

**UNII-1 (5150-5250MHz) Wi-Fi Radio Test Report
(Radiated Spurious Emissions Only)**

For

IW9165DH-B, IW9165DH-A & IW9165DH-ROW

Supports

5/6 GHz 802.11 a/n/ac/ax Wi-Fi + Bluetooth LE v5.0 + GNSS radio

FCC ID: LDKIW9165DH

IC: 2461A-IW9165DH

Against the following Specifications:

47 CFR 15.205

47 CFR 15.209

CFR47 Part 15.407

RSS-247 issue 2

RSS-Gen issue 5


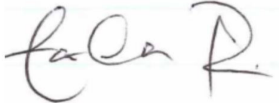



Cisco Systems

170 West Tasman Drive

San Jose, CA 95134

Radio Test Report No: **EDCS - 23771100**

| | |
|---|--|
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| Revision | 1.0 |

This report replaces any previously entered test report under EDCS – 23771100. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 1526148



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Revision History

| Revision | Date | Comment |
|----------|------------|-----------------|
| 1 | 01/12/2023 | Initial release |

Section 1: Overview

1.1 Test Summary

The samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

| Specifications |
|-----------------------|
| 47 CFR 15.205 |
| 47 CFR 15.209 |
| 47 CFR 15.407 |
| RSS-247 Issue 2 |
| RSS-Gen Issue 5 |

Section 2: Assessment Information

2.1 General

This report contains an assessment of an apparatus against Radio Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

- a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.
- b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.
- c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).
- d) All testing was performed under the following environmental conditions:
 - Temperature 15°C to 35°C (54°F to 95°F)
 - Atmospheric Pressure 860mbar to 1060mbar (25.4" to 31.3")
 - Humidity 10% to 75*%
- e) All AC testing was performed at one or more of the following supply voltages:
 - 48VDC

2.2 Units of Measurement

The units of measurements defined in the appendices are reported in specific terms, which are test dependent. Where radiated measurements are concerned these are defined at a particular distance. Basic voltage measurements are defined in units of [dBuV]

As an example, the basic calculation for all measurements is as follows:

$$\text{Emission level [dBuV]} = \text{Indicated voltage level [dBuV]} + \text{Cable Loss [dB]} + \text{Other correction factors [dB]}$$

The combinations of correction factors are dependent upon the exact test configurations [see test equipment lists for further details] and may include:-

Antenna Factors, Pre Amplifier Gain, LISN Loss, Pulse Limiter Loss and Filter Insertion Loss..

Note: to convert the results from dBuV/m to uV/m use the following formula:-

$$\text{Level in uV/m} = \text{Common Antilogarithm } [(X \text{ dBuV/m})/20] = Y \text{ uV/m}$$

Measurement Uncertainty Values

| | |
|-----------------------------------|--------------------------------|
| voltage and power measurements | ± 2 dB |
| RF Output Power, conducted | ± 2 dB |
| radiated measurements | ± 3.2 dB |
| frequency measurements | ± 2.4 10 ⁻⁷ MHz |
| temperature measurements | $\pm 0.54^\circ\text{C}$ |
| humidity measurements | $\pm 2.3\%$ |
| DC and low frequency measurements | $\pm 2.5\%$. |

Where relevant measurement uncertainty levels have been estimated for tests performed on the apparatus. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Radiated emissions (expanded uncertainty, confidence interval 95%)

| | |
|--------------------|------------|
| 30 MHz - 300 MHz | +/- 3.8 dB |
| 300 MHz - 1000 MHz | +/- 4.3 dB |
| 1 GHz - 10 GHz | +/- 4.0 dB |
| 10 GHz - 18GHz | +/- 8.2 dB |
| 18GHz - 26.5GHz | +/- 4.1 dB |
| 26.5GHz - 40GHz | +/- 3.9 dB |

Conducted emissions (expanded uncertainty, confidence interval 95%)

| | |
|----------------|-------------|
| 30 MHz – 40GHz | +/- 0.38 dB |
|----------------|-------------|

A product is considered to comply with a requirement if the nominal measured value is below the limit line. The product is considered to not be in compliance in case the nominal measured value is above the limit line.

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2.3 Date of testing (initial sample receipt date to last date of testing)

21-November-2022 to 05-January-2023

2.4 Report Issue Date

12-January-2023

2.5 Testing facilities

This assessment was performed by:

Testing Laboratory

Cisco Systems, Inc.
125 West Tasman Drive (Building P)
San Jose, CA 95134
USA

Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134
USA

Registration Numbers for Industry Canada

| Cisco System Site | Address | Site Identifier |
|--------------------------|--|------------------------|
| Building P, 10m Chamber | 125 West Tasman Dr San Jose, CA 95134 | Company #: 2461N-2 |
| Building P, 5m Chamber | 125 West Tasman Dr San Jose, CA 95134 | Company #: 2461N-1 |
| Building 7, 5m Chamber | 425 E. Tasman Drive San Jose, California 95134 United States | Company #: 2461N-3 |

Test Engineer

Farida Rahmanzai

2.6 Equipment Assessed (EUT)

IW9165DH-B with embedded 5/6GHz radio module.

2.7 EUT Description

The Catalyst IW9165 Series addresses the growing need for reliable client wireless connectivity to mission-critical applications as organizations automate processes and operations. It comes with two 2x2 radios, features an industrial design, and is packed with advanced features.

The Cisco Catalyst IW9165D Heavy Duty Access Point is designed to make wireless backhaul deployment simple. It comes with a built-in directional antenna that enables long-range, high-throughput connectivity anywhere fiber is not an option. The external antenna ports let you quickly extend your network to new places when needed and choose the right antenna based on the use cases and deployment architectures. With heavy-duty IP67 design, the Catalyst IW9165D is certified to operate under wet, dusty, and extreme temperature conditions.

IW9165DH Key Features:

- Dual radio – 5GHz, 5/6GHz
- Directional & External (2 x N Type) antennas
- 2x2 MIMO 2SS, Max data rate – 3.6 Gbps
- BTLE, GNSS radio
- CURWB mode provides reliable wireless connectivity
- RJ45, M12 – 1 x 2.5Gbps, 1x 1 Gbps
- Dual power input – PoE-in & 24-48VDC
- Dual mounting options – Pole & Wall mount
- IP67

Wireless Protocols support

- Wi-Fi: IEEE 802.11a, 802.11n, 802.11ac, 802.11ax
- Bluetooth Low Energy v5.0: IEEE 802.15 (1Mbps & 2Mbps, single stream)
- GNSS (Global Navigation Satellite System) receiver

5/6 GHz radio specification:

- 802.11a (5 GHz band only): 6, 9, 12, 18, 24, 36, 48, 54 Mbps
- 802.11n (5 GHz band only): HT20 and HT40, MCS0 to 15
- 802.11ac (5 GHz band only):
 - VHT20 MCS0 to 8, 1 or 2 spatial streams
 - VHT80, VHT160 MCS0 to 9, 1 or 2 spatial streams
- 802.11ax: ◦ HE20, HT40, HE80, and HE160 MCS0 to 11, 1 or 2 spatial streams



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The following antennas are supported by this product series.

Please note the following antenna gain information was provided by the customer:

| Frequency | Part Number | Antenna Type | Peak Antenna Gain (dBi) |
|-----------|-------------------|---|-------------------------|
| 5/6 GHz | IW-ANT-OMH-2567-N | Tri-band 2.4Ghz 4dBi, 5/6GHz 7dBi Omnidirectional Collinear Array Antenna, Horizontally Polarized, N male connector | 7.0 |

Model/PID differences

All PIDs have identical components, PCB layout, electronics circuitries and enclosure. The only difference is domain code selected in the software.

The model differences are described below:

IW9165DH-B represents U.S PID with US domain code selected

IW9165DH-A represents Canada PID with Canada domain code selected.

IW9165DH-ROW represents Worldwide PID, except for US & CAN, with ROW domain code selected.

Section 3: Result Summary

3.1 Results Summary Table

Radiated Emissions (General requirements)

| Basic Standard | Technical Requirements / Details | Result |
|---|---|--------|
| FCC 15.407 (b)(1) | TX Spurious Emissions in non-restricted bands: FCC: Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits: For transmitters operating in the 5.15–5.25 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of –27 dBm/MHz. | Pass |
| FCC 15.407 (b)(9) | FCC: Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209 . | |
| FCC 15.209 | FCC: Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the field strength limits table in this section. | |
| RSS-247 6.2.1.2 | RSS: For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. | |
| FCC 15.209 FCC 15.205 RSS-Gen 8.10 | TX Spurious Emissions in restricted bands: FCC: Unwanted emissions falling within the restricted bands, as defined in FCC 15.205 (a) must also comply with the radiated emission limits specified in FCC 15.209 (a). RSS: Unwanted emissions falling into restricted bands of Table 6 shall comply with the limits of Table 4 specified in RSS-Gen 8.9. | Pass |



Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the “Justification for worst Case test Configuration” section of this report for further details on the selection of EUT samples.

4.1 Sample Details

| Sample Number | Equipment Details | Serial Number | CISCO Part Number | Radio FW Version |
|---------------|---|---------------|-------------------|---------------------------------------|
| S01 | IW9165DH-B with embedded 5GHz radio module. | FOC2638BL8Z | 68-103412-02 | WLAN.HK.2.4.c2-00211-QCAHKSUPL_SILICO |
| S02 | IW-PWRADPT-MFIT4PN Liteon AC Adaptor | LIN2631203M | 341-101392-01 | ---- |

4.2 System Details

| System # | Description | Samples |
|----------|---|----------|
| 1 | IW9165DH-B w/ embedded Wi-Fi Radio module + external power supply | S01, S02 |

4.3 Mode of Operation Details

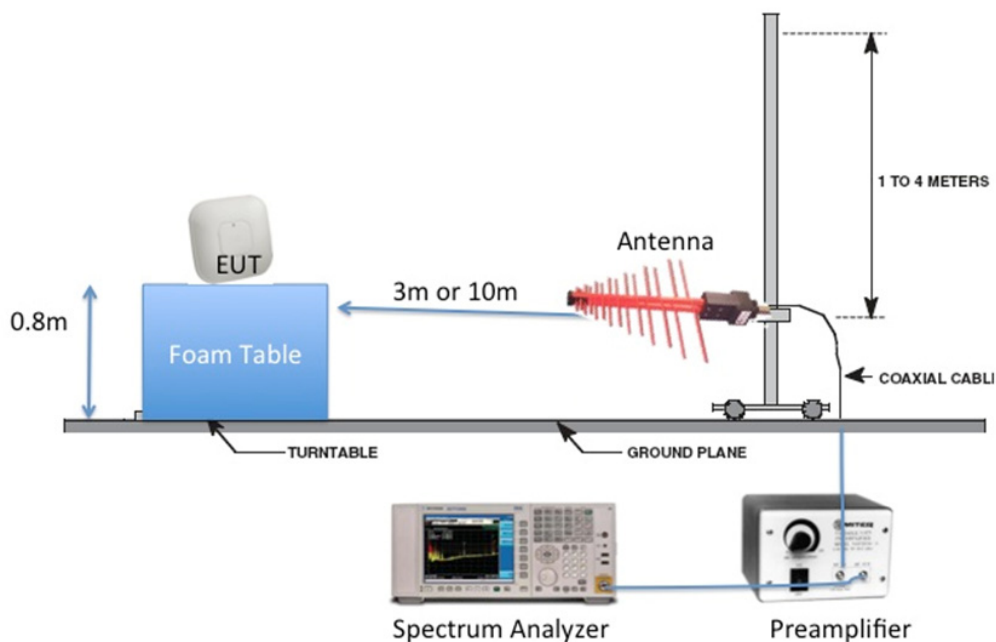
| Mode # | Wi-Fi Mode | Modulation | Data Rate | BW |
|-------------|-----------------------|------------|-----------|-------|
| 1. Transmit | 2x2 MIMO 802.11n/HT20 | MIMO-OFDM | MCS0 | 20MHz |

Note: Table above represents the worst-case scenarios for all modulations and data rate combination of each mode. The TX modes in the table above were determined to be the worst-case emissions of all TX modes and selected for RSE testing.

Appendix A: Radiated Spurious Emission

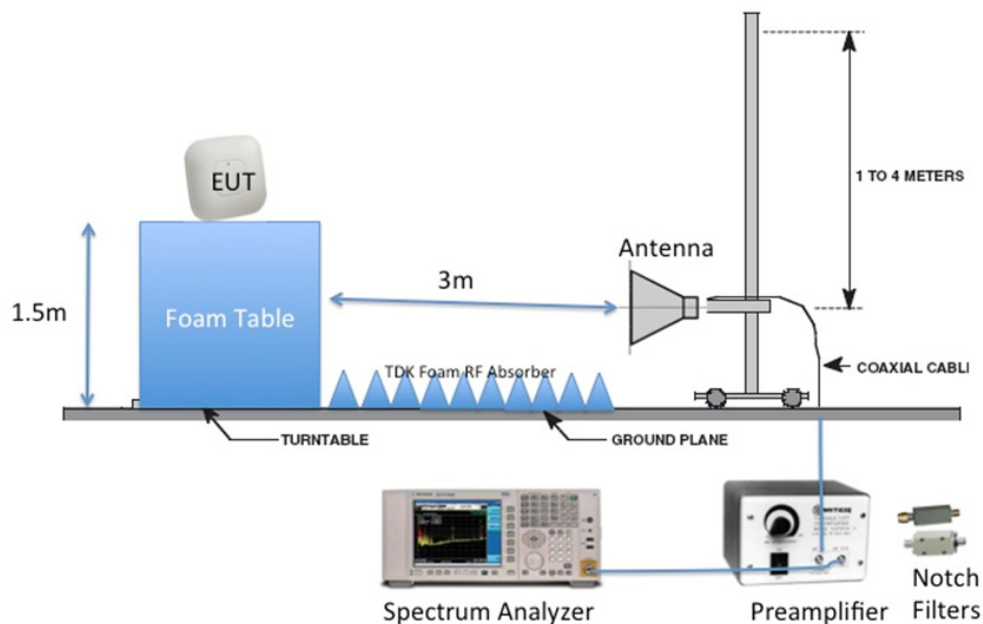
A.1 Setup Diagram

Radiated Emission Setup Diagram-Below 1G (Preamp used is optional)



Note: The radiated spurious emissions test setup referenced to KDB789033 D02, v02r01, Section II (G)(3)(b)(i)), the EUT antenna ports were terminated with 50Ω loads.

Radiated Emission Setup Diagram-Above 1G



Note: The radiated spurious emissions test setup referenced to KDB789033 D02, v02r01, Section II (G)(3)(b)(i)), the EUT antenna ports were terminated with 50Ω loads.

A.2 Radiated Spurious Emissions Test Requirements & Limits

Emissions on frequency or frequencies which are outside the necessary bandwidth and level of which may be reduced without effecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Restricted bands Limits

FCC 15.407 (b) (10) The provisions of 15.205 apply to intentional radiators operating under this section.

FCC 15.205 (b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

| Restricted Bands for FCC | | | |
|--------------------------|---------------------|---------------|-------------|
| MHz | MHz | MHz | GHz |
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 10.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

RSS-Gen 8.10

(b) Unwanted emissions that fall into restricted bands of Table 7 shall comply with the limits specified in table 5 (general field strength limits at frequencies above 30 MHz) and table 6 (general field strength limits at frequencies below 30 MHz).

(c) Unwanted emissions that do not fall within the restricted frequency bands of Table 7 comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7 Restricted Bands

| MHz | MHz | GHz |
|-------------------|---------------------|-------------|
| 0.090-0.110 | 74.8-75.2 | 9.0-9.2 |
| 2.1735-2.1905 | 108-138 | 9.3-9.5 |
| 3.020-3.026 | 156.52475-156.52525 | 10.6-12.7 |
| 4.125-4.128 | 156.7-156.9 | 13.25-13.4 |
| 4.17725-4.17775 | 240-285 | 14.47-14.5 |
| 4.20725-4.20775 | 322-335.4 | 15.35-16.2 |
| 5.677-5.683 | 399.9-410 | 17.7-21.4 |
| 6.215-6.218 | 608-614 | 22.01-23.12 |
| 6.26775-6.26825 | 960-1427 | 23.6-24.0 |
| 6.31175-6.31225 | 1435-1626.5 | 31.2-31.8 |
| 8.291-8.294 | 1645.5-1646.5 | 36.43-36.5 |
| 8.362-8.366 | 1660-1710 | Above 38.6 |
| 8.37625-8.38675 | 1718.8-1722.2 | * |
| 8.41425-8.41475 | 2200-2300 | |
| 12.29-12.293 | 2310-2390 | |
| 12.51975-12.52025 | 2655-2900 | |
| 12.57675-12.57725 | 3260-3267 | |
| 13.36-13.41 | 3332-3339 | |
| 16.42-16.423 | 3345.8-3358 | |
| 16.69475-16.69525 | 3500-4400 | |
| 16.80425-16.80475 | 4500-5150 | |
| 25.5-25.67 | 5350-5460 | |
| 37.5-38.25 | 7250-7750 | |
| 73-74.6 | 8025-8500 | |

Non-Restricted Bands Limits

Below 1 GHz

FCC 15.209

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the table specified in the table in FCC§15.209(a).

FCC15.407

(b) (9) Unwanted emissions below 1GHz must comply with general field strength limits set forth in §15.209.

RSS-Gen 8.9

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

| General Field Strength Limits Table | | | |
|-------------------------------------|---------------------------|-----------------------------|-------------------------------|
| Frequency (MHz) | Field strength (uV/meter) | Field strength (dBuV/meter) | Measurement distance (meters) |
| 30-88 | 100** | 40 Qp | 3 |
| 88-216 | 150** | 43.5 Qp | 3 |
| 216-960 | 200** | 46 Qp | 3 |
| Above 960 | 500 | 54 Av / 74 Pk | 3 |

Above 1 GHz

FCC15.407

(b) *Undesirable emission limits.* Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz

RSS-247 (6.2.1.2)

For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.

A.3 Limit Conversion (power to field strength)

The field strength limit in dBμV can be converted from power (logarithmic) by using the field strength (linear) approach formula as follows:

$$V/m = \frac{\sqrt{30 \times Pt \times gt}}{d}$$

where: **pt** = transmitter output power in watts,
gt = numeric gain of the transmitting antenna (unit less),
E = electric field strength in V/m,
d = measurement distance in meters (m).

From the equation above, unit conversion from log => linear with a known power limit of -27 dBm.

(1) Conversion from dBm to Watt

$$\text{dBm to Watts } W = 10^{((\text{dBm} - 30)/10)}$$

$$\begin{aligned} P(W) &= 10^{(-27 - 30) / 10} \\ &= 10^{-5.7} \\ &= 1.995 \times 10^{-6} \end{aligned}$$

(2) Convert from Watt to field strength

- a. Convert from Watt to V/m @ 3m distance

$$\begin{aligned} V/m &= \frac{\sqrt{30 \times Pt \times gt}}{3} \\ &= \frac{\sqrt{30 \times 0.000001995 \times 1}}{3} \\ &= \mathbf{0.00257} \end{aligned}$$

- b. Convert field strength to power density (V/m to dBμV/m)

$$\begin{aligned} \text{dB}\mu\text{V/m} &= 20 \log (V/m) + 120 \\ &= \mathbf{68.2} \end{aligned}$$

A.4 Test Procedure

Ref. ANSI C63.10: 2013 section 5 / section 6.5, section 6.6

| Test Procedure |
|--|
| <ol style="list-style-type: none"> 1. Place EUT on the tabletop 80cm above ground below 1GHz scan and 1.5m above 1GHz scan with @3m test distance from measuring antenna from 30MHz – 40GHz preferably. If necessary due to instrument setup capabilities in higher frequency range, 1m test distance can be used. 2. Turn on the lowest radio operating frequency in continuous transmit mode. 3. Use Vasona software to configure the Spectrum analyzer test parameters as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). 4. Allow Vasona software to initiate the pre-scan and identify all emissions close to the limits. 5. Manually fine tune all identified emissions and use the marker function to determine the maximum spurs amplitude level. 6. Record at least 6 highest identified emissions with amplitude relative to the limits. Emissions more than 20 dB below the peak limits do not need to be reported. 7. For all emissions identified in the restricted bands, perform formal measurement. 8. Capture graphs and record pertinent measurement data. 9. Repeat step 2- 8 with middle and highest operating radio frequency. |
| <p>Note: Vasona software shall automatically control the movement of the antenna height from 1m – 4m and rotation of the turntable from 0° - 360° and perform the measurement for all identified emissions.</p> |

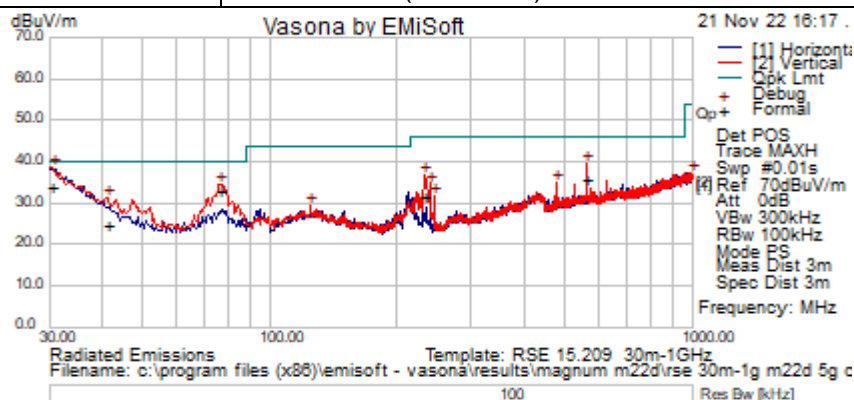
Ref. ANSI C63.10: 2013 section 4.1.4 / section 12.7.5 (Quasi-Peak), section 12.7.6 (peak), section 12.7.7.3 (average), Cisp16-1-1

| Test parameters |
|--|
| <ol style="list-style-type: none"> (i) Span = Entire frequency range or segment if necessary. (ii) Reference Level \geq 10dB headroom between Spectrum analyzer's ceiling and top carrier signal (iii) RBW = 100 kHz (less than or equal to 1 GHz); 1 MHz (above 1 GHz) (iv) VBW \geq 3 x RBW (v) Detector = Peak & Quasi-Peak (frequency range 30 MHz to 1 GHz); Peak & Average (frequency range above 1 GHz); Change VBW to 10 Hz for average measurement (vi) Sweep Time = Couple |

Note: The data displayed on the plots detailed in the graphical test results section were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements.

A.5 TX Radiated Spurious Emissions Graphical Data Results

| | |
|---|--|
| Subtest Date | 21-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 30MHz - 1GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 36 (5180 MHz) |

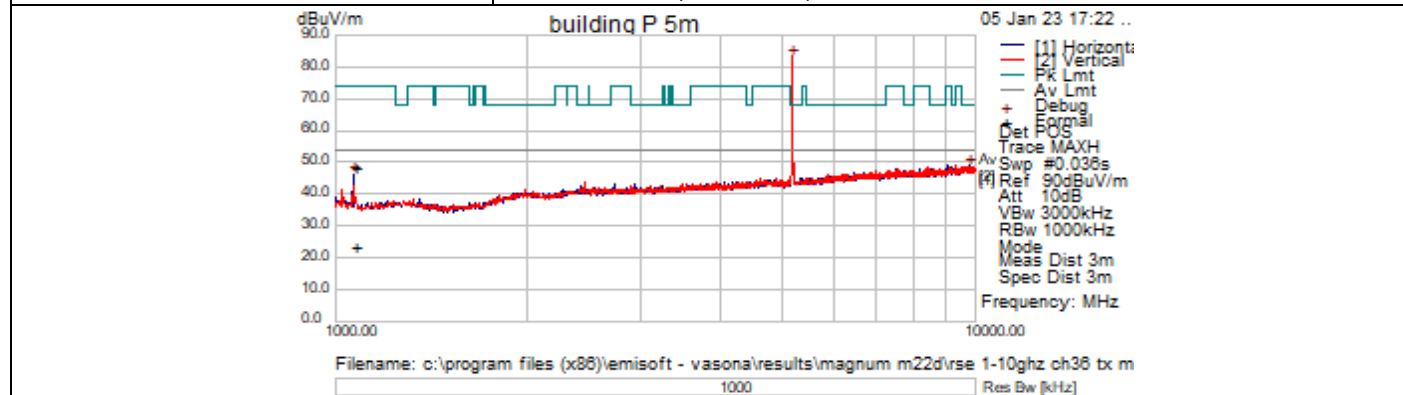


| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 30.22638 | 12.2 | 0.46 | 21.17 | 33.83 | Quasi-pk | V | 102 | 296 | 40 | -6.17 | Pass | |
| 76.25291 | 24.3 | 0.72 | 7.9 | 32.92 | Quasi-pk | V | 122 | 69 | 40 | -7.08 | Pass | |
| 560.0398 | 15.51 | 2 | 18.35 | 35.86 | Quasi-pk | V | 99 | 250 | 46 | -10.14 | Pass | |
| 41.16175 | 10.81 | 0.54 | 13.38 | 24.73 | Quasi-pk | V | 215 | 332 | 40 | -15.27 | Pass | |
| 232.2887 | 19.24 | 1.27 | 11.05 | 31.57 | Quasi-pk | V | 99 | 127 | 46 | -14.43 | Pass | |



Radio Test Report No: **EDCS - 23771100**

| | |
|---|---|
| Subtest Date | 05-Jan-2023 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1GHz - 18GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 36 (5180 MHz) |



TX Spurious Emissions from 1GHz-10GHz

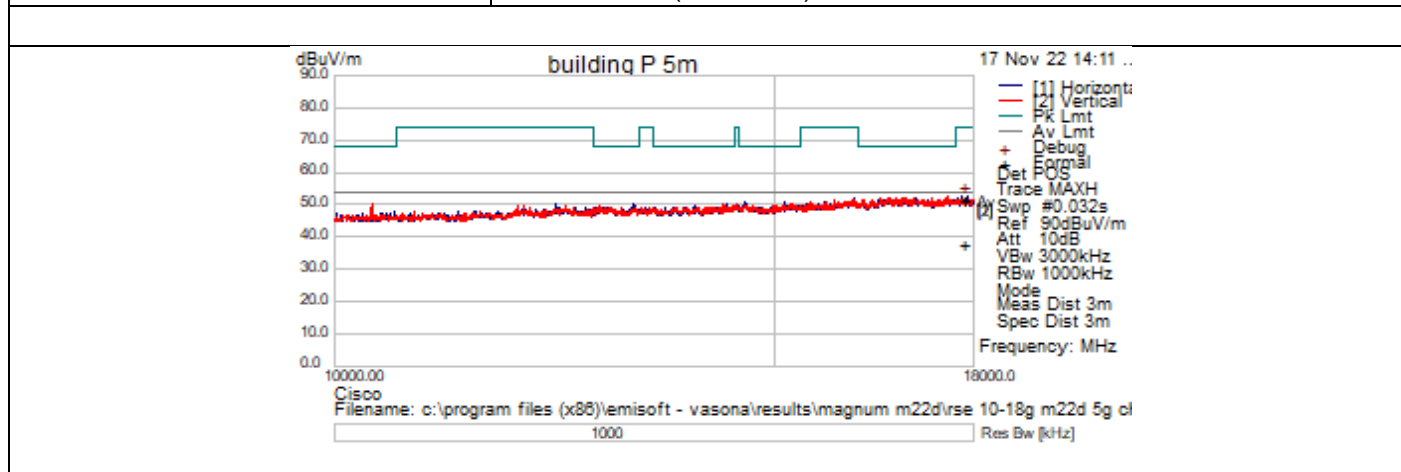
| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|-------------|
| 5176 | 92.83 | 7.44 | -16.9 | 83.37 | Peak | V | 150 | 319 | -- | -- | Ignored | fundamental |
| 9788.5 | 51.88 | 10.83 | -13.83 | 48.87 | Peak | H | 300 | 282 | 54 | -5.13 | Pass | Noise floor |
| 1070.623 | 70.5 | 3.25 | -25.04 | 48.72 | Peak | H | 251 | 22 | 74 | -25.28 | Pass | RB |
| 1070.623 | 45.09 | 3.25 | -25.04 | 23.31 | Average | H | 251 | 22 | 54 | -30.69 | Pass | RB |

Note: RB means restricted band



Radio Test Report No: **EDCS - 23771100**

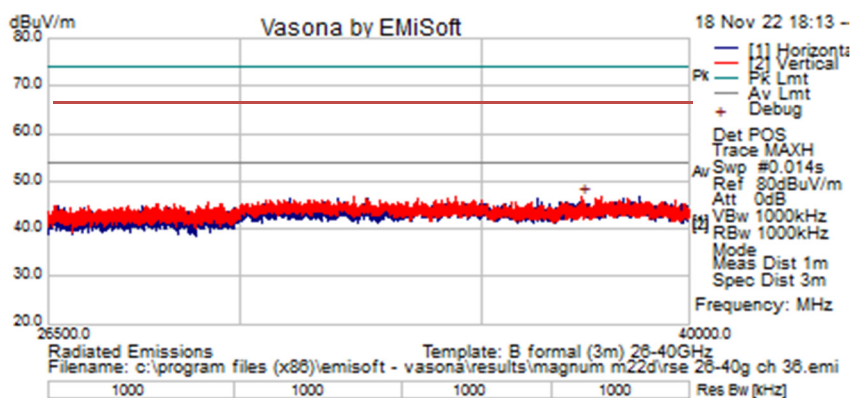
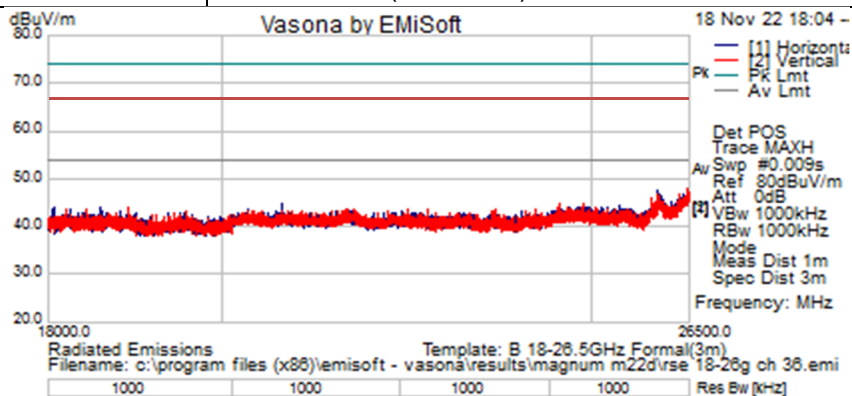
| | |
|---|---|
| Subtest Date | 17-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1GHz - 18GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 36 (5180 MHz) |



Note: No measurable emissions found from 10GHz - 18GHz

Radio Test Report No: **EDCS - 23771100**

| | |
|---|---|
| Subtest Date: | 18-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 18GHz - 40GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 36 (5180 MHz) |



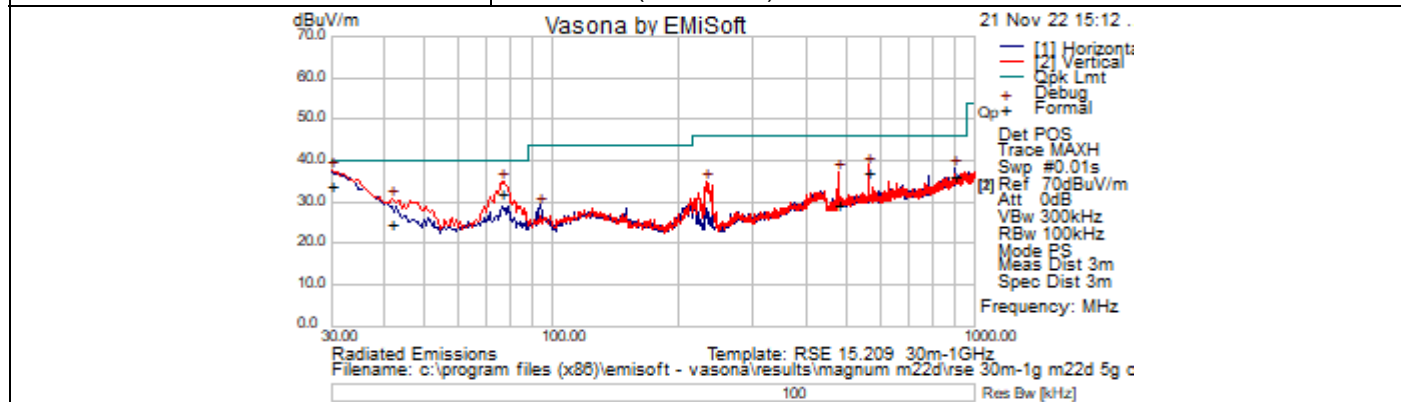
Legend: — 74dB μ V/m (Peak); — 54 dB μ V/m (Average); — 68dB μ V/m (Peak)(-27dbm)

Note: No measurable emissions found from 18GHz - 40GHz.



Radio Test Report No: **EDCS - 23771100**

| | |
|---|---|
| Subtest Date | 21-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 30MHz - 1GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Channel 44 (5220 MHz) |

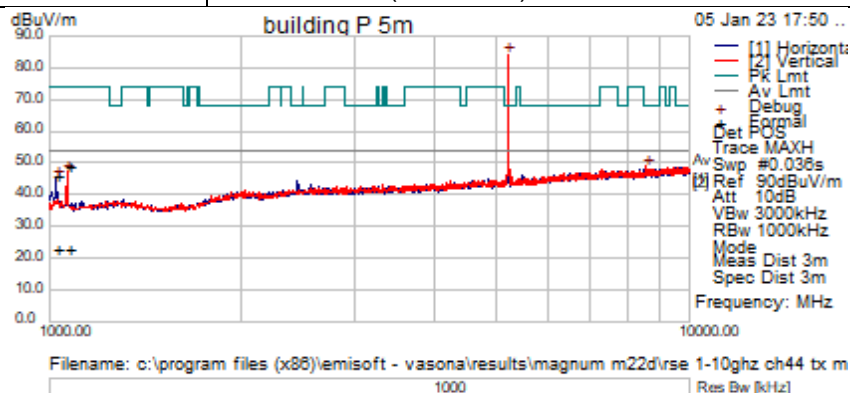


TX Spurious Emissions from 30MHz-1GHz

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 30.11048 | 12.33 | 0.46 | 21.23 | 34.02 | Quasi-pk | H | 225 | 221 | 40 | -5.98 | Pass | |
| 75.80988 | 23.69 | 0.72 | 7.96 | 32.37 | Quasi-pk | V | 143 | 110 | 40 | -7.63 | Pass | |
| 560.0523 | 16.76 | 2 | 18.35 | 37.11 | Quasi-pk | V | 101 | 245 | 46 | -8.89 | Pass | |
| 899.9786 | 11.23 | 2.54 | 22.35 | 36.12 | Quasi-pk | V | 99 | 253 | 46 | -9.88 | Pass | |
| 474.9629 | 9.91 | 1.84 | 17.46 | 29.21 | Quasi-pk | V | 100 | -1 | 46 | -16.79 | Pass | |
| 41.59052 | 11.11 | 0.54 | 13.05 | 24.7 | Quasi-pk | V | 187 | 330 | 40 | -15.3 | Pass | |

Radio Test Report No: **EDCS - 23771100**

| | |
|---|---|
| Subtest Date | 05-Jan-2023 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1GHz - 18GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 44 (5220 MHz) |



TX Spurious Emissions from 1GHz-10GHz

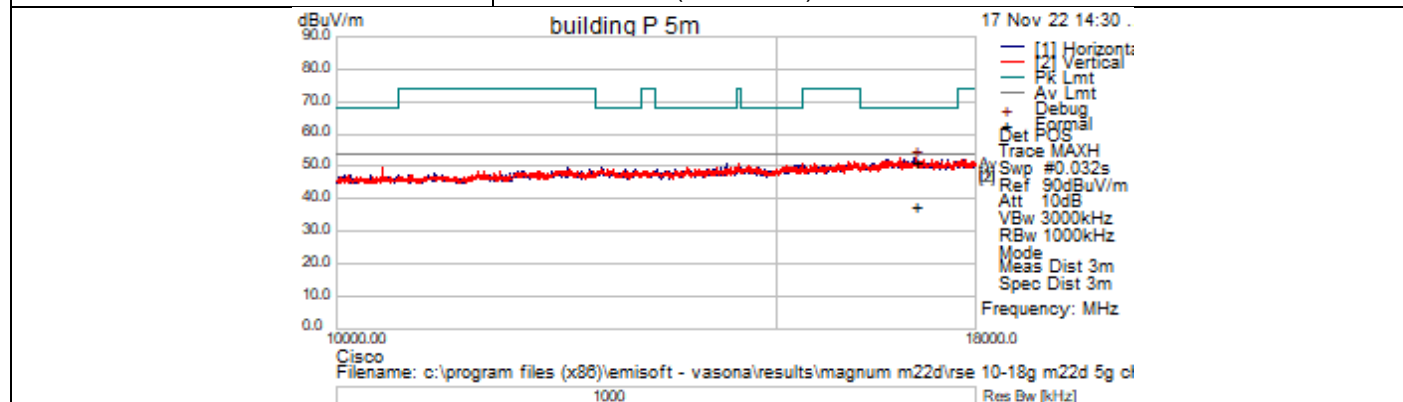
| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|-------------|
| 5212 | 93.61 | 7.47 | -16.82 | 84.26 | Peak | V | 200 | 303 | -- | -- | Ignored | Fundamental |
| 8578 | 53.52 | 10.06 | -14.59 | 48.99 | Peak | V | 250 | 142 | 54 | -5.01 | Pass | Noise floor |
| 1071.423 | 70.58 | 3.25 | -25.04 | 48.79 | Peak | V | 201 | 329 | 74 | -25.21 | Pass | RB |
| 1071.423 | 44.81 | 3.25 | -25.04 | 23.02 | Average | V | 201 | 329 | 54 | -30.98 | Pass | RB |
| 1029.775 | 67.26 | 3.18 | -24.56 | 45.89 | Peak | H | 146 | 53 | 74 | -28.11 | Pass | RB |
| 1029.775 | 44.37 | 3.18 | -24.56 | 22.99 | Average | H | 146 | 53 | 54 | -31.01 | Pass | RB |

Note: RB means restricted band



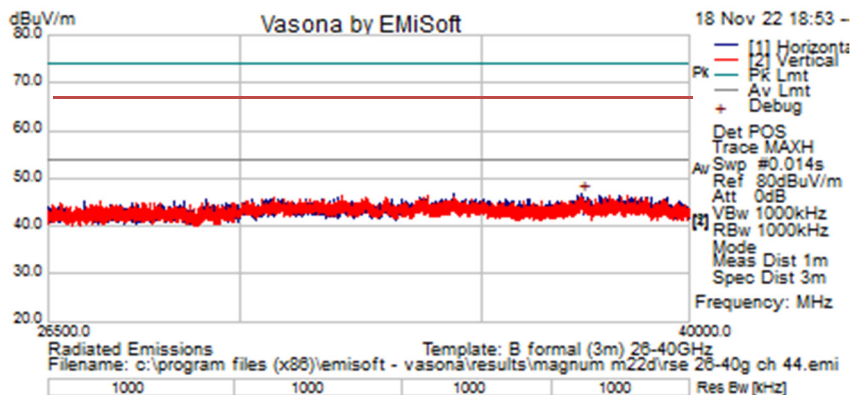
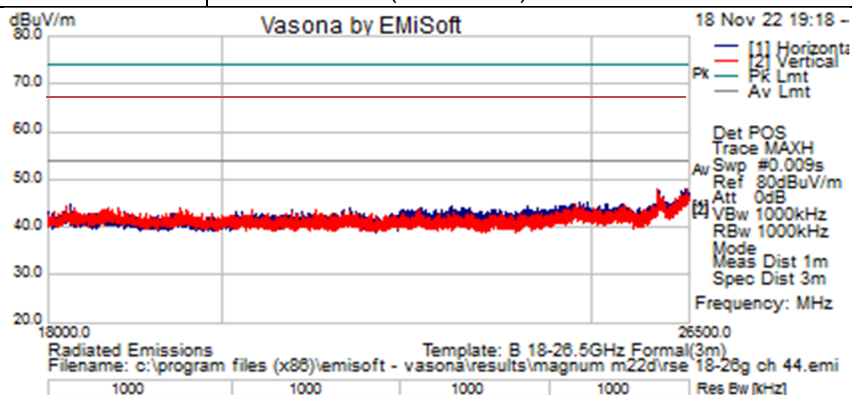
Radio Test Report No: **EDCS - 23771100**

| | |
|---|---|
| Subtest Date | 17-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1GHz - 18GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 44 (5220 MHz) |



Note: No measurable emissions found from 10GHz - 18GHz

| | |
|---|--|
| Subtest Date | 18-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 18GHz - 40GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 44 (5220 MHz) |



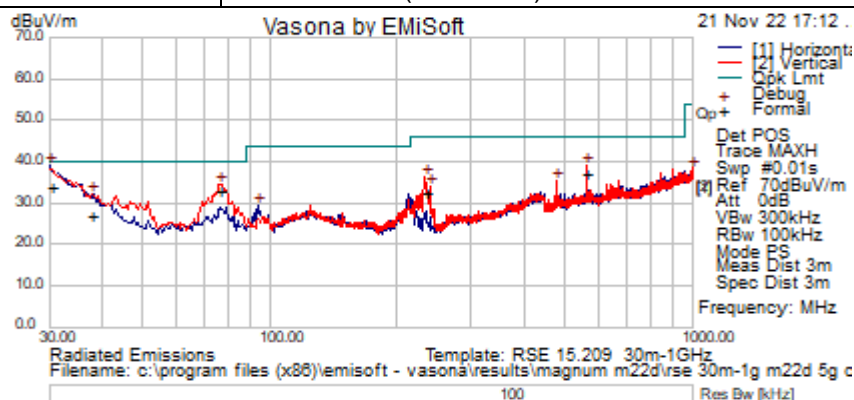
Legend: — 74dB μ V/m (Peak); — 54 dB μ V/m (Average); — 68dB μ V/m (Peak)(-27dbm)

Note: No measurable emissions found from 18GHz - 40GHz.



Radio Test Report No: **EDCS - 23771100**

| | |
|---|--|
| Subtest Date | 21-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 30MHz - 1GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 48 (5240 MHz) |



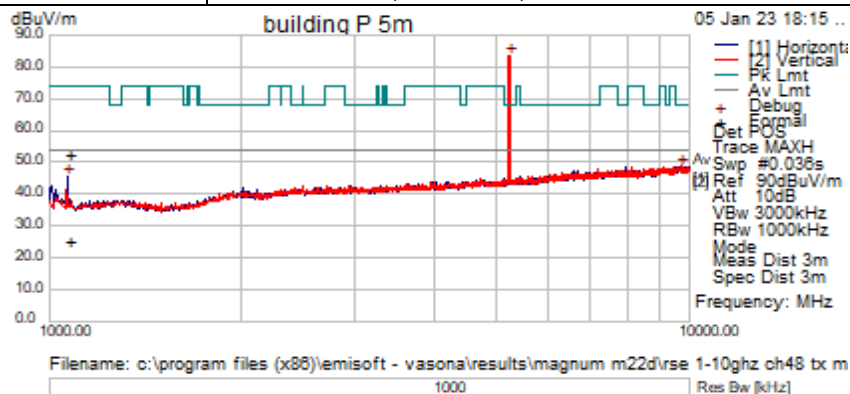
TX Spurious Emissions from 30MHz-1GHz

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 30.25725 | 12.42 | 0.46 | 21.15 | 34.03 | Quasi-pk | H | 306 | 218 | 40 | -5.97 | Pass | |
| 76.25416 | 24.56 | 0.72 | 7.9 | 33.19 | Quasi-pk | V | 142 | 338 | 40 | -6.81 | Pass | |
| 560.0323 | 16.72 | 2 | 18.35 | 37.07 | Quasi-pk | V | 99 | 245 | 46 | -8.93 | Pass | |
| 37.63406 | 10.46 | 0.52 | 16.03 | 27 | Quasi-pk | V | 173 | 57 | 40 | -13 | Pass | |
| 232.824 | 20.04 | 1.27 | 11.08 | 32.39 | Quasi-pk | V | 113 | 144 | 46 | -13.61 | Pass | |



Radio Test Report No: **EDCS - 23771100**

| | |
|---|---|
| Subtest Date | 05-Jan-2023 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1GHz - 10GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 48 (5240 MHz) |

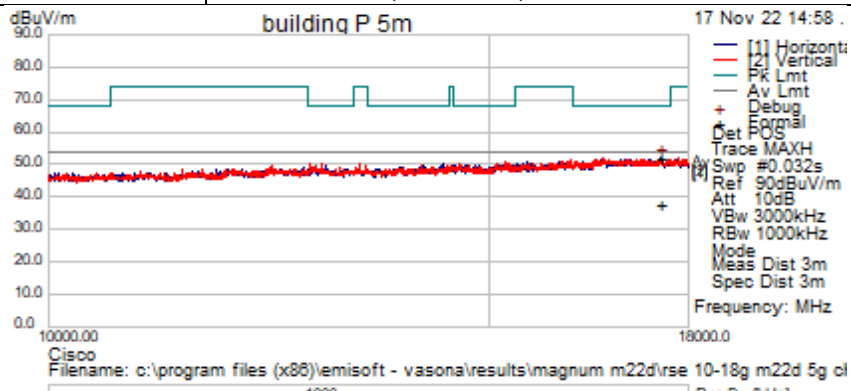


TX Spurious Emissions from 1GHz-10GHz

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|-------------|
| 5230 | 92.83 | 7.5 | -16.81 | 83.52 | Peak | V | 150 | 314 | -- | -- | Ignored | Fundamental |
| 9707.5 | 52.01 | 10.75 | -13.89 | 48.86 | Peak | V | 150 | 250 | 54 | -5.14 | Pass | Noise floor |
| 1070.698 | 74.46 | 3.25 | -25.04 | 52.68 | Peak | H | 151 | 333 | 74 | -21.32 | Pass | RB |
| 1070.698 | 47.16 | 3.25 | -25.04 | 25.38 | Average | H | 151 | 333 | 54 | -28.62 | Pass | RB |

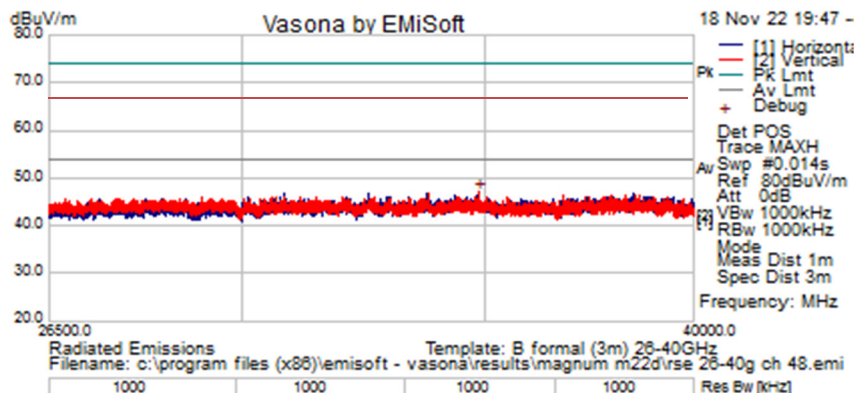
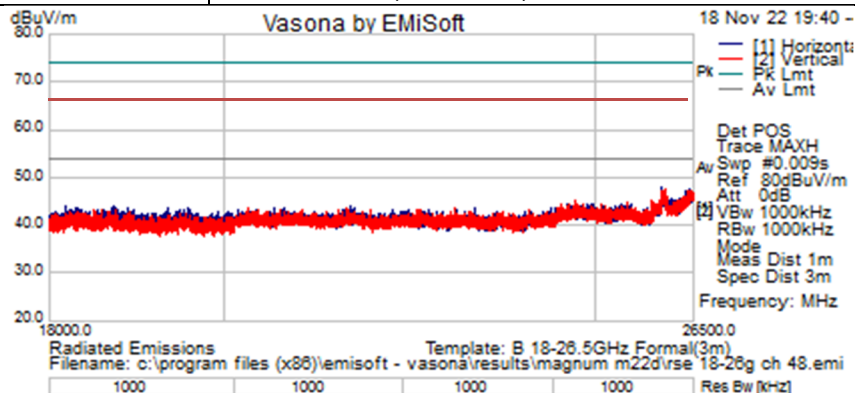
Note: RB means restricted band

Radio Test Report No: **EDCS - 23771100**

| | |
|--|---|
| Subtest Date | 17-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 10GHz - 18GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 48 (5240 MHz) |
|  | |

Note: No measurable emissions found from 10GHz - 18GHz

| | |
|---|--|
| Subtest Date | 18-Nov-2022 |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 18GHz - 40GHz |
| Mode | 2x2 MIMO 802.11n/HT20 (Refer to section 4.3 for system details) |
| Comments on the above Test Results | Tx Channel 48 (5240 MHz) |



Legend: — 74dB μ V/m (Peak); — 54 dB μ V/m (Average); — 68dB μ V/m (Peak)(-27dbm)

Note: No measurable emissions found from 18GHz - 40GHz.



Appendix B: List of Test Equipment Used to perform the test

| Equip# | Manufacturer/ Model | Description | Last Cal | Next Due | Test Section |
|---|--|--|-------------|-------------|--------------|
| Radiated Emissions 30MHz – 1GHz | | | | | |
| CIS008448 | Cisco/NSA 5m Chamber | NSA 5m Chamber | 23-Aug-2022 | 23-Aug-2023 | A.5 |
| CIS058263 | ROHDE & SCHWARZ/ ESW44 | EMI TEST RECEIVER, 44Ghz | 22-Aug-2022 | 22-Aug-2023 | A.5 |
| CIS032367 | Sunol Sciences / JB1 | Combination Bi-Log Antenna, 30MHz-2GHz | 16-May-2022 | 16-May-2023 | A.5 |
| CIS008515 | Huber+Suhner /SF106 | Sucoflex Cable | 30-Aug-2022 | 30-Aug-2023 | A.5 |
| CIS021117 | Micro-Coax / UFB311A-0- 2484-520520 | RF Coaxial Cable, 272.0 in. - 18GHz | 12-Sep-2022 | 12-Sep-2023 | A.5 |
| CIS063069 | Micro-Coax / UFB311A-0- 2484-520520 | RF Coaxial Cable, 272.0 in. - 18GHz | 12-Sep-2022 | 12-Sep-2023 | A.5 |
| Radiated Emissions 1GHz – 18GHz | | | | | |
| CIS40597 | Cisco/NSA 5m Chamber | NSA 5m Chamber Above 1GHz | 10-Sep-2022 | 10-Sep-2023 | A.5 |
| CIS037581 | ETS Lindgren / 3117 | Double Ridged Guide Horn Antenna | 05-May-2022 | 05-May-2023 | A.5 |
| CIS063061 | Cisco / TstHd1 | External Preamplifier Array, 1-18GHz | 06-Jul-2022 | 06-Jul-2023 | A.5 |
| CIS055357 | MITEQ/TTA1800-30-HG-N-M | N-Type Pre-amplifier 18GHz | 09-Jun-2022 | 09-Jun-2023 | A.5 |
| CIS058263 | ROHDE & SCHWARZ/ ESW44 | EMI TEST RECEIVER, 44Ghz | 22-Aug-2022 | 22-Aug-2023 | A.5 |
| CIS008515 | Huber+Suhner /SF106 | Sucoflex Cable | 30-Aug-2022 | 30-Aug-2023 | A.5 |
| CIS021117 | Micro-Coax / UFB311A-0- 2484-520520 | RF Coaxial Cable, 272.0 in. - 18GHz | 12-Sep-2022 | 12-Sep-2023 | A.5 |
| CIS063069 | Micro-Coax / UFB311A-0- 2484-520520 | RF Coaxial Cable, 272.0 in. - 18GHz | 12-Sep-2022 | 12-Sep-2023 | A.5 |
| CIS025000 | Micro-Coax / UFB197C | RF Coaxial Cable | 10-Aug-2022 | 10-Aug-2023 | A.5 |
| Radiated Emissions 18GHz – 40GHz | | | | | |
| CIS40597 | Cisco/NSA 5m Chamber | NSA 5m Chamber Above 1GHz | 10-Sep-2022 | 10-Sep-2023 | A.5 |
| CIS41971 | CISCO/1840 | 18-40GHz EMI Test Head/Verification Fixture including Horn antenna | 14-Sep-2022 | 14-Sep-2023 | A.5 |
| CIS59832 | ROHDE & SCHWARZ/ ESW44 | EMI TEST RECEIVER, 44Ghz | 31-Oct-2022 | 31-Nov-2023 | A.5 |

Appendix C: Abbreviation Key and Definitions

The following table defines abbreviations used within this test report.

| Abbreviation | Description | Abbreviation | Description |
|--------------|--|--------------|------------------------------------|
| EMC | Electro Magnetic Compatibility | °F | Degrees Fahrenheit |
| EMI | Electro Magnetic Interference | °C | Degrees Celsius |
| EUT | Equipment Under Test | Temp | Temperature |
| ITE | Information Technology Equipment | S/N | Serial Number |
| TAP | Test Assessment Schedule | Qty | Quantity |
| ESD | Electro Static Discharge | emf | Electromotive force |
| EFT | Electric Fast Transient | RMS | Root mean square |
| EDCS | Engineering Document Control System | Qp | Quasi Peak |
| Config | Configuration | Av | Average |
| CIS# | Cisco Number (unique identification number for Cisco test equipment) | Pk | Peak |
| Cal | Calibration | kHz | Kilohertz (1x10 ³) |
| EN | European Norm | MHz | MegaHertz (1x10 ⁶) |
| IEC | International Electro technical Commission | GHz | Gigahertz (1x10 ⁹) |
| CISPR | International Special Committee on Radio Interference | H | Horizontal |
| CDN | Coupling/Decoupling Network | V | Vertical |
| LISN | Line Impedance Stabilization Network | dB | decibel |
| PE | Protective Earth | V | Volt |
| GND | Ground | kV | Kilovolt (1x10 ³) |
| L1 | Line 1 | μV | Microvolt (1x10 ⁻⁶) |
| L2 | Line2 | A | Amp |
| L3 | Line 3 | μA | Micro Amp (1x10 ⁻⁶) |
| DC | Direct Current | mS | Milli Second (1x10 ⁻³) |
| RAW | Uncorrected measurement value, as indicated by the measuring device | μS | Micro Second (1x10 ⁻⁶) |
| RF | Radio Frequency | μS | Micro Second (1x10 ⁻⁶) |
| SLCE | Signal Line Conducted Emissions | m | Meter |
| Meas dist | Measurement distance | Spec dist | Specification distance |
| N/A or NA | Not Applicable | SL | Signal Line (or Telecom Line) |
| P | Power Line | L | Live Line |
| N | Neutral Line | R | Return |
| S | Supply | AC | Alternating Current |

Appendix D: Photographs of Test Setups

See FCC/RSS RSE Test Setup document – EDCS-23771099



Radio Test Report No: **EDCS - 23771100**

Appendix E: Software Used to Perform Testing

EMlsoft Vasona, version 6.083

Appendix F: Test Procedures

Measurements were made in accordance with

- KDB 789033 - D02 General UNII Test Procedures New Rules v02r01
- KDB 662911 - MIMO
- ANSI C63.10 2013 Intentional Radiators

Test procedures are summarized below:

| | |
|------------------------------|----------------|
| FCC 5GHz Test Procedures | EDCS # 1445048 |
| FCC 5GHz RSE Test Procedures | EDCS # 1511600 |



Radio Test Report No: **EDCS - 23771100**

Appendix G: Scope of Accreditation (A2LA certificate number 1178-01)

The scope of accreditation of Cisco Systems, Inc. can be found on the A2LA web page at:

<http://www.a2la.org/scopepdf/1178-01.pdf>

Appendix H: Test Assessment Plan

Compliance Test Plan (Excel) EDCS# 23771097

Target Power Tables EDCS# 23409888

Appendix I: Worst Case Justification

Worst case modes were selected by by ANSI C63.10 2013 Section **5.6.2.2, 6.3.1**

All 3 orientations (Z, Y, Z) of the EUT were assessed by performing pre-scan.

The Y orientation was determined to be the worst-case orientation.