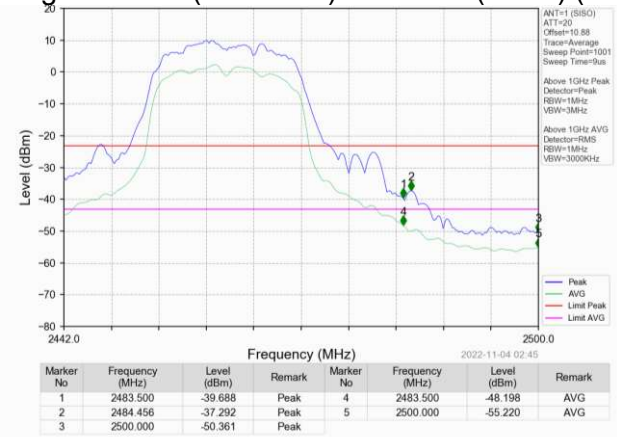
| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -49.35 | 4 | 49.85 | 54 | -4.15 | AVG |
| | -34.05 | 4 | 65.16 | 74 | -8.85 | Peak |
| 2500 | -55.42 | 4 | 43.78 | 54 | -10.22 | AVG |
| | -53.27 | 4 | 45.93 | 74 | -28.07 | Peak |

Low Channel(2412MHz) – 802.11n(HT20) (WF1)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -50.901 | Peak | 4 | 2310.000 | -55.127 | AVG |
| 2 | 2345.258 | -48.977 | Peak | 5 | 2342.208 | -54.555 | AVG |
| 3 | 2390.000 | -51.715 | Peak | 6 | 2390.000 | -56.013 | AVG |

High Channel(2462MHz) – 802.11n(HT20) (WF1)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -39.688 | Peak | 4 | 2483.500 | -48.198 | AVG |
| 2 | 2484.456 | -37.292 | Peak | 5 | 2500.000 | -55.220 | AVG |
| 3 | 2500.000 | -50.361 | Peak | | | | |

Low Channel(2412MHz) – 802.11n(HT20) (WF1)

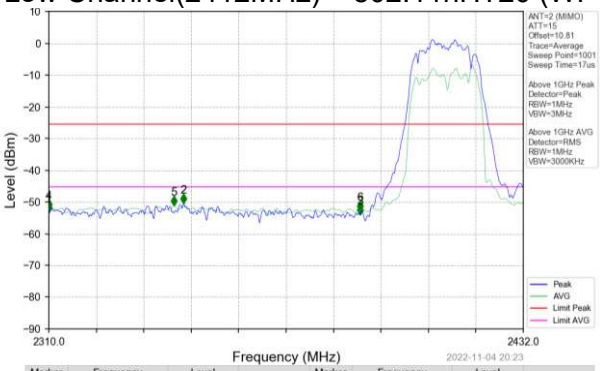
| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -55.13 | 2 | 42.07 | 54 | -11.93 | AVG |
| | -50.9 | 2 | 46.3 | 74 | -27.7 | Peak |
| 2342.208 | -54.55 | 2 | 42.65 | 54 | -11.36 | AVG |
| 2345.258 | -48.98 | 2 | 48.22 | 74 | -25.78 | Peak |
| 2390 | -56.01 | 2 | 41.19 | 54 | -12.81 | AVG |
| | -51.72 | 2 | 45.48 | 74 | -28.52 | Peak |

High Channel(2462MHz) – 802.11n(HT20) (WF1)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -48.2 | 2 | 49 | 54 | -5 | AVG |
| | -39.69 | 2 | 57.51 | 74 | -16.49 | Peak |
| 2484.456 | -37.29 | 2 | 59.91 | 74 | -14.09 | Peak |
| 2500 | -55.22 | 2 | 41.98 | 54 | -12.02 | AVG |
| | -50.36 | 2 | 46.84 | 74 | -27.16 | Peak |

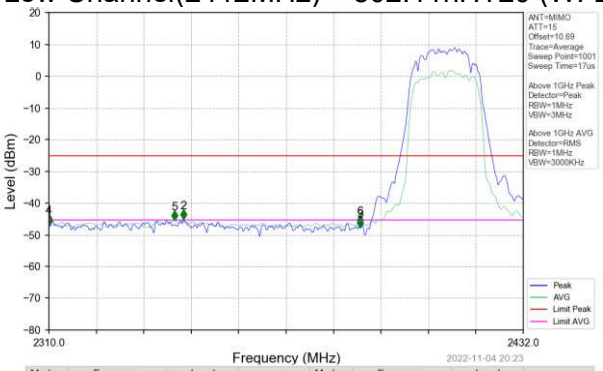
## 8.6 *Data – Restricted Band Edges - MIMO*

Low Channel(2412MHz) – 802.11nHT20 (WF1)



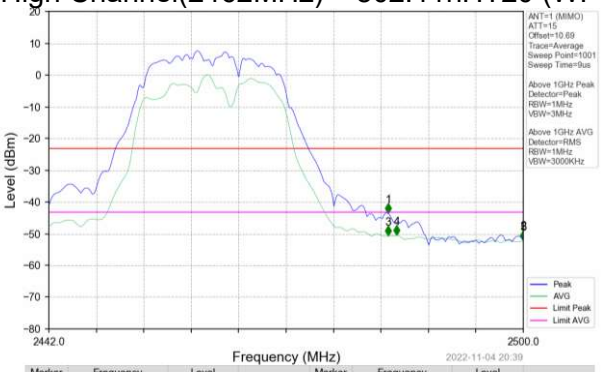

| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -53.372 | Peak | 4 | 2310.000 | -52.200 | AVG |
| 2 | 2344.648 | -50.449 | Peak | 5 | 2342.208 | -51.215 | AVG |
| 3 | 2390.000 | -54.017 | Peak | 6 | 2390.000 | -52.770 | AVG |

Low Channel(2412MHz) – 802.11nHT20 (WF2)



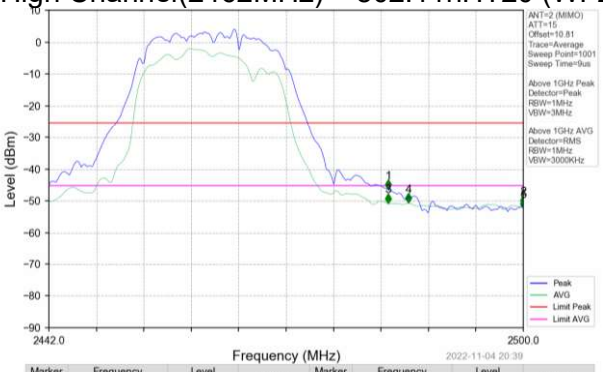

| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | -47.124 | Peak | 4 | 2310.000 | -46.498 | AVG |
| 2 | 2344.648 | -45.093 | Peak | 5 | 2342.330 | -45.434 | AVG |
| 3 | 2390.000 | -47.730 | Peak | 6 | 2390.000 | -46.914 | AVG |

High Channel(2462MHz) – 802.11nHT20 (WF1)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -43.491 | Peak | 4 | 2484.514 | -50.418 | AVG |
| 2 | 2500.000 | -51.877 | Peak | 5 | 2500.000 | -52.188 | AVG |
| 3 | 2483.500 | -50.617 | AVG | | | | |

High Channel(2462MHz) – 802.11nHT20 (WF2)




| Marker No | Frequency (MHz) | Level (dBm) | Remark | Marker No | Frequency (MHz) | Level (dBm) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | -46.443 | Peak | 4 | 2485.964 | -50.746 | AVG |
| 2 | 2500.000 | -51.375 | Peak | 5 | 2500.000 | -52.341 | AVG |
| 3 | 2483.500 | -50.782 | AVG | | | | |

Low Channel(2412MHz) – 802.11nHT20 (WF1)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -52.2 | 4 | 47 | 54 | -7 | AVG |
| | -53.37 | 4 | 45.83 | 74 | -28.17 | Peak |
| 2342.208 | -51.22 | 4 | 47.98 | 54 | -6.01 | AVG |
| 2344.648 | -50.45 | 4 | 48.75 | 74 | -25.25 | Peak |

Low Channel(2412MHz) – 802.11nHT20 (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2310 | -46.5 | 4 | 48.7 | 54 | -5.3 | AVG |
| | -47.12 | 4 | 48.08 | 74 | -25.92 | Peak |
| 2342.33 | -45.43 | 4 | 49.77 | 54 | -4.23 | AVG |
| 2344.648 | -45.09 | 4 | 50.11 | 74 | -23.89 | Peak |

High Channel(2462MHz) – 802.11nHT20 (WF1)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -50.62 | 2 | 46.58 | 54 | -7.42 | AVG |
| | -43.49 | 2 | 53.71 | 74 | -20.29 | Peak |
| 2484.514 | -50.42 | 2 | 46.78 | 54 | -7.22 | AVG |
| 2500 | -52.19 | 2 | 45.01 | 54 | -8.99 | AVG |
| | -51.88 | 2 | 45.32 | 74 | -28.68 | Peak |

High Channel(2462MHz) – 802.11nHT20 (WF2)

| Frequency (MHz) | Reading Level (dBm) | Antenna Gain (dBi) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 2483.5 | -50.78 | 4 | 48.42 | 54 | -5.58 | AVG |
| | -46.44 | 4 | 52.76 | 74 | -21.24 | Peak |
| 2485.964 | -50.75 | 4 | 48.45 | 54 | -5.55 | AVG |
| 2500 | -52.34 | 4 | 46.86 | 54 | -7.14 | AVG |
| | -51.38 | 4 | 47.83 | 74 | -26.18 | Peak |

# 9 Measurement Uncertainty

The measurement uncertainty figures are be calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) k = 2 (which provide confidence levels of 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

| | Expanded Uncertainty for Normal k factor equal to 2 | |
|---|---|---|
| Parameter | Required | Laboratory Actual |
| Radio Frequency | ±1 x 10-5 | ±9.8 x 10-8 |
| total RF power, conducted | ±1.5 dB | ±1.2 dB |
| RF power density, conducted | ±3 dB | ±0.7 dB |
| spurious emissions, conducted | ±3 dB | ±2.1 dB |
| all emissions, radiated | ±6 dB | ±4.8 dB |
| temperature | ±1°C | ±0.5°C |
| humidity | ±5 % | ±3.5% |
| DC and low frequency voltages | ±3 % | ±0.4% |

# 10 Revision History

| Revision Level | Description of changes | Revision Date |
|---|---|---|
| 0 | Initial release | 30 November 2022 |
| 1 | Section 1 was updated for FCC 15.203 internal antennas.<br>Section 2 Client information was updated.<br>Equipment tables were updated for test software.<br>Section 4.6 limits were updated and formula added<br>WF1 and WF2 antenna usage was clarified throughout report.<br>Corrected frequency on page 26 & 28 plots.<br>dBuV/m data was added to restricted band band edges.<br>Fixed plot for 802.11g – MCH – 3-18GHz – Vertical<br>Update plot for radiated spurious emissons. | 24 February 2023 |
| 2 | Updated Section 7.4 to include 18GHz – 26GHz data in the Equipment List. | 28 February 2023 |
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