UNII-3 (5725-5850MHz) Wi-Fi Radio Test Report

(Radiated Spurious Emissions Only)

For

IW9165DH-B, IW9165DH-A & IW9165DH-ROW

Supports

5/6 GHz 802.11 a/ac/ax/n Wi-Fi radio + 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

A2LA ACCREDITED
CERTIFICATE #1178.01

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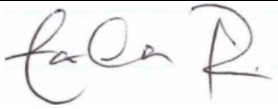
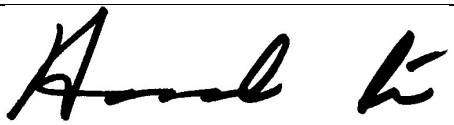
Tested By: Farida Rahmanzai **Title**: Test Engineer	
Approved By: Howard Ji **Title**: Compliance Manager	
Revision	1.0

This report replaces any previously entered test report under EDCS – 23771103. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 1526152.

This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

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:

Emission level [dBuV] = Indicated voltage level [dBuV] + Cable Loss [dB] + 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:-

Level in uV/m = Common Antilogarithm [(X dBuV/m)/20] = Y 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	± 0.54ºC
humidity measurements	± 2.3%
DC and low frequency measurements	± 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.

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

22-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	Company #: 2461N-3

Test Engineer
Farida Rahmanzai

2.6 Equipment Assessed (EUT)

IW9165DH-B with embedded 5/6 GHz 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

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)(4) **FCC 15.407** (b)(9) **FCC 15.209** **RSS-247** 6.2.4.2	**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 5.725–5.850 GHz band: (i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge. **FCC**: Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §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:** Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following: d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges	Pass
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-QCAHKSWPL_SILICO
S02	IW-PWRADPT-MFIT4PN Liteon AC Adaptor	LIN2631203M	341-101392-01	----

4.2 System Details

System #	Description	Samples
1	IW9165DH-B with embedded Radio module, radio + ext. PS.	S01, S02

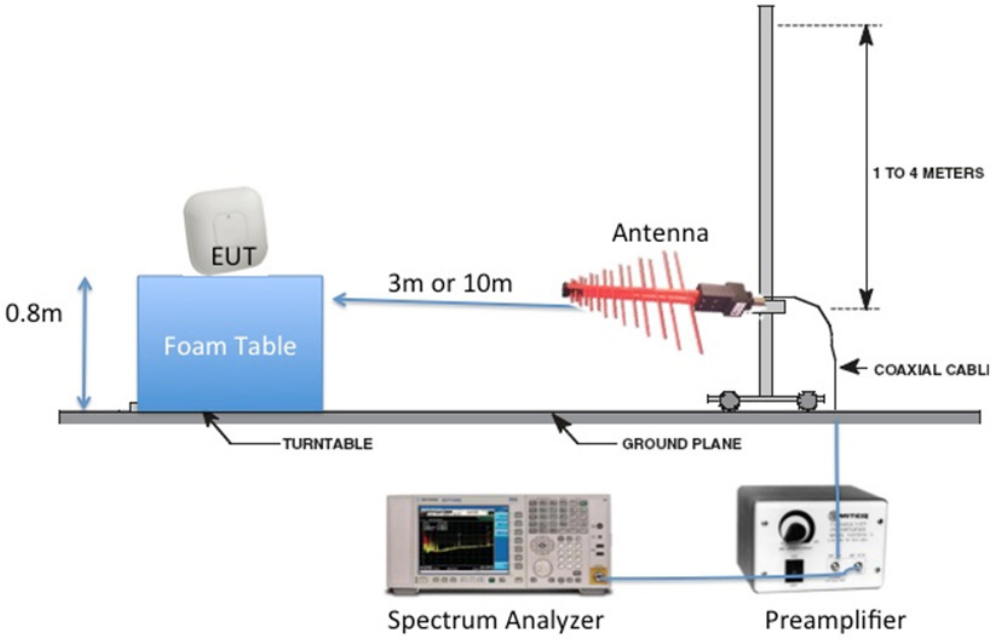
4.3 Mode of Operation Details

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

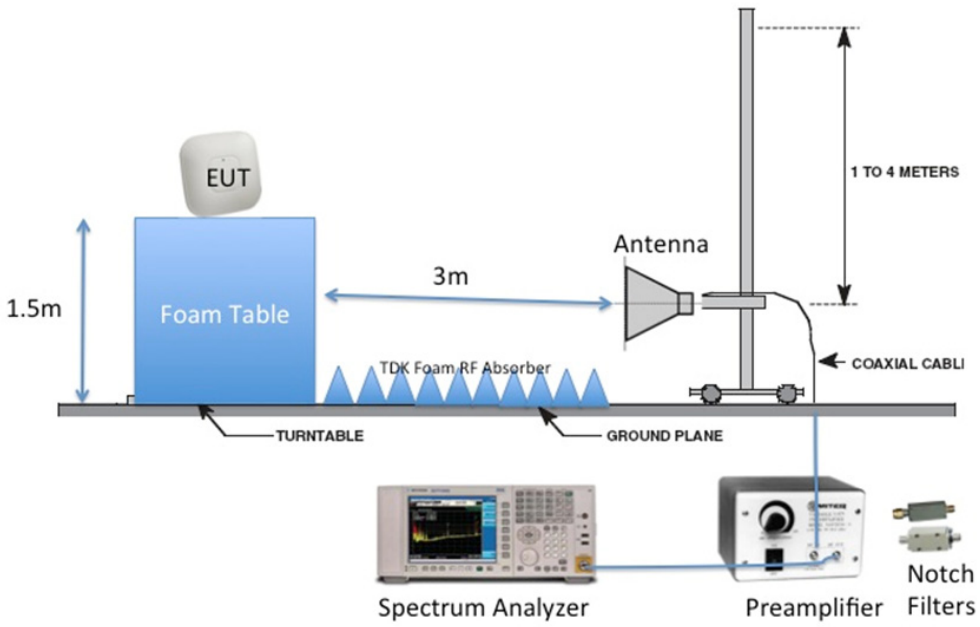
A.1 Setup Diagram

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

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

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
[1]0.495-0.505	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:

(4) For transmitters operating in the 5.725-5.850 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

RSS-247 (6.2.4.2)
Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges.

b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges.

c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and

d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

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:

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

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

dBm to Watts W = 10((dBm – 30)/10)

$$P(W) = 10^{(-27 - 120)/20}$$
$$= 10^{-5.7}$$
$$= 1.995 \times 10^{-6}$$

(2) Convert from Watt to field strength

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

$$\mathbf{V/m} = \frac{\sqrt{30 \times Pt \times gt}}{3}$$

$$= \frac{\sqrt{30 \times 0.000001995 \times 1}}{3}$$

= **0.00257**

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

dBµV/m = 20 log (V/m) + 120

= **68.2**

A.4 Test Procedure

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

Test Procedure
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.
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.

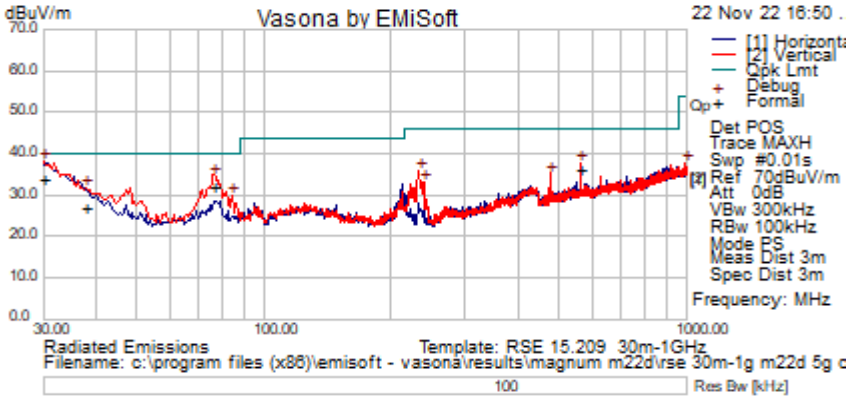
Ref. ANSI C63.10: 2013 section 4.1.4 / section 12.7.5 (Quasi-Peak), section 12.7.6 (peak), section 12.7.7.3 (average), Cispr16-1-1

Test parameters
(i) Span = Entire frequency range or segment if necessary. (ii) Reference Level ≥ 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 ≥ 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

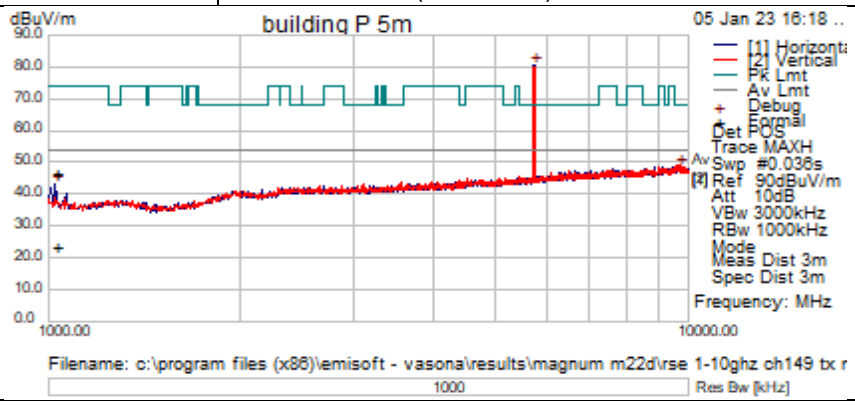
Subtest Date	22-Nov-2022
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz - 1GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 149 (5745 MHz)



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
30.104	12.41	0.46	21.23	34.1	Quasi-pk	H	149	328	40	-5.9	Pass	
75.84713	23.51	0.72	7.95	32.19	Quasi-pk	V	138	29	40	-7.81	Pass	
37.72301	10.5	0.52	15.96	26.97	Quasi-pk	V	227	308	40	-13.03	Pass	
560.0663	15.94	2	18.35	36.29	Quasi-pk	V	102	243	46	-9.71	Pass	

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 149 (5745 MHz)

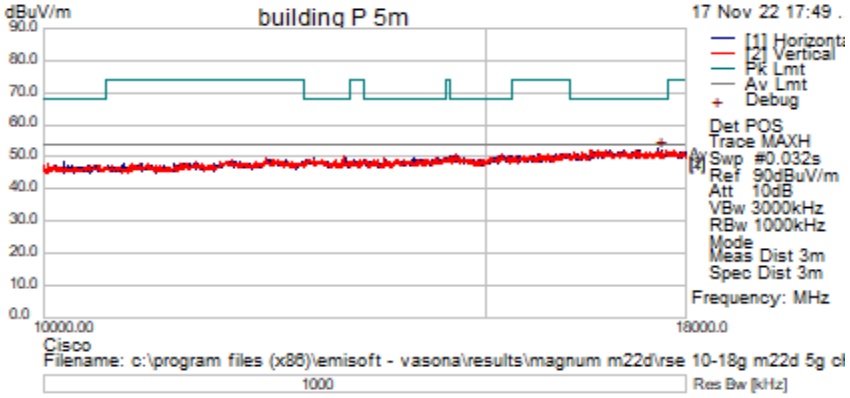


TX Spurious Emissions from 1GHz-10GHz

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
5747.5	89.13	7.89	-16.48	80.54	Peak	H	150	22	--	--	Ignored	Fundamental
1029.199	68.1	3.18	-24.55	46.73	Peak	H	151	59	74	-27.27	Pass	RB
1029.199	44.58	3.18	-24.55	23.21	Average	H	151	59	54	-30.79	Pass	RB
9712	52.05	10.76	-13.83	48.98	Peak	V	350	340	54	-5.02	Pass	Noise Floor

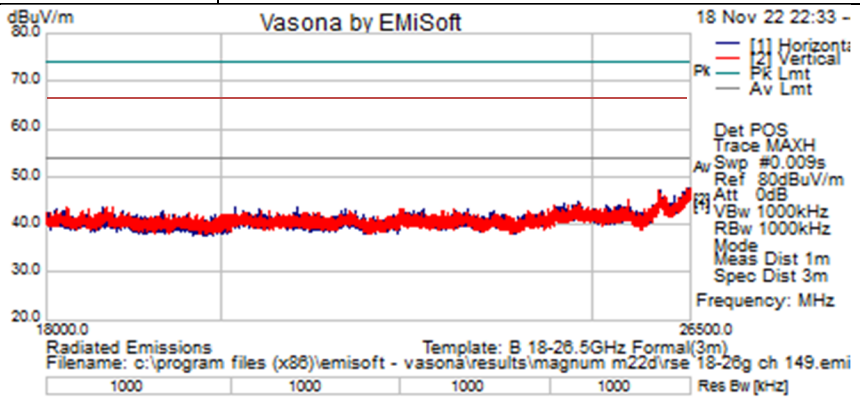
Note: RB means restricted band

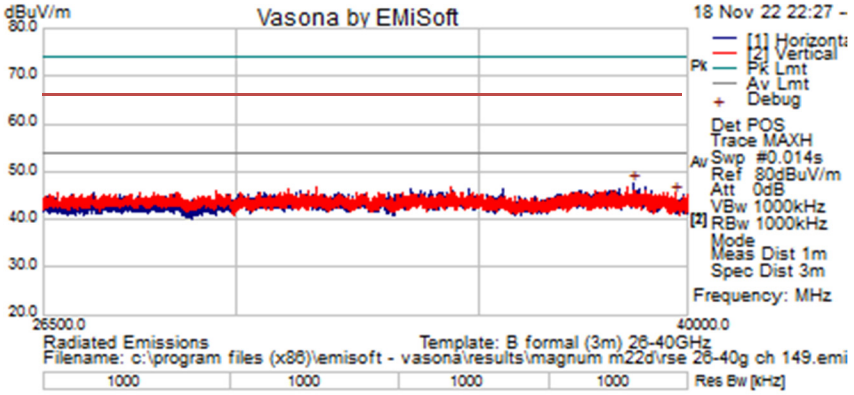
Subtest Date	17-Nov-2022
Subtest Title	Transmitter Spurious Emissions
Frequency Range	10GHz - 18GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 149 (5745 MHz)



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

Subtest Date	18-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 149 (5745 MHz)

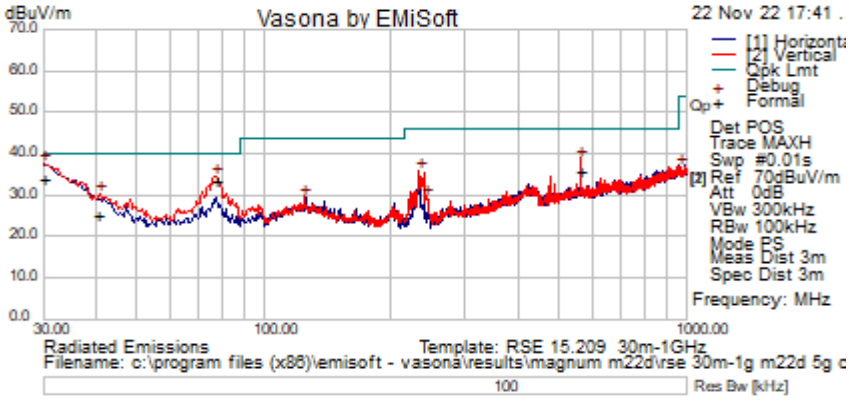




Legend: 74dBµV/m (Peak); 54 dBµV/m (Average); 68dBµV/m (Peak)(-27dbm)

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

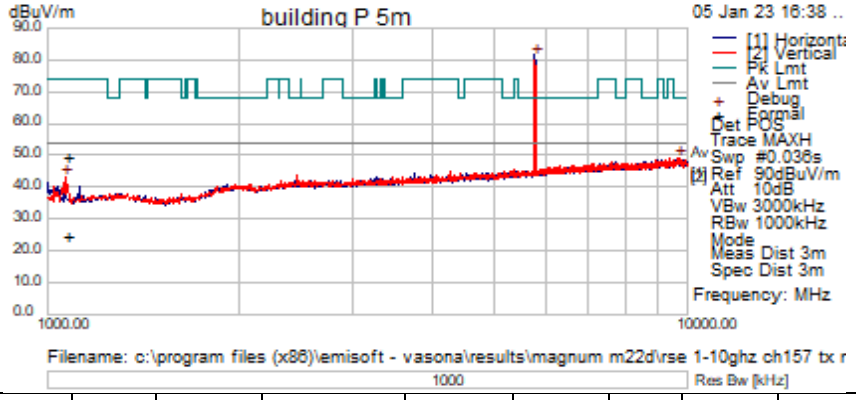
Subtest Date	22-Nov-2022
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz - 1GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 157 (5785 MHz)



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
30.11693	12.48	0.46	21.23	34.16	Quasi-pk	H	149	205	40	-5.84	Pass	
76.70793	24.81	0.73	7.84	33.38	Quasi-pk	V	147	325	40	-6.62	Pass	
560.0428	15.71	2	18.35	36.06	Quasi-pk	V	99	257	46	-9.94	Pass	
40.34666	10.47	0.53	14	25.01	Quasi-pk	V	99	142	40	-14.99	Pass	

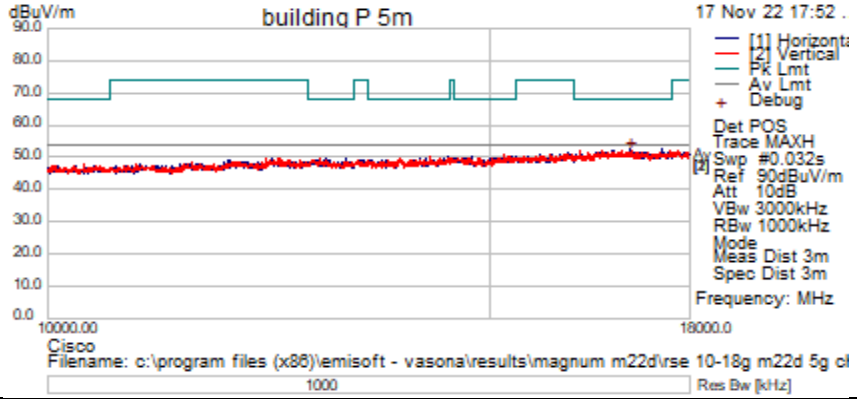
Subtest Date	05-Jan-2023
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1GHz - 10GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 157 (5785 MHz)



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
5779	90.14	7.93	-16.44	81.63	Peak	H	150	338	--	--	Ignored	Fundamental
1070.973	71.71	3.25	-25.04	49.92	Peak	H	180	13	74	-24.08	Pass	RB
1070.973	46.35	3.25	-25.04	24.56	Average	H	180	13	54	-29.44	Pass	RB
9694	52.34	10.72	-13.95	49.11	Peak	V	100	4	54	-4.89	Pass	Noise Floor

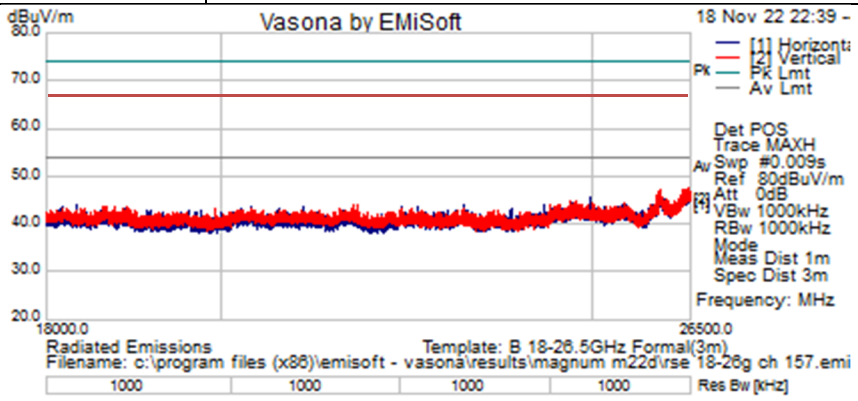
Note: RB means restricted band

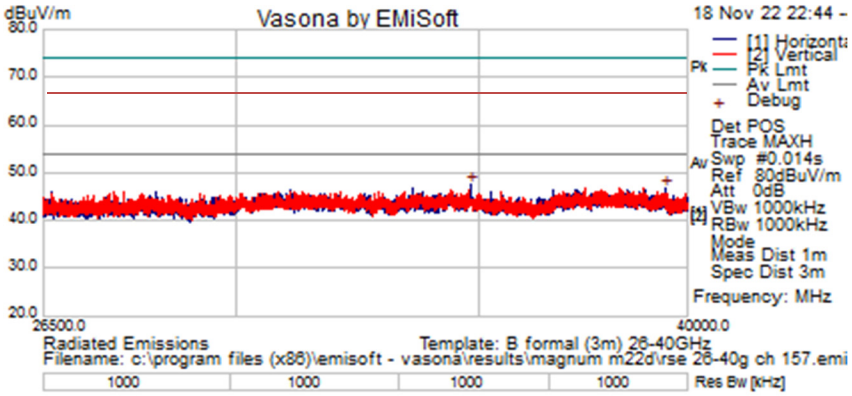
Subtest Date	17-Nov-2022
Subtest Title	Transmitter Spurious Emissions
Frequency Range	10GHz - 18GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 157 (5785 MHz)



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 157 (5785 MHz)

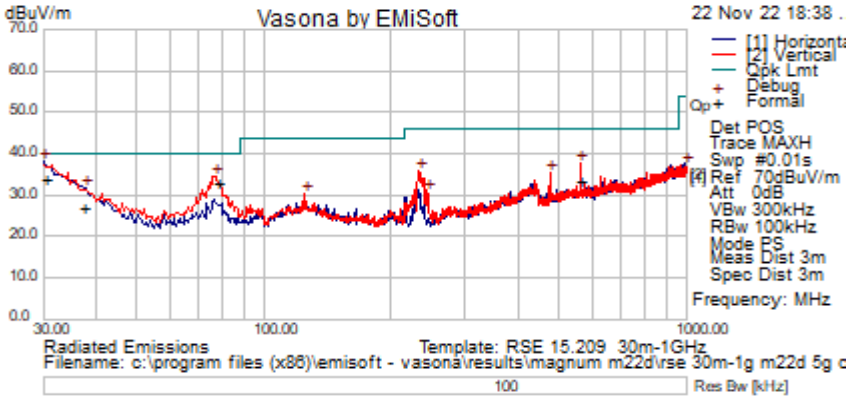




Legend: 74dBµV/m (Peak); 54 dBµV/m (Average); 68dBµV/m (Peak)(-27dbm)

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

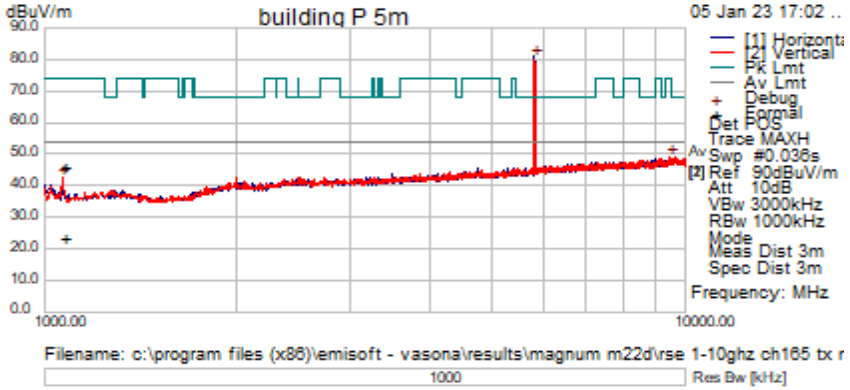
Subtest Date	22-Nov-2022
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz - 1GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 165 (5825 MHz)



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
30.255	12.48	0.46	21.15	34.09	Quasi-pk	H	273	317	40	-5.91	Pass	
77.12946	24.54	0.73	7.78	33.06	Quasi-pk	V	120	44	40	-6.94	Pass	
37.3612	10.43	0.51	16.24	27.19	Quasi-pk	V	215	360	40	-12.81	Pass	
560.0818	13.2	2	18.35	33.55	Quasi-pk	V	99	233	46	-12.45	Pass	

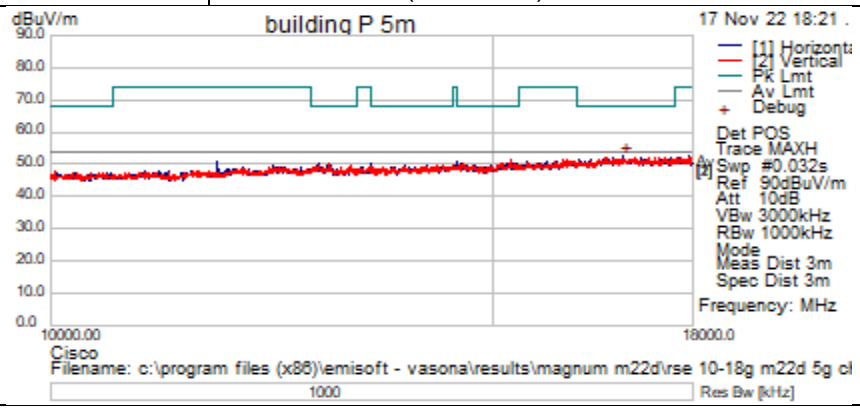
Subtest Date	05-Jan-2023
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1GHz - 10GHz
Mode	**2x2 MIMO 802.11n/HT20** (Refer to section 4.3 for system details)
Comments on the above Test Results	Tx Channel 165 (5825 MHz)



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
5815	89.4	7.96	-16.38	80.98	Peak	H	200	348	--	--	Ignored	Fundamental
1070.723	68.03	3.25	-25.04	46.25	Peak	H	201	297	74	-27.75	Pass	RB
1070.723	45.05	3.25	-25.04	23.27	Average	H	201	297	54	-30.73	Pass	RB
9469	52.68	10.63	-14.09	49.22	Peak	V	400	243	54	-4.78	Pass	Noise Floor

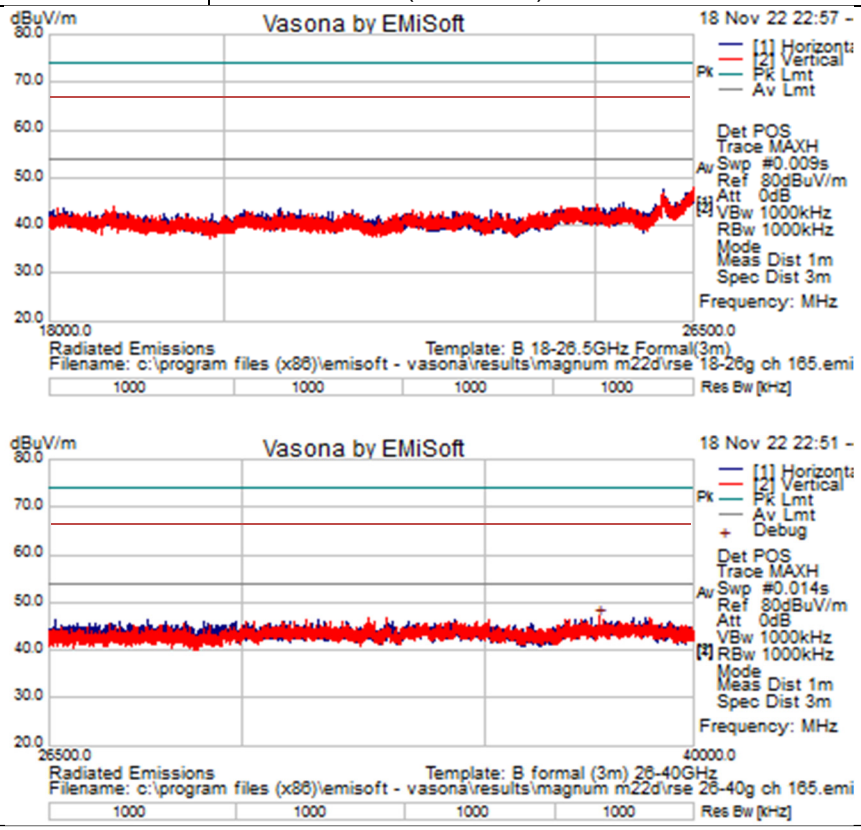
Note: RB means restricted band

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 165 (5825 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 165 (5825 MHz)



Legend: 74dBµV/m (Peak); 54 dBµV/m (Average); 68dBµV/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
CIS000638	Keysight (Agilent/HP)/ 8447F OPT H64	AMPLIFIER	11-Jun-2022	11-Jun-2022	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 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

Appendix E: Software Used to Perform Testing

EMIsoft 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

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 I: Test Assessment Plan

Compliance Test Plan (Excel) EDCS# 23771097
Target Power Tables EDCS# 23409888

Appendix J: 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.