Radio Test Report

Model: C9120AXI-x
Cisco Catalyst C9120AX Series 802.11ax Access Point
2.4GHz WiFi Radio

FCC ID: LDKVCVER1937
IC: 2461N-VCVER1937

2400-2483.5 MHz

Against the following Specifications for Radiated Spurious Emissions (RSE):
CFR47 Part 15.247

RSS-247
RSS-Gen

Cisco Systems
170 West Tasman Drive
San Jose, CA 95134

Author: Chris Blair, Allan Beecroft **Tested By: Chris Blair, Allan Beecroft**	**Approved By:** Gez Thorpe **Title:** Radio Compliance Manager **Revision:** 2.0

This report replaces any previously entered test report under EDCS – 18849631. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 703456.

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
CFR47 Part 15.247 RSS-247 Issue 2: Feb 2017 RSS-Gen Issue 4: Nov 2014

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*%

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
conducted EIRP measurements	± 1.4 dB
radiated measurements	± 3.2 dB
frequency measurements	± 2.4 10-7
temperature measurements	± 0.54º.
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-JAN-2020 to 20-FEB-2020

2.4 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

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 ISED (Innovation, Science and Economic Development Canada)

Cisco System Site	Address	Site Identifier
Building P, 10m Chamber	125 West Tasman Dr San Jose, CA 95134 United States	Company #: 2461N-2
Building P, 5m Chamber	125 West Tasman Dr San Jose, CA 95134 United States	Company #: 2461N-1
Building I, 5m Chamber	285 W. Tasman Drive San Jose, California 95134 United States	Company #: 2461M-1
Building 7, 5m Chamber	425 E. Tasman Drive San Jose, California 95134 United States	Company #: 2461N-3

Test Engineers

Chris Blair, Allan Beecroft

2.6 Equipment Assessed (EUT)

Model: C9120AXI-x, VE

2.7 EUT Description

802.11ax Access Point with Dual 4x4 MIMO with 4 Spatial Streams

The EUT 2.4GHz WiFi radio supports the following modes of operation. The modes are further defined in the radio Theory of Operation. The modes included in this report represent the worst-case data for all modes. Data is recorded at the lowest supported data rate for each mode. This report covers operation on channel 1-11.

802.11b - Legacy CCK, Two Antennas, 1 to 11 Mbps
802.11b - Legacy CCK, Three Antennas, 1 to 11 Mbps
802.11b - Legacy CCK, Four Antennas, 1 to 11 Mbps

802.11g - Non HT20, One Antenna, 6 to 54 Mbps, 1ss
802.11g - Non HT20, Two Antennas, 6 to 54 Mbps, 1ss
802.11g - Non HT20, Three Antennas, 6 to 54 Mbps, 1ss
802.11g - Non HT20, Four Antennas, 6 to 54 Mbps, 1ss

802.11g - Non HT20 Beam Forming, Two Antennas, 6 to 54 Mbps, 1ss
802.11g - Non HT20 Beam Forming, Three Antennas, 6 to 54 Mbps, 1ss
802.11g - Non HT20 Beam Forming, Four Antennas, 6 to 54 Mbps, 1ss

802.11n - HT20, One Antenna, M0 to M7, 1ss
802.11n - HT20, Two Antennas, M0 to M7, 1ss
802.11n - HT20, Two Antennas, M8 to M15, 2ss
802.11n - HT20, Three Antennas, M0 to M7, 1ss
802.11n - HT20, Three Antennas, M8 to M15, 2ss
802.11n – HT20, Three Antennas, M16 to M23, 3ss
802.11n – HT20, Four Antennas, M0 to M7, 1ss
802.11n - HT20, Four Antennas, M8 to M15, 2ss
802.11n - HT20, Four Antennas, M16 to M23, 3ss
802.11n - HT20, Four Antennas, M24 to M31, 4ss

802.11n - HT20 Beam Forming, Two Antennas, M0 to M7, 1ss
802.11n – HT20 Beam Forming, Two Antennas, M8 to M15, 2ss
802.11n – HT20 Beam Forming, Three Antennas, M0 to M7, 1ss
802.11n - HT20 Beam Forming, Three Antennas, M8 to M15, 2ss
802.11n - HT20 Beam Forming, Three Antennas, M16 to M23, 3ss
802.11n - HT20 Beam Forming, Four Antennas, M0 to M7, 1ss
802.11n - HT20 Beam Forming, Four Antennas, M8 to M15, 2ss
802.11n - HT20 Beam Forming, Four Antennas, M16 to M23, 3ss
802.11n - HT20 Beam Forming, Four Antennas, M24 to M31, 4ss

802.11n - HT20 STBC, Two Antennas, M0 to M7, 2ss
802.11n - HT20 STBC, Three Antennas, M0 to M7, 2ss
802.11n - HT20 STBC, Four Antennas, M0 to M7, 2ss

802.11ax - HE20, One Antenna, M0 to M7, 1ss
802.11ax - HE20, Two Antennas, M0 to M7, 1ss
802.11ax - HE20, Two Antennas, M8 to M15, 2ss
802.11ax - HE20, Three Antennas, M0 to M7, 1ss
802.11ax - HE20, Three Antennas, M8 to M15, 2ss

802.11ax - HE20, Three Antennas, M16 to M23, 3ss
802.11ax - HE20, Four Antennas, M0 to M7, 1ss
802.11ax - HE20, Four Antennas, M8 to M15, 2ss
802.11ax - HE20, Four Antennas, M16 to M23, 3ss
802.11ax - HE20, Four Antennas, M24 to M31, 4ss

802.11ax - HE20 Beam Forming, Two Antennas, M0 to M7, 1ss
802.11ax - HE20 Beam Forming, Two Antennas, M8 to M15, 2ss
802.11ax - HE20 Beam Forming, Three Antennas, M0 to M7, 1ss
802.11ax - HE20 Beam Forming, Three Antennas, M8 to M15, 2ss
802.11ax - HE20 Beam Forming, Three Antennas, M16 to M23, 3ss
802.11ax - HE20 Beam Forming, Four Antennas, M0 to M7, 1ss
802.11ax - HE20 Beam Forming, Four Antennas, M8 to M15, 2ss
802.11ax - HE20 Beam Forming, Four Antennas, M16 to M23, 3ss
802.11ax - HE20 Beam Forming, Four Antennas, M24 to M31, 4ss

802.11ax - HE20 STBC, Two Antennas, M0 to M7, 2ss
802.11ax - HE20 STBC, Three Antennas, M0 to M7, 2ss
802.11ax - HE20 STBC, Four Antennas, M0 to M7, 2ss

802.11b - Legacy CCK, One Antenna, 1 to 11 Mbps

The following antennas are supported by this product series.
The data included in this report represent the worst-case data for all antennas.

Frequency	Part Number	Antenna Type	Antenna Gain (dBi)
2400-2483.5MHz	-	Internal, Dual-band, VPOL, Omni	4

Section 3: Result Summary

3.1 Results Summary Table

Conducted emissions

Basic Standard	Technical Requirements / Details	Result
FCC 15.247 RSS-247	**6dB Bandwidth** Systems using digital modulation techniques may operate in the 2400-2483.5MHz band. The minimum 6dB bandwidth shall be at least 500 kHz	Not Tested
FCC 15.247 RSS-247	**99% & 26 dB Bandwidth**: The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. There is no limit for 99% OBW. The 26 dB emission is the width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.	Not Tested
FCC 15.247 RSS-247	**Output Power**: **15.247** The maximum conducted output power of the intentional radiator for systems using digital modulation in the 2400-2483.5 MHz band shall not exceed 1 Watt (30dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. **RSS-247** For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(e), the e.i.r.p. shall not exceed 4 W.	Not Tested
FCC 15.247 RSS-247	**Power Spectral Density** For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	Not Tested

FCC 15.247 RSS-247	**Conducted Spurious Emissions / Band-Edge**: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.	Not Tested
FCC 15.247 RSS-247 FCC 15.205 RSS-Gen	**Restricted band**: Unwanted emissions falling within the restricted bands, as defined in FCC 15.205 (a) and RSS-Gen 8.10 must also comply with the radiated emission limits specified in FCC 15.209 (a) and RSS-Gen 8.9	Not Tested

Radiated Emissions (General requirements)

Basic Standard	Technical Requirements / Details	Result
FCC 15.209 RSS-Gen	**TX Spurious Emissions:** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the filed strength limits table in this section. Unwanted emissions falling within the restricted bands, as defined in FCC 15.205 (a) and RSS-Gen 8.10 must also comply with the radiated emission limits specified in FCC 15.209 (a) and RSS-Gen 8.9	Pass
RSS-Gen	**RX Spurious Emissions:** **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 4 and Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission. **RSS-Gen 8.10 Restricted Bands** Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.	Pass
FCC 15.207 RSS-Gen	**AC conducted Emissions:** Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table in these sections. The more stringent limit applies at the frequency range boundaries.	Not Tested

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.

4.1 Sample Details

Sample No.	Equipment Details	Maker	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	C9120AXI-B	Foxconn (for Cisco)	800-106693-01	Radio FW ver. : 14948.14801. r39245 39245	Cisco AP Software, (ap1g7), [cheetah-build6:/san2/BUILD/ workspace/Nightly-Cheetah-axel-bcm-mfg-c8_10_throttle] Compiled Mon Jan 27 08:40:01 PST 2020	FOC23447WF2
S02	AIR-PWRINJ6	Microsemi (for Cisco)	V01	NA	NA	C1617666300000860

4.2 System Details

System #	Description	Samples
1	EUT+power source for RSE test	S01+S02

4.3 Mode of Operation Details

Mode#	Description	Comments
1	Continuous Transmitting	
2	Receive mode	

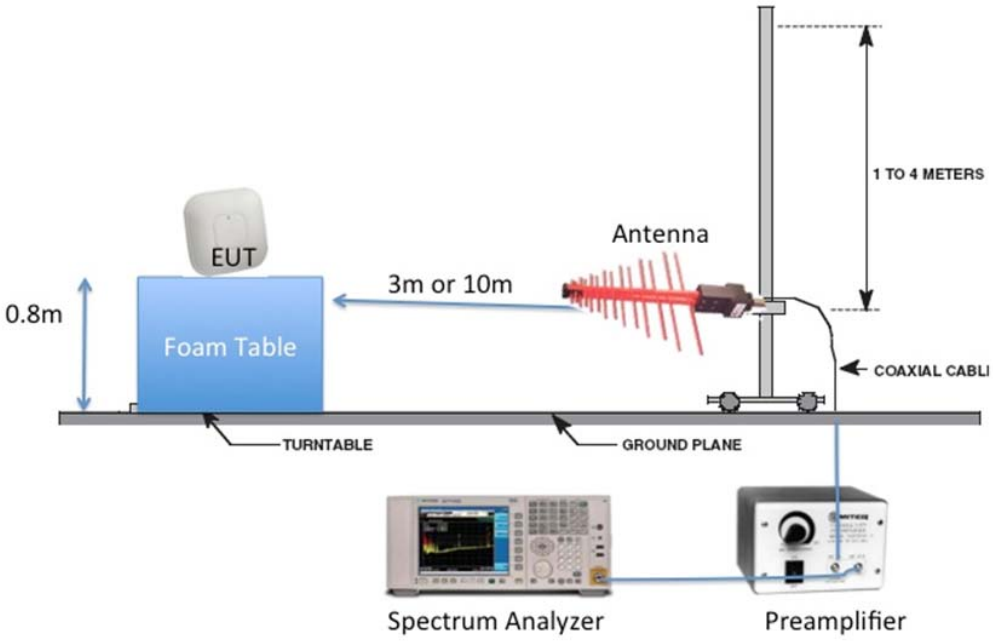
Appendix A: RF Conducted Test Results

RF conducted tests are not covered by this report.

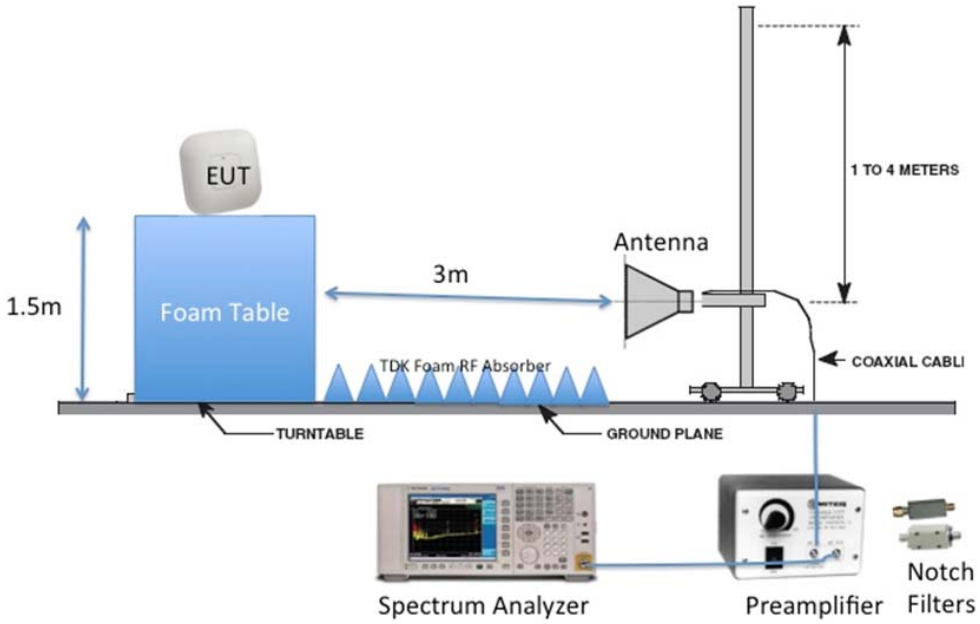
Appendix B: Radiated Emission Test Results

Testing Laboratory: Cisco Systems, Inc., 125 West Tasman Drive, San Jose, CA 95134, USA

Radiated Emission Setup Diagram-Below 1G



Radiated Emission Setup Diagram-Above 1G



B.1 Radiated Spurious Emissions

15.205 / RSS-Gen: Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) and RSS-Gen 8.10, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)) and RSS-Gen 8.9.

Ref. ANSI C63.10: 2013 section 4.1.4.2.2, 4.1.4.2.3, 6.6.4 & 11.12.2

Radiated Spurious Emissions Test parameters	
Peak Span = 1-18GHz /18GHz-26.5GHz RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto couple Detector = Peak Trace = Max Hold.	**Average** Span = 1-18GHz /18GHz-26.5GHz RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto couple Detector = RMS Power Averaging

Using Vasona, configure the spectrum analyzer as shown above (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode. Terminate the access Point RF ports with 50 ohm loads.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m
2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

This report represents the worst case data for all supported operating modes and antennas.

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01	☑	☐
	Support	S02	☐	☑

Tested By : Chris Blair & Allan Beecroft	**Date of testing: February 2-20, 2020**
Test Result : PASS	

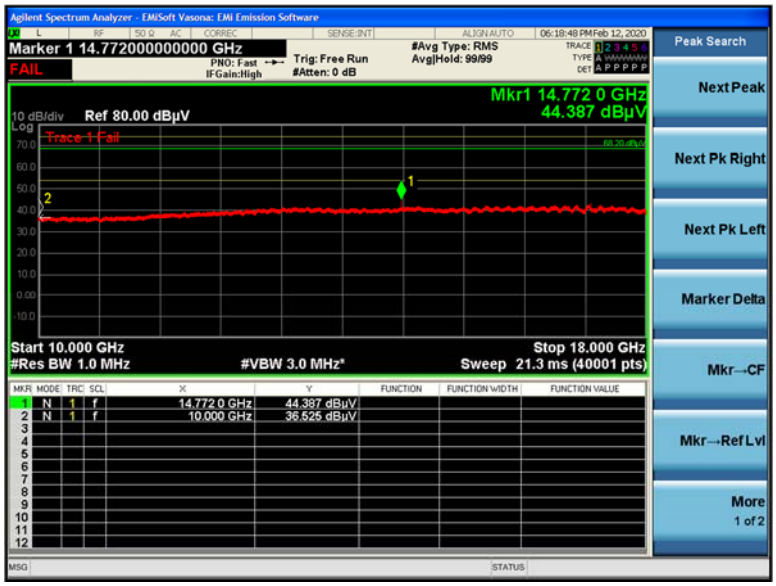
See Appendix C for list of test equipment

B.1.A Transmitter Radiated Spurious Emissions-Average

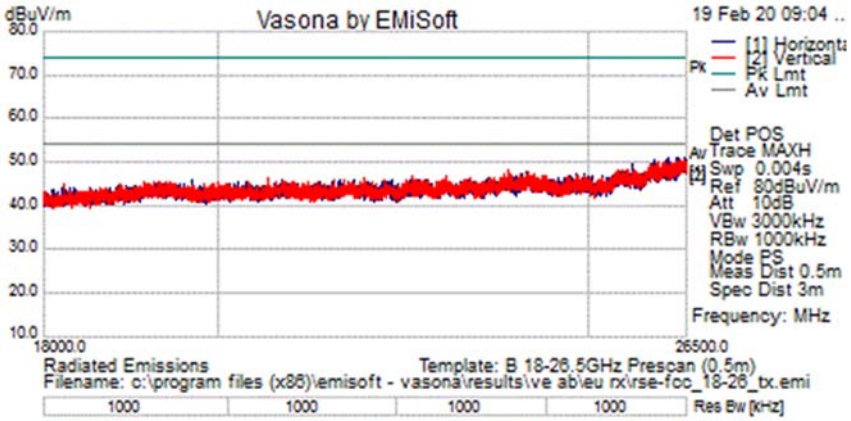
Frequency (MHz)	Mode	Data Rate (Mbps)	Spurious Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2412	CCK	1	43.49	**<54**	10.5
	NonHT20	6	43.57	**<54**	10.4
	HE20	m0.1	43.69	**<54**	10.3
2437	CCK	1	43.32	**<54**	10.7
	NonHT20	6	43.93	**<54**	10.1
	HE20	m0.1	43.45	**<54**	10.6
2462	CCK	1	44.22	**<54**	9.8
	NonHT20	**6**	**44.39**	**<54**	**9.6**
	HE20	m0.1	43.91	**<54**	10.1

Note: Formal average measurements not required for 1-10GHz, because peak emissions were under the average limit. See section B.1.P.

B.1.A.1 Radiated Transmitter Spurs, Average, 2462, NonHT20 (10-18GHz)



B.1.A.2 Radiated Transmitter Spurs, Peak and Average (18-26.5GHz)

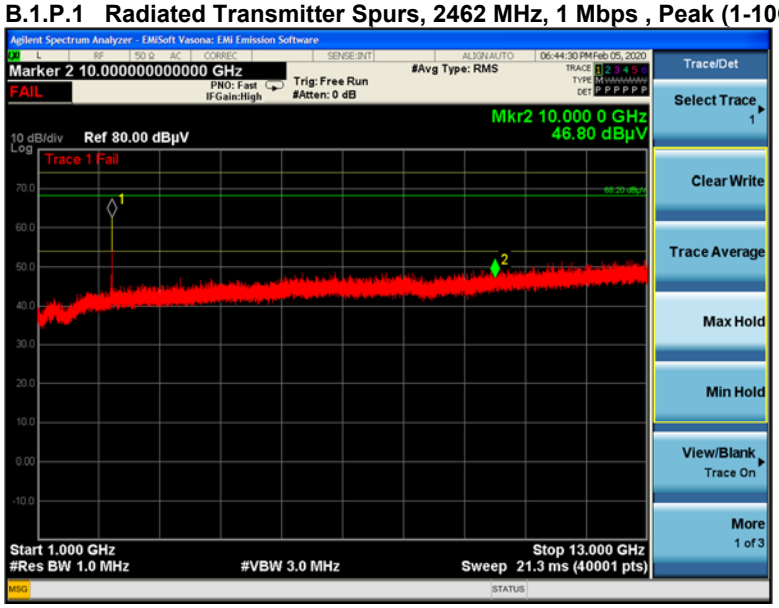


All emissions were below the average limit when measured using a peak detector. There were no emissions within 20dB of the peak limit.

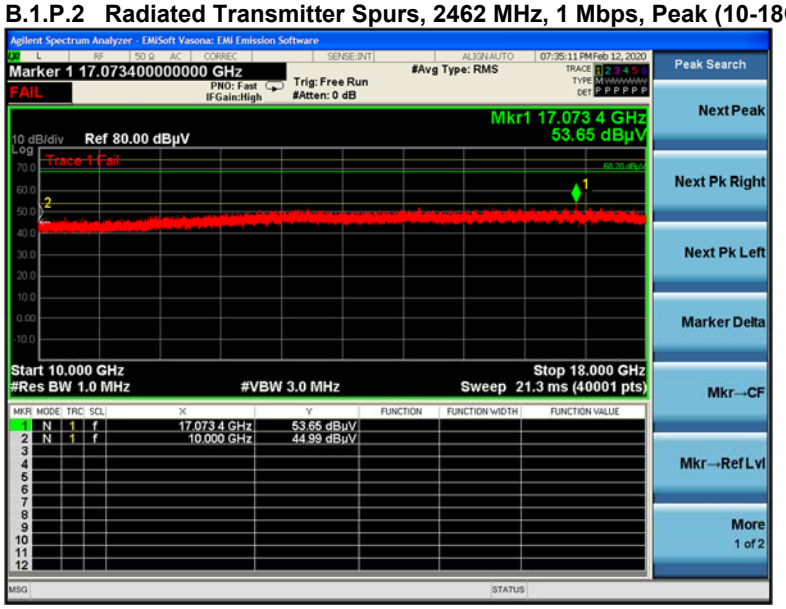
B.1.P Transmitter Radiated Spurious Emissions-Peak

Frequency (MHz)	Mode	Data Rate (Mbps)	Spurious Emission Level (dBuV/m)	Limit (dBuV/m)*	Margin (dB)
2412	CCK	1	51.96	**<74**	22.04
	NonHT20	6	52.97	**<74**	21.03
	HE20	m0.1	52.40	**<74**	21.60
2437	CCK	1	52.30	**<74**	21.70
	NonHT20	6	53.19	**<74**	20.81
	HE20	m0.1	52.60	**<74**	21.40
2462	**CCK**	**1**	**53.65**	**<74**	**20.35**
	NonHT20	6	52.83	**<74**	21.17
	HE20	m0.1	52.50	**<74**	21.50

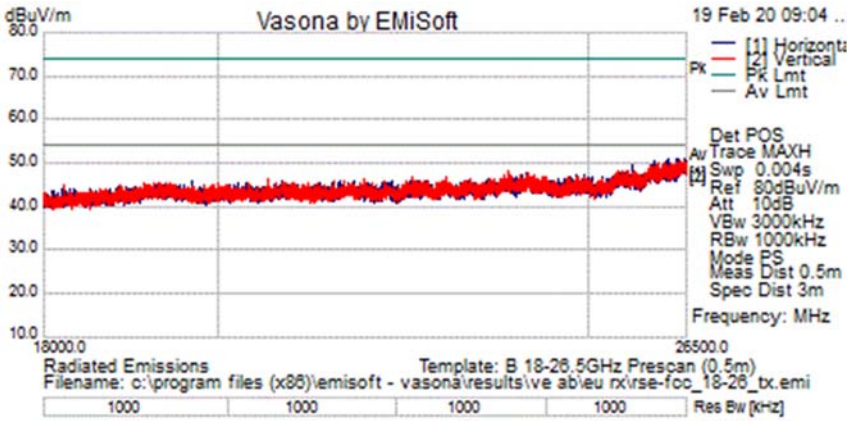
B.1.P.1 Radiated Transmitter Spurs, 2462 MHz, 1 Mbps , Peak (1-10GHz)



B.1.P.2 Radiated Transmitter Spurs, 2462 MHz, 1 Mbps, Peak (10-18GHz)



B.1.A.2 Radiated Transmitter Spurs, Peak and Average (18-26.5GHz)



All emissions were below the average limit when measured using a peak detector. There were no emissions within 20dB of the peak limit.

B.2 Receiver Spurious Emissions

RSS-GEN:
Receivers are required to comply with the limits of spurious emissions as set out in this section. Receiver emission measurements are to be performed as per the normative test method referenced in section 3.

Radiated emissions which fall in the restricted bands, as defined in RSS-Gen section 8.10, must also comply with the radiated emission limits specified in RSS-Gen section 8.9.

For emissions at frequencies below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. At frequencies above 1 GHz, measurements shall be performed using a linear average detector with a minimum resolution bandwidth of 1 MHz.

Test Procedure
Ref. ANSI C63.10: 2013 section 4.1.4.2.2, 4.1.4.2.3, 6.6.4 & 11.12.2

Radiated Spurious Emissions Test parameters	
Peak Span = 1-18GHz /18GHz-26.5GHz RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto couple Detector = Peak Trace = Max Hold.	**Average** Span = 1-18GHz /18GHz-26.5GHz RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto couple Detector = RMS Power Averaging

Using Vasona, configure the spectrum analyzer as shown above (be sure to enter all losses between the transmitter output and the spectrum analyzer). Terminate the access Point RF ports with 50 ohm loads.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m
2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

This report represents the worst case data for all supported operating modes and antennas.

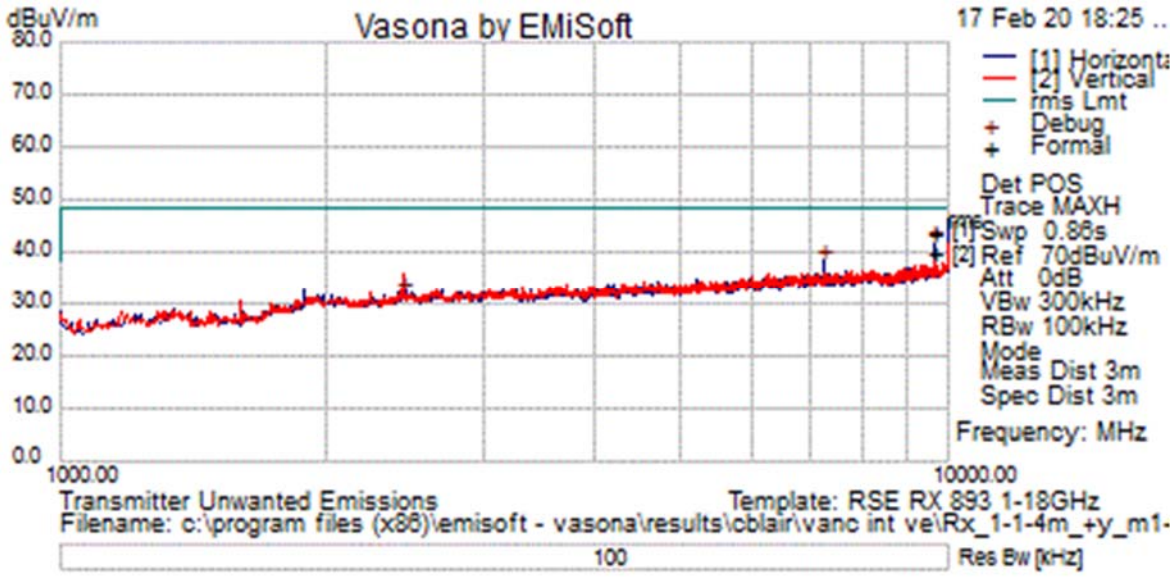
System Number	Description	Samples	System under test	Support equipment
1	EUT	S01	☑	☐
	Support	S02	☐	☑

Tested By : Chris Blair & Allan Beecroft	**Date of testing: February 2-20, 2020**
Test Result : PASS	

See Appendix C for list of test equipment

B.2.A Receiver Radiated Spurious Emissions, 1-26.5GHz

B.2.1 Radiated Receiver Spurs, Peak Scan (1-10GHz)
Note that Rx emissions were compared to EU limit = 48.2dBuV/m < 54dBuV/m = FCC/ISED average limit.
Note that Rx emissions were simultaneously measured for several collocated radios at once.



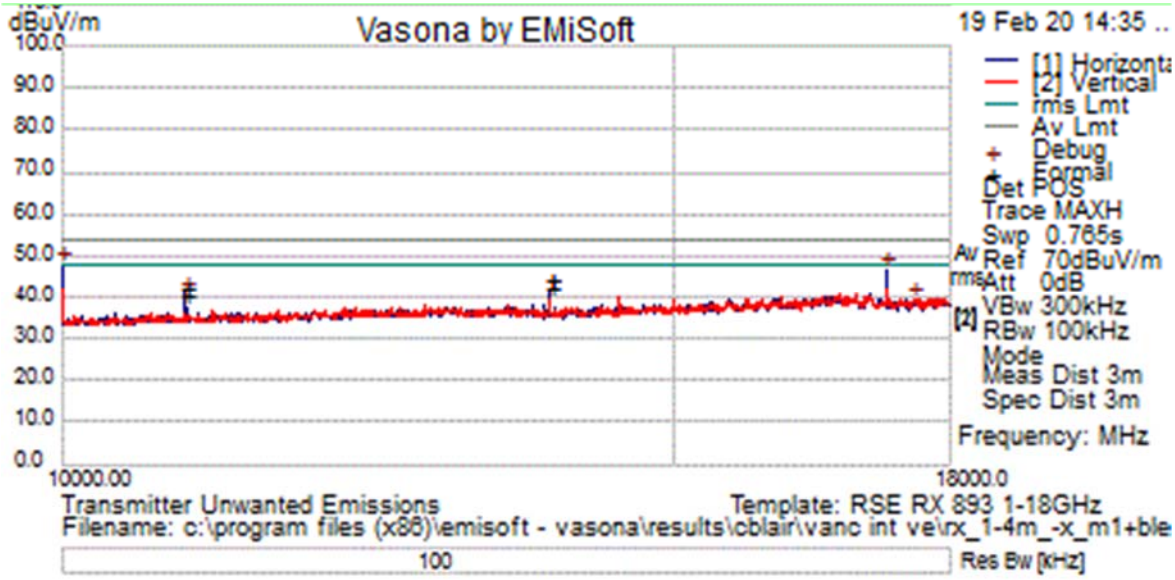
Formal Data (Average)

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	9647.957	29.7	11.3	-.8	40.1	RMS Max	V	106	340	48.2	-8.1	Pass	
2	9647.957	33.4	11.3	-.8	43.9	RMS Max	H	149	44	48.2	-4.3	Pass	
3	7235.974	34.3	9.4	-3.5	40.3	RMS Max	H	111	286	48.2	-7.9	Pass	ht

Debug Data (Peak Scan)

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	2440.837	35.1	5.1	-8.5	31.7	Peak [Scan]	H	149	44	48.2	-16.6	Pass	added
2	7238.132	32.3	9.4	-3.5	38.2	Peak [Scan]	H	149	44	48.2	-10.0	Pass	added
3	9645.625	31.1	11.3	-.8	41.5	Peak [Scan]	H	150	293	48.2	-6.7	Pass	
4	10000.000	35.5	11.5	-.4	46.6	Peak [Scan]	H	200	294	48.2	-1.6	Pass	Not radio

B.2.2 Radiated Receiver Spurs, Peak Scan (10-18GHz)
Note that Rx emissions were compared to EU limit = 48.2dBuV/m < 54dBuV/m = FCC/ISED average limit.
Note that Rx emissions were simultaneously measured for several collocated radios at once.



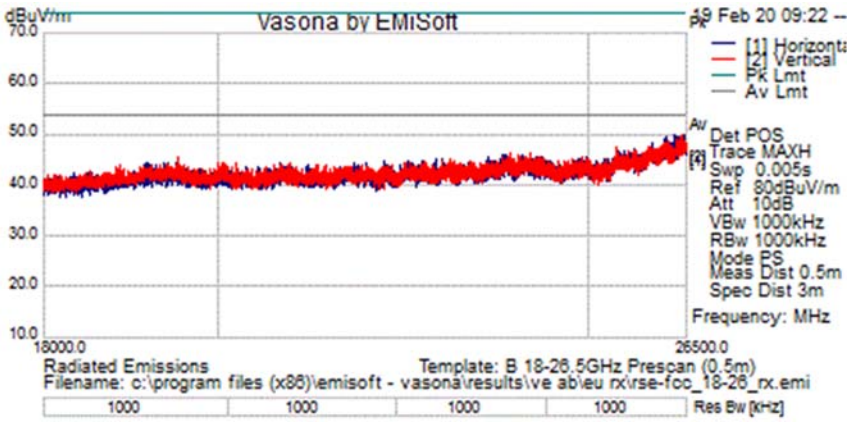
Formal Data (Average)

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	10853.953	43.4	12.1	-13.1	42.4	RMS Max	H	142	82	48.2	-5.8	Pass	ht
2	13813.286	41.1	14.0	-10.9	44.3	RMS Max	H	169	64	48.2	-3.9	Pass	ht

Debug Data (Peak Scan)

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	10000.000	51.0	11.5	-14.7	47.9	Peak [Scan]	H	150	56	48.2	-.3	Pass	not radio
2	10855.000	42.0	12.1	-13.1	41.1	Peak [Scan]	H	150	81	48.2	-7.2	Pass	added
3	13815.000	38.2	14.1	-10.9	41.4	Peak [Scan]	H	150	64	48.2	-6.8	Pass	
4	17265.000	40.5	16.3	-9.9	46.9	Peak [Scan]	H	150	36	48.2	-1.3	Pass	not radio
5	17570.000	32.8	16.7	-9.8	39.6	Peak [Scan]	V	150	294	48.2	-8.6	Pass	filter/amp /floor

B.2.3 Radiated Receiver Spurs, Peak and Average (18-26.5GHz)



All emissions were below the average limit when measured using a peak detector. There were no emissions within 20dB of the peak limit.

B.3 Radiated Emissions 30MHz to 1GHz

15.205 / 15.209 / RSS-Gen:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) and RSS-GEN section 8.10, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)) and RSS-Gen section 8.9.

Test Procedure

Ref. ANSI C63.10: 2013 section 6.5

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span:	30MHz – 1GHz
Reference Level:	80 dBuV
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	100kHz
Video Bandwidth:	300kHz
Detector:	Peak for Pre-scan, Quasi-Peak
.	Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

Terminate the access Point RF ports with 50 ohm loads.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

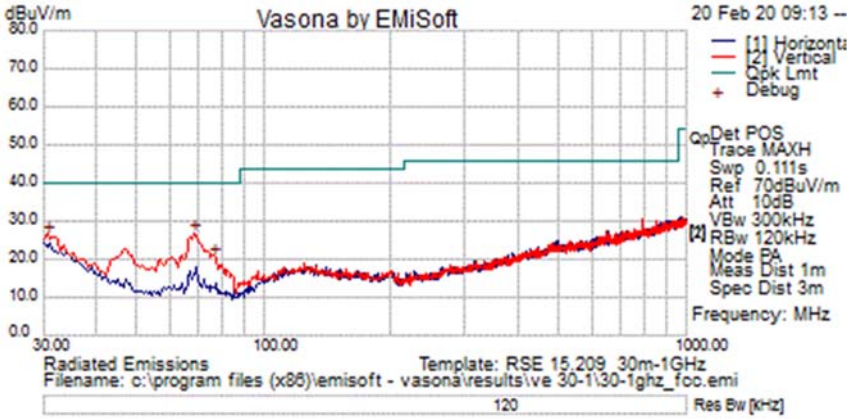
This report represents the worst case data for all supported operating modes and antennas.

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01	☑	☐
	Support	S02	☐	☑

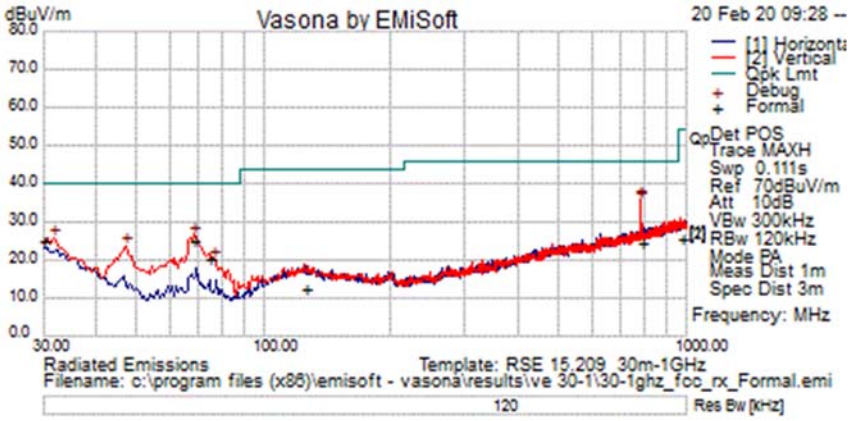
Tested By : Allan Beecroft	**Date of testing: February 20, 2020**
Test Result : PASS	

See Appendix C for list of test equipment

Transmitter Radiated Emission



Receiver Radiated Emission



Formal Data

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail	Comments
1	30.000	12.8	.5	11.7	25.0	Quasi Peak	V	99	-3	40.0	-15.0	Pass	
2	68.372	25.7	.8	-1.4	25.1	Quasi Peak	V	261	363	40.0	-14.9	Pass	
3	787.111	10.1	2.8	11.9	24.7	Quasi Peak	H	99	363	46.0	-21.3	Pass	Cell frequency
4	74.441	20.9	.8	-1.6	20.1	Quasi Peak	V	153	-3	40.0	-19.9	Pass	
5	977.875	9.2	3.1	13.6	25.8	Quasi Peak	H	361	-3	54.0	-28.2	Pass	
6	124.999	7.0	1.1	4.5	12.6	Quasi Peak	H	99	-3	43.5	-30.9	Pass	

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

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due	Test Item
Test Equipment used for Radiated Emissions, 1-18GHz					
41201	ETS/Lindgren 3117	Double Ridged Horn Antenna	27 Aug 2019	27 Aug 2020	B.1, B.2
45096	Cisco TH0118	Mast Mount Preamplifier Array, 1-18GHz	29 Oct 2019	29 Oct 2020	B.1, B.2
38375	Cisco TH0118-PS	Power Supply for TH0118 1-18GHz Preamplifier	NA	NA	B.1, B.2
37237	JFW 50CB-015	GPIB control box	NA	NA	B.1, B.2
41202	ETS/Lindgren 3117	Double Ridged Horn Antenna	15 Feb 2019	15 Feb 2020	B.1, B.2
56066	Miteq TTA1800-30-HG-S	18GHz SMA Pre-Amplifier	20 May 2019	20 May 2020	B.1, B.2
56060	Miteq TTA1800-30-HG	SMA 18GHz Pre Amplifier	08 Apr 2019	08 Apr 2020	B.1, B.2
47286	H+S Sucoflex 102E	40GHz Cable K Connector	05 Sep 2019	05 Sep 2020	B.1, B.2
35040	Micro-Tronics HPM50112-02	Notch Filter	27 Jun 2019	27 Jun 2020	B.1, B.2
51802	H+S Sucoflex 102PE	40 GHz Cable, K-Type	23 Dec 2019	23 Dec 2020	B.1, B.2
49563	H+S Sucoflex 106A	Coaxial Cable, 8m	12 Aug 2019	12 Aug 2020	B.1, B.2, B.3
21117	Micro-coax UFB311A-0-2484-520520	Coaxial Cable-18Ghz	12 Aug 2019	12 Aug 2020	B.1, B.2, B.3
56155	H+S Sucoflex 104PEA	Sucoflex N Type blue 7ft cable	13 Jan 2020	13 Jan 2021	B.1, B.2, B.3
47300	Keysight N9038A	EMI Receiver	29 May 2019	29 May 2020	B.1, B.2, B.3
34075	Schaffner RSG 2000	Reference Spectrum Generator, 1-18GHz	NA	NA	B.1, B.2
4883	EMCO 3115	Horn antenna	NA	NA	B.1, B.2
8171	Keysight 8491B Opt 010	Attenuator	23 Apr 2019	23 Apr 2020	B.1, B.2
35242	Klein tools 926-8ME	8m measurement tape	NA	NA	B.1, B.2, B.3
40597	Cisco Above 1GHz Site Cal	1GHz Cispr Site Verification	27 Sep 2019	27 Sep 2020	B.1, B.2
8448	Cisco NSA Cal	NSA/chamber	26 Sep 2019	26 Sep 2020	B.1, B.2, B.3
58225	Comet T7611-4	WEB SENSOR FOR REMOTE THERMOMETER HYGROMETER	20 Aug 2019	20 Aug 2020	B.1, B.2, B.3
56328	Pasternack PE5019-1	Torque wrench	25 Feb 2020	25 Feb 2021	B.1, B.2
56330	Pasternack PE5019-1	Torque wrench	02 Mar 2020	02 Mar 2021	B.1, B.2
33040	Fluke 175	True RMS Multimeter	04 Sep 2019	04 Sep 2020	B.1, B.2, B.3

Test Equipment used for Radiated Emissions, 18-26.5GHz					
CIS040597	CISCO Above 1GHz Site Cal	1GHz Cispr Site Verification	27 Sep 2019	27 Sep 2020	B.1.A.2, B.2.3
CIS45166	STANLEY 33-428	26' Tape Measure	Cal Not Required	Cal Not Required	B.1.A.2, B.2.3
CIS54235	PASTERNACK PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	28 Feb 2019	28 Feb 2020	B.1.A.2, B.2.3
CIS41979	CISCO 1840	18-40GHz EMI Test Head/Verification Fixture	09 Apr 2019	09 Apr 2020	B.1.A.2, B.2.3
58225	Comet T7611-4	WEB SENSOR FOR REMOTE THERMOMETER HYGROMETER	20 Aug 2019	20 Aug 2020	B.1.A.2, B.2.3
CIS5972	Keysight (Agilent/HP) 83712B	SYNTHESIZED CW GENERATOR	Cal Not Required	Cal Not Required	B.1.A.2, B.2.3
CIS44940	ROHDE & SCHWARZ ESU40	EMI RECEIVER, 40GHZ	18 Dec 2019	18 Dec 2020	B.1.A.2, B.2.3
CIS37236	JFW 50CB-015	Control Box, GPIB	Cal Not Required	Cal Not Required	B.1.A.2, B.2.3
30MHz to 1GHz					
CIS008448	NSA 5m Chamber Cisco	NSA 5m Chamber	26-SEP-19	26-SEP-20	B3
CIS047300	Keysight N9038A	MXE EMI Receiver	29-MAY-2019	29-MAY-2020	B3
CIS030654	JB1 Sunol Sciences	Combination Antenna, 30MHz-2GHz	05 Jun 2019	05 Jun 2020	B3
CIS021117	MICRO-COAX UFB311A-0-2484-520520	Coaxial Cable-18Ghz	12 Aug 2019	12 Aug 2020	B3
CIS 56157	HUBER + SUHNER Sucoflex 104PEA	Sucoflex N Type blue 7ft cable	13 Jan 2020	13 Jan 2021	B3
58225	Comet T7611-4	WEB SENSOR FOR REMOTE THERMOMETER HYGROMETER	20 Aug 2019	20 Aug 2020	B3
CIS49563	HUBER + SUHNER Sucoflex 106A	Coaxial Cable, 8m	12 Aug 2019	12 Aug 2020	B3
CIS45166	STANLEY 33-428	26' Tape Measure	Cal Not Required	Cal Not Required	B3
CIS27233	YORK VNE V	Comparison Noise Emitter	Cal Not Required	Cal Not Required	B3
CIS54235	PASTERNACK PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	28 Feb 2019	28 Feb 2020	B3

Appendix D: 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 E: Photographs of Test Setups

Please refer to the attachment

Appendix F: Software Used to Perform Testing

EMIsoft Vasona, version 6.047 & 6.071

Appendix G:Test Procedures

Measurements were made in accordance with

- KDB 558074 - D01 DTS Meas Guidance v05
- KDB 662911 - MIMO
- ANSI C63.4 2014 Unintentional Radiators
- ANSI C63.10 2013 Intentional Radiators

Test procedures are summarized below

FCC 2.4GHz Test Procedures	EDCS # 1445042
FCC 2.4GHz RSE Test Procedures	EDCS # 1480386

Appendix H: 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