

A.6: Conducted Band Edge

Conducted Band Edge Test Requirement

15.407(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.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Use formula below to substitute conducted measurements in place of radiated measurements

$$E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77, \text{ where } E = \text{field strength and } d = 3 \text{ meter}$$

- 1) Average Plot, Limit= -41.25 dBm eirp
- 2) Peak plot, Limit = -21.25 dBm eirp

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

2. Unwanted Emissions that fall Outside of the Restricted Bands

- a) For all measurements, follow the requirements in II.G.3. *“General Requirements for Unwanted Emissions Measurements.”*
- b) At frequencies below 1000 MHz, use the procedure described in II.G.4. *“Procedure for Unwanted Emissions Measurements Below 1000 MHz.”*
- c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in II.G.5., *“Procedure for Unwanted Emissions Measurements Above 1000 MHz.”*
- (i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.

Conducted Band Edge Test Procedure

Ref. ANSI C63.10: 2013

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Conducted Spurious Emissions Test Procedure
1. Connect the antenna port(s) to the spectrum analyzer input. 2. Place the radio in continuous transmit mode 3. Configure Spectrum analyzer as per test parameters below (be sure to enter all losses between the transmitter output and the spectrum analyzer). 4. Use the peak marker function to determine the maximum spurs amplitude level. 5. The “measure-and-sum technique” is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units. The worst case output is recorded. (see ANSI C63.10:2013 section 14.3.2.2) 6. Capture graphs and record pertinent measurement data.

Ref. ANSI C63.10: 2013 section 12.7.6 (Peak) and 12.7.7.2 (Average)

KDB 789033 D02 General UNII Test Procedures New Rules v02r01, Sec. 5 (Peak), Sec. 6 (Average Method AD)

Conducted Spurious Emissions Test parameters	
Peak RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto Detector = Peak Trace = Max Hold.	Average RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto Detector = RMS Power Averaging
Tested By: Ronak Patel	Date of testing: 11/1/2022 - 2/10/2023
Test Result: PASS	

Test Equipment

See Appendix C for list of test equipment

Conducted Band Edge Average – Antenna gain 3dBi.**Frequency 5180 MHz**

Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Duty Cycle (dB)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT20, 6 to 54 Mbps	1	3	-52.6		0.41	-49.2	-41	7.94
Non HT20, 6 to 54 Mbps	2	3	-57.3	-57.4	0.41	-50.9	-41	9.68
Non HT20 Beam Forming, 6 to 54 Mbps	2	6	-58.6	-59.0	0.41	-49.4	-41	8.13
HT/VHT20, M0 to M7	1	3	-52.8		0.31	-49.5	-41	8.24
HT/VHT20, M0 to M7	2	3	-57.5	-57.3	0.31	-51.1	-41	9.83
HT/VHT20, M8 to M15	2	3	-57.5	-57.3	0.31	-51.1	-41	9.83
HT/VHT20 Beam Forming, M0 to M7	2	6	-58.3	-58.9	0.31	-49.3	-41	8.02
HT/VHT20 Beam Forming, M8 to M15	2	3	-57.5	-57.3	0.31	-51.1	-41	9.83
HT/VHT20 STBC, M8 to M15	2	3	-57.5	-57.3	0.31	-51.1	-41	9.83
HE20, M0 to M11 1ss	1	3	-50.5		0.21	-47.3	-41	6.04
HE20, M0 to M11 1ss	2	3	-57.7	-57.7	0.21	-51.5	-41	10.23
HE20, M0 to M11 2ss	2	3	-57.7	-57.7	0.21	-51.5	-41	10.23
HE20 Beam Forming, M0 to M11 1ss	2	6	-58.5	-58.3	0.21	-49.2	-41	7.93
HE20 Beam Forming, M0 to M11 2ss	2	3	-57.7	-57.7	0.21	-51.5	-41	10.23
HE20 STBC, M0 to M11 2ss	2	3	-57.7	-57.7	0.21	-51.5	-41	10.23

Frequency 5190 MHz

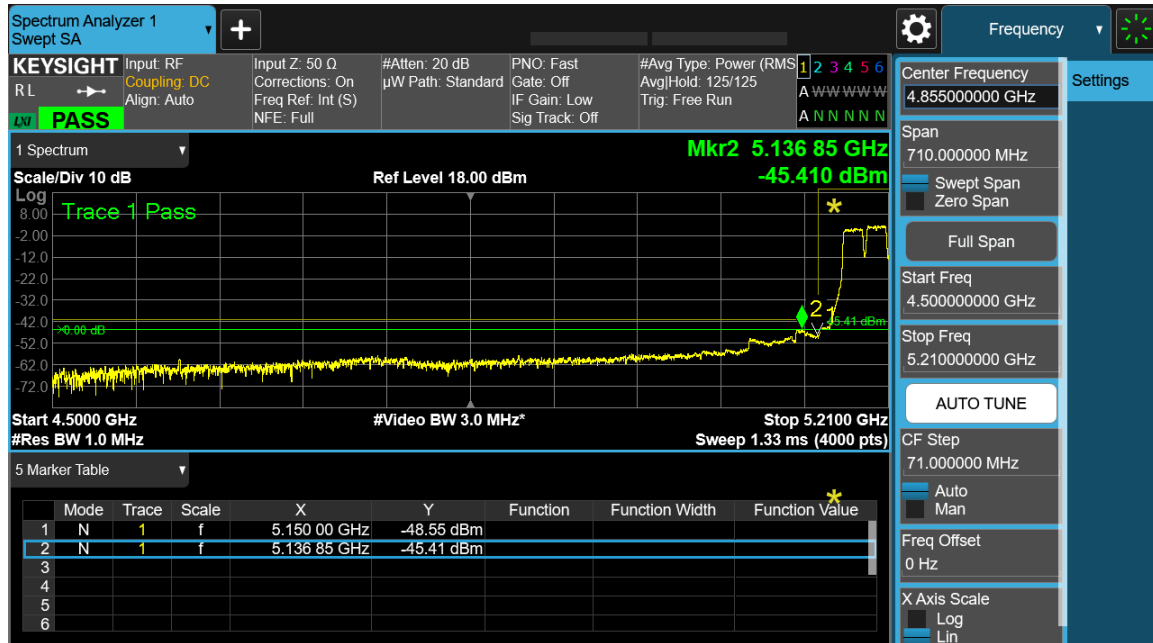
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Duty Cycle (dB)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT40, 6 to 54 Mbps	1	3	-50.5		0.46	-47.0	-41	5.79
Non HT40, 6 to 54 Mbps	2	3	-59.6	-51.4	0.46	-47.3	-41	6.08
HT/VHT40, M0 to M7	1	3	-47.8		0.55	-44.3	-41	3.0
HT/VHT40, M0 to M7	2	3	-58.8	-57.5	0.55	-51.5	-41	10.29
HT/VHT40, M8 to M15	2	3	-58.8	-57.5	0.55	-51.5	-41	10.29
HT/VHT40 Beam Forming, M0 to M7	2	6	-60.7	-60.7	0.55	-51.1	-41	9.89
HT/VHT40 Beam Forming, M8 to M15	2	3	-58.8	-57.5	0.55	-51.5	-41	10.29
HT/VHT40 STBC, M8 to M15	2	3	-58.8	-57.5	0.55	-51.5	-41	10.29
HE40, M0 to M11 1ss	1	3	-47.4		0.26	-44.1	-41	2.89
HE40, M0 to M11 1ss	2	3	-60.3	-48.3	0.26	-44.8	-41	3.53
HE40, M0 to M11 2ss	2	3	-60.3	-48.3	0.26	-44.8	-41	3.53
HE40 Beam Forming, M0 to M11 1ss	2	6	-58.6	-53.4	0.26	-46.0	-41	4.75
HE40 Beam Forming, M0 to M11 2ss	2	3	-60.3	-48.3	0.26	-44.8	-41	3.53
HE40 STBC, M0 to M11 2ss	2	3	-60.3	-48.3	0.26	-44.8	-41	3.53

Frequency 5210 MHz

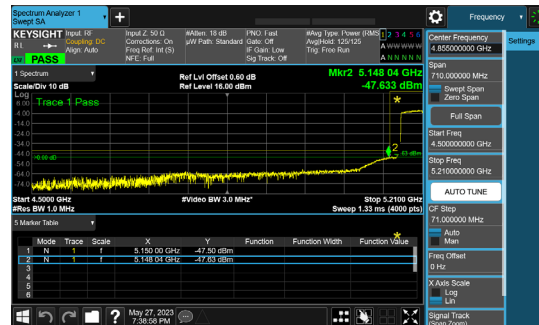
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Duty Cycle (dB)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT80, 6 to 54 Mbps	1	3	-45.4		0.23	-42.2	-41	0.92
Non HT80, 6 to 54 Mbps	2	3	-60.8	-48.3	0.23	-44.8	-41	3.58
VHT80, M0 to M11 1ss	1	3	-49.7		0.55	-46.2	-41	4.9
VHT80, M0 to M11 1ss	2	3	-55.2	-48.9	0.55	-44.4	-41	3.19
VHT80, M0 to M11 2ss	2	3	-55.2	-48.9	0.55	-44.4	-41	3.19
VHT80 Beam Forming, M0 to M11 1ss	2	6	-66.1	-53.3	0.55	-46.5	-41	5.28
VHT80 Beam Forming, M0 to M11 2ss	2	3	-55.2	-48.9	0.55	-44.4	-41	3.19
VHT80 STBC, M0 to M11 2ss	2	3	-55.2	-48.9	0.55	-44.4	-41	3.19
HE80, M0 to M11 1ss	1	3	-48.8		0.23	-45.6	-41	4.32
HE80, M0 to M11 1ss	2	3	-62.5	-47.5	0.23	-44.1	-41	2.88
HE80, M0 to M11 2ss	2	3	-62.5	-47.5	0.23	-44.1	-41	2.88
HE80 Beam Forming, M0 to M11 1ss	2	6	-56.6	-52.9	0.23	-45.1	-41	3.88
HE80 Beam Forming, M0 to M11 2ss	2	3	-62.5	-47.5	0.23	-44.1	-41	2.88
HE80 STBC, M0 to M11 2ss	2	3	-62.5	-47.5	0.23	-44.1	-41	2.88

Data Screenshots – Antenna gain 15dBi.

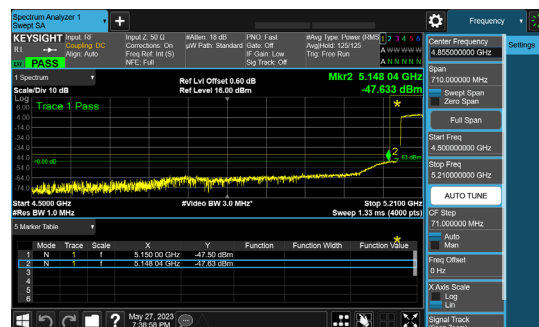
5210 MHz: Non HT80, 6 to 54 Mbps



5210 MHz: HE80, M0 to M11 1ss



5210 MHz: HE80, M0 to M11 2ss



Conducted Band Edge Peak – Antenna gain 3dBi.**Frequency 5180 MHz**

Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT20, 6 to 54 Mbps	1	3	-40.5		-37.1	-27	10.09
Non HT20, 6 to 54 Mbps	2	3	-43.0	-42.7	-36.4	-27	9.43
Non HT20 Beam Forming, 6 to 54 Mbps	2	6	-43.9	-48.4	-36.2	-27	9.17
HT/VHT20, M0 to M7	1	3	-40.2		-36.9	-27	9.89
HT/VHT20, M0 to M7	2	3	-42.2	-44.5	-36.9	-27	9.88
HT/VHT20, M8 to M15	2	3	-42.2	-44.5	-36.9	-27	9.88
HT/VHT20 Beam Forming, M0 to M7	2	6	-45.3	-46.9	-36.7	-27	9.71
HT/VHT20 Beam Forming, M8 to M15	2	3	-42.2	-44.5	-36.9	-27	9.88
HT/VHT20 STBC, M8 to M15	2	3	-42.2	-44.5	-36.9	-27	9.88
HE20, M0 to M11 1ss	1	3	-38.4		-35.2	-27	8.19
HE20, M0 to M11 1ss	2	3	-43.4	-44.7	-37.8	-27	10.79
HE20, M0 to M11 2ss	2	3	-43.4	-44.7	-37.8	-27	10.79
HE20 Beam Forming, M0 to M11 1ss	2	6	-45.8	-43.5	-35.3	-27	8.28
HE20 Beam Forming, M0 to M11 2ss	2	3	-43.4	-44.7	-37.8	-27	10.79
HE20 STBC, M0 to M11 2ss	2	3	-43.4	-44.7	-37.8	-27	10.79

Frequency 5190 MHz

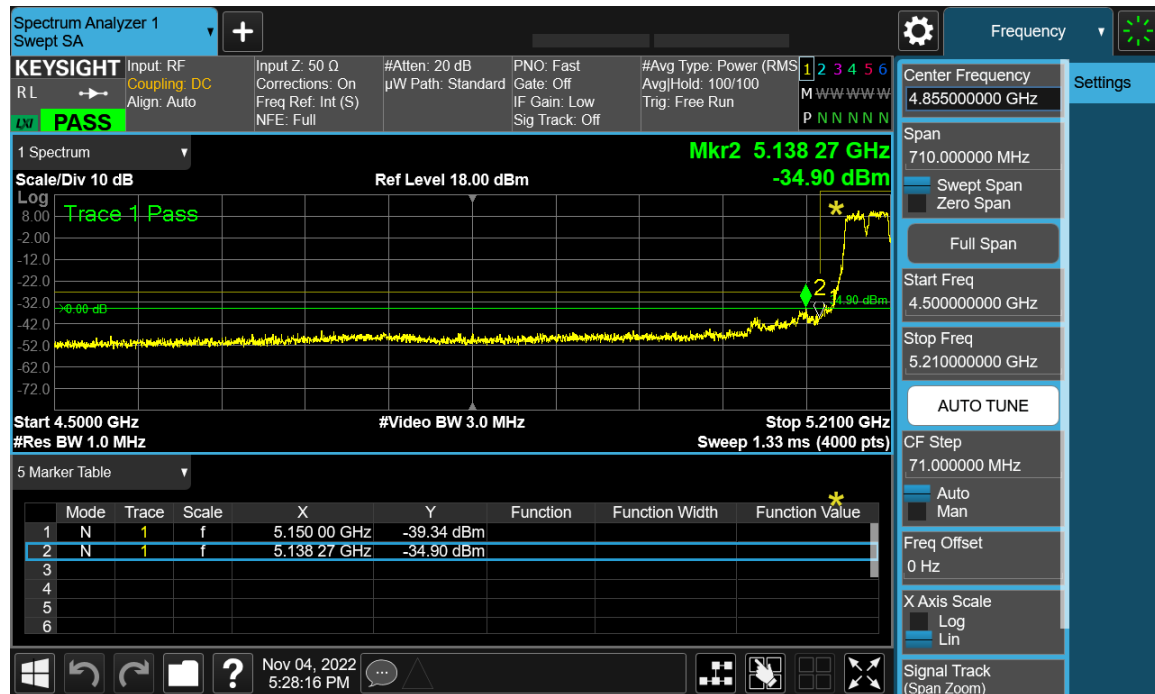
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT40, 6 to 54 Mbps	1	3	-38.9		-35.4	-27	8.44
Non HT40, 6 to 54 Mbps	2	3	-49.4	-39.9	-36.0	-27	8.98
HT/VHT40, M0 to M7	1	3	-37.0		-33.5	-27	6.45
HT/VHT40, M0 to M7	2	3	-43.9	-43.8	-37.3	-27	10.29
HT/VHT40, M8 to M15	2	3	-43.9	-43.8	-37.3	-27	10.29
HT/VHT40 Beam Forming, M0 to M7	2	6	-44.0	-45.8	-35.2	-27	8.25
HT/VHT40 Beam Forming, M8 to M15	2	3	-43.9	-43.8	-37.3	-27	10.29
HT/VHT40 STBC, M8 to M15	2	3	-43.9	-43.8	-37.3	-27	10.29
HE40, M0 to M11 1ss	1	3	-37.3		-34.0	-27	7.04
HE40, M0 to M11 1ss	2	3	-50.6	-39.1	-35.5	-27	8.55
HE40, M0 to M11 2ss	2	3	-50.6	-39.1	-35.5	-27	8.55
HE40 Beam Forming, M0 to M11 1ss	2	6	-47.4	-43.6	-35.8	-27	8.83
HE40 Beam Forming, M0 to M11 2ss	2	3	-50.6	-39.1	-35.5	-27	8.55
HE40 STBC, M0 to M11 2ss	2	3	-50.6	-39.1	-35.5	-27	8.55

Frequency 5210 MHz

Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT80, 6 to 54 Mbps	1	3	-34.9		-31.7	-27	4.67
Non HT80, 6 to 54 Mbps	2	3	-51.5	-39.5	-36.0	-27	9.0
VHT80, M0 to M11 1ss	1	3	-36.5		-33.0	-27	5.95
VHT80, M0 to M11 1ss	2	3	-44.7	-38.3	-33.9	-27	6.86
VHT80, M0 to M11 2ss	2	3	-44.7	-38.3	-33.9	-27	6.86
VHT80 Beam Forming, M0 to M11 1ss	2	6	-55.4	-44.2	-37.3	-27	10.34
VHT80 Beam Forming, M0 to M11 2ss	2	3	-44.7	-38.3	-33.9	-27	6.86
VHT80 STBC, M0 to M11 2ss	2	3	-44.7	-38.3	-33.9	-27	6.86
HE80, M0 to M11 1ss	1	3	-36.1		-32.9	-27	5.87
HE80, M0 to M11 1ss	2	3	-52.4	-38.5	-35.1	-27	8.1
HE80, M0 to M11 2ss	2	3	-52.4	-38.5	-35.1	-27	8.1
HE80 Beam Forming, M0 to M11 1ss	2	6	-45.8	-42.4	-34.5	-27	7.53
HE80 Beam Forming, M0 to M11 2ss	2	3	-52.4	-38.5	-35.1	-27	8.1
HE80 STBC, M0 to M11 2ss	2	3	-52.4	-38.5	-35.1	-27	8.1

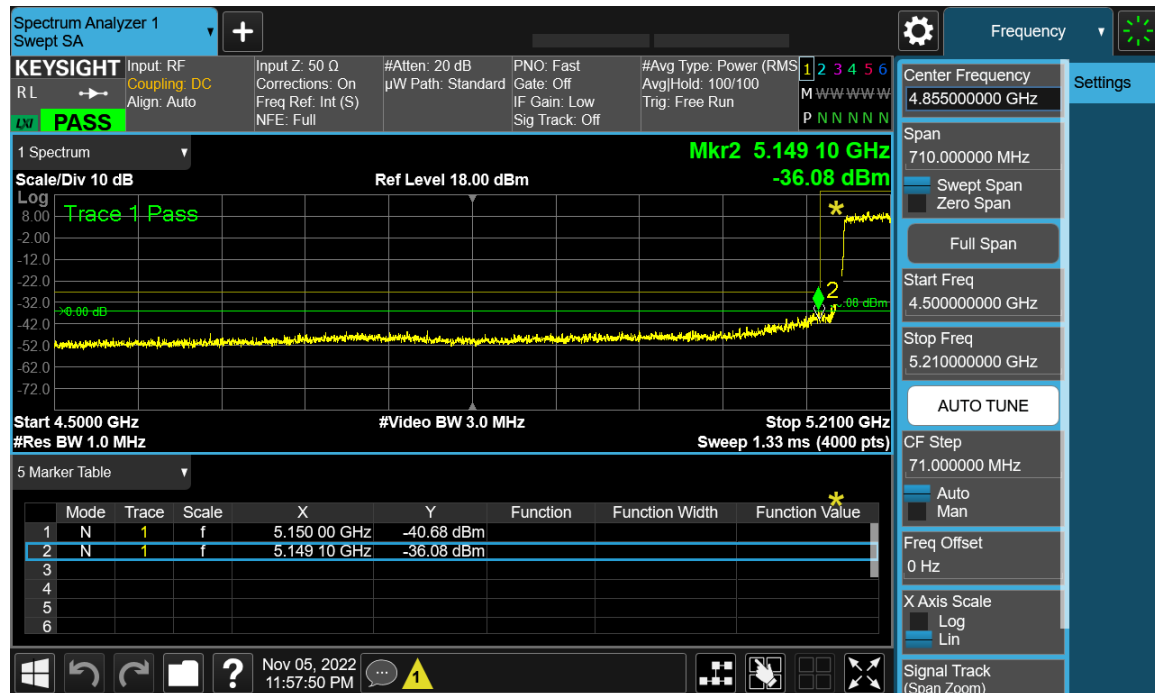
Data Screenshots – Antenna gain 3dBi peak.

5210 MHz: Non HT80, 6 to 54 Mbps



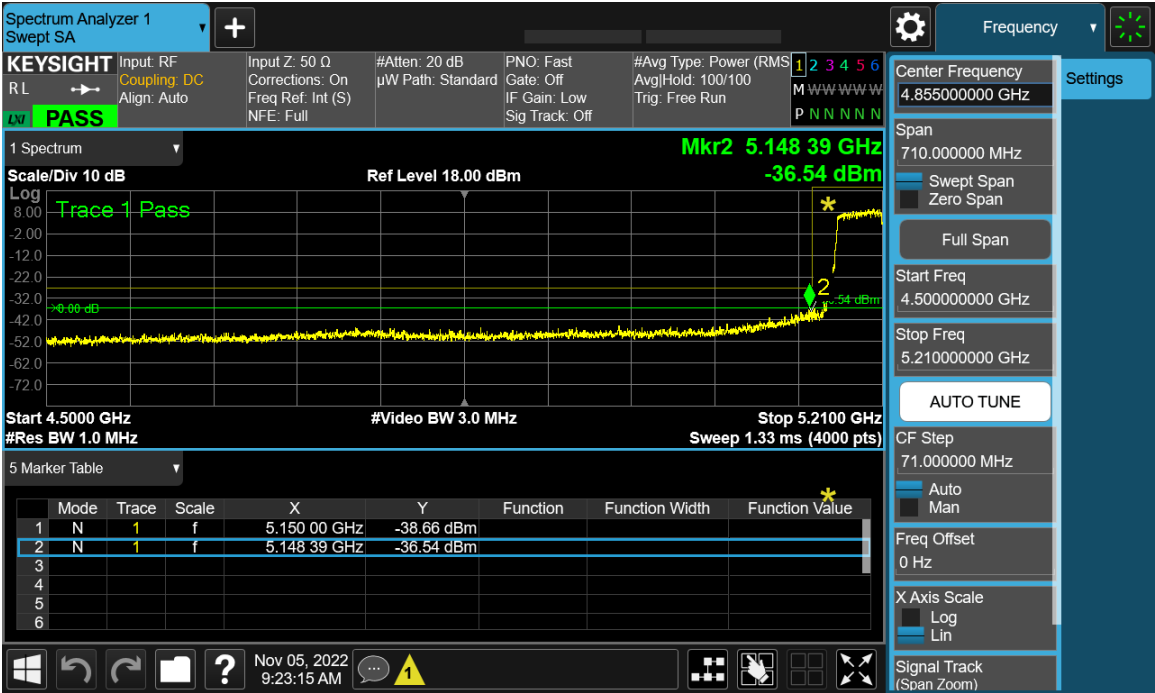
Antenna A

5210 MHz: HE80, M0 to M11 1ss



Antenna A

5210 MHz: VHT80, M0 to M11 1ss



Antenna A

Conducted Band Edge Average – Antenna gain 8dBi.**Frequency 5180 MHz**

Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Duty Cycle (dB)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT20, 6 to 54 Mbps	1	8	-57.3		0.41	-48.9	-41	7.64
Non HT20, 6 to 54 Mbps	2	8	-58.6	-59.0	0.41	-47.4	-41	6.13
Non HT20 Beam Forming, 6 to 54 Mbps	2	11	-65.4	-60.1	0.41	-47.6	-41	6.32
HT/VHT20, M0 to M7	1	8	-57.5		0.31	-49.2	-41	7.94
HT/VHT20, M0 to M7	2	8	-58.3	-58.9	0.31	-47.3	-41	6.02
HT/VHT20, M8 to M15	2	8	-58.3	-58.9	0.31	-47.3	-41	6.02
HT/VHT20 Beam Forming, M0 to M7	2	11	-58.6	-59.4	0.31	-44.7	-41	3.42
HT/VHT20 Beam Forming, M8 to M15	2	8	-58.3	-58.9	0.31	-47.3	-41	6.02
HT/VHT20 STBC, M8 to M15	2	8	-58.3	-58.9	0.31	-47.3	-41	6.02
HE20, M0 to M11 1ss	1	8	-57.7		0.21	-49.5	-41	8.24
HE20, M0 to M11 1ss	2	8	-58.5	-58.3	0.21	-47.2	-41	5.93
HE20, M0 to M11 2ss	2	8	-58.5	-58.3	0.21	-47.2	-41	5.93
HE20 Beam Forming, M0 to M11 1ss	2	11	-58.8	-59.5	0.21	-44.9	-41	3.67
HE20 Beam Forming, M0 to M11 2ss	2	8	-58.5	-58.3	0.21	-47.2	-41	5.93
HE20 STBC, M0 to M11 2ss	2	8	-58.5	-58.3	0.21	-47.2	-41	5.93

Frequency 5190 MHz

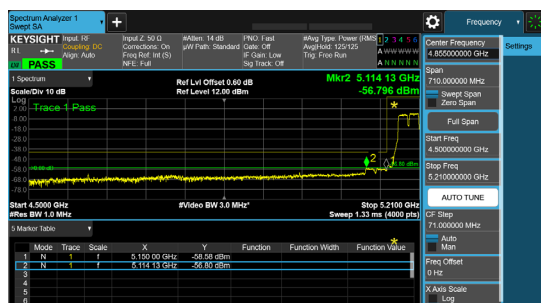
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Duty Cycle (dB)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT40, 6 to 54 Mbps	1	8	-59.6		0.46	-51.1	-41	9.89
Non HT40, 6 to 54 Mbps	2	8	-58.1	-54.7	0.46	-44.6	-41	3.36
HT/VHT40, M0 to M7	1	8	-58.8		0.55	-50.3	-41	9.0
HT/VHT40, M0 to M7	2	8	-60.7	-60.7	0.55	-49.1	-41	7.89
HT/VHT40, M8 to M15	2	8	-60.7	-60.7	0.55	-49.1	-41	7.89
HT/VHT40 Beam Forming, M0 to M7	2	11	-67.0	-60.9	0.55	-48.4	-41	7.15
HT/VHT40 Beam Forming, M8 to M15	2	8	-60.7	-60.7	0.55	-49.1	-41	7.89
HT/VHT40 STBC, M8 to M15	2	8	-60.7	-60.7	0.55	-49.1	-41	7.89
HE40, M0 to M11 1ss	1	8	-60.3		0.26	-52.0	-41	10.79
HE40, M0 to M11 1ss	2	8	-58.6	-53.4	0.26	-44.0	-41	2.75
HE40, M0 to M11 2ss	2	8	-58.6	-53.4	0.26	-44.0	-41	2.75
HE40 Beam Forming, M0 to M11 1ss	2	11	-67.0	-59.6	0.26	-47.6	-41	6.37
HE40 Beam Forming, M0 to M11 2ss	2	8	-58.6	-53.4	0.26	-44.0	-41	2.75
HE40 STBC, M0 to M11 2ss	2	8	-58.6	-53.4	0.26	-44.0	-41	2.75

Frequency 5210 MHz

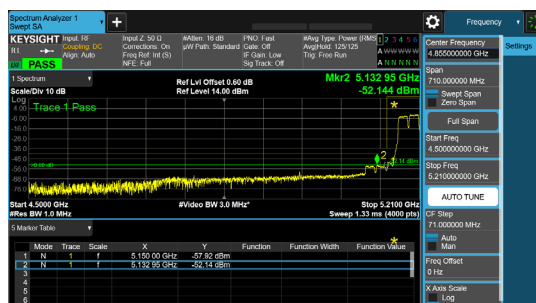
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Duty Cycle (dB)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT80, 6 to 54 Mbps	1	8	-60.8		0.23	-52.6	-41	11.32
Non HT80, 6 to 54 Mbps	2	8	-56.8	-52.1	0.23	-42.6	-41	1.35
VHT80, M0 to M11 1ss	1	8	-55.2		0.55	-46.7	-41	5.4
VHT80, M0 to M11 1ss	2	8	-66.1	-53.3	0.55	-44.5	-41	3.28
VHT80, M0 to M11 2ss	2	8	-66.1	-53.3	0.55	-44.5	-41	3.28
VHT80 Beam Forming, M0 to M11 1ss	2	11	-66.1	-58.3	0.55	-46.1	-41	4.84
VHT80 Beam Forming, M0 to M11 2ss	2	8	-66.1	-53.3	0.55	-44.5	-41	3.28
VHT80 STBC, M0 to M11 2ss	2	8	-66.1	-53.3	0.55	-44.5	-41	3.28
HE80, M0 to M11 1ss	1	8	-55.8		0.23	-47.6	-41	6.32
HE80, M0 to M11 1ss	2	8	-56.6	-52.9	0.23	-43.1	-41	1.88
HE80, M0 to M11 2ss	2	8	-56.6	-52.9	0.23	-43.1	-41	1.88
HE80 Beam Forming, M0 to M11 1ss	2	11	-66.8	-58.1	0.23	-46.3	-41	5.07
HE80 Beam Forming, M0 to M11 2ss	2	8	-56.6	-52.9	0.23	-43.1	-41	1.88
HE80 STBC, M0 to M11 2ss	2	8	-56.6	-52.9	0.23	-43.1	-41	1.88

Data Screenshots – Antenna gain 8dBi average.

5210 MHz: Non HT80, 6 to 54 Mbps

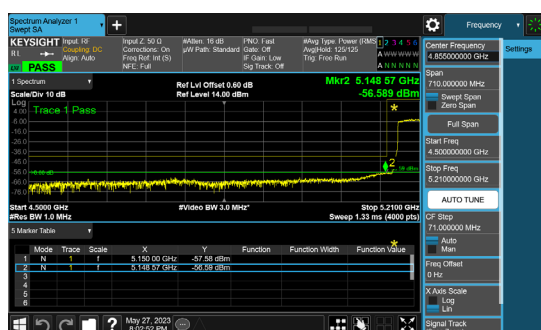


Antenna A

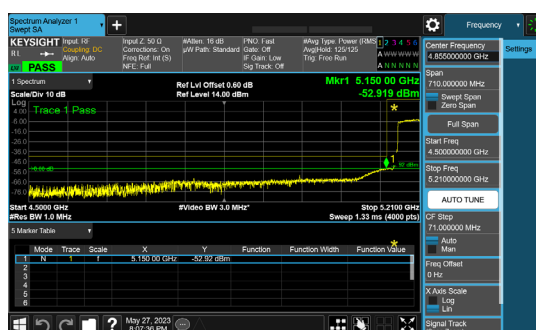


Antenna B

5210 MHz: HE80, M0 to M11 1ss

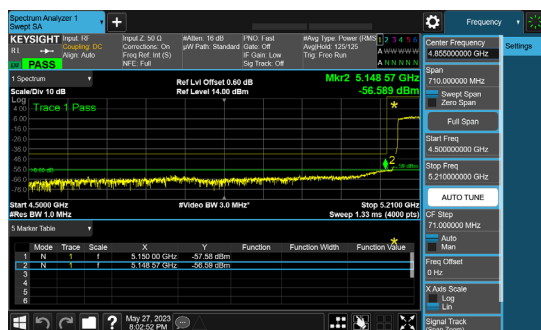


Antenna A

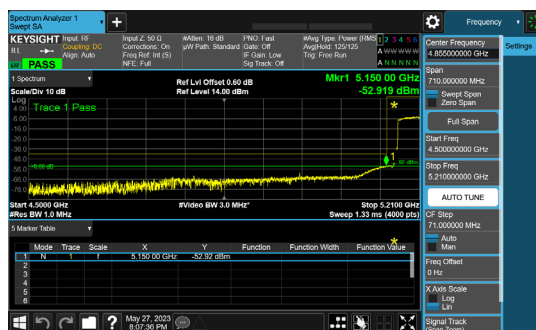


Antenna B

5210 MHz: HE80, M0 to M11 2ss



Antenna A



Antenna B

Conducted Band Edge Peak – Antenna gain 8dBi.**Frequency 5180 MHz**

Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT20, 6 to 54 Mbps	1	8	-43.0		-34.6	-27	7.59
Non HT20, 6 to 54 Mbps	2	8	-43.9	-48.4	-34.2	-27	7.17
Non HT20 Beam Forming, 6 to 54 Mbps	2	11	-55.1	-47.6	-35.5	-27	8.48
HT/VHT20, M0 to M7	1	8	-42.2		-33.9	-27	6.89
HT/VHT20, M0 to M7	2	8	-45.3	-46.9	-34.7	-27	7.71
HT/VHT20, M8 to M15	2	8	-45.3	-46.9	-34.7	-27	7.71
HT/VHT20 Beam Forming, M0 to M7	2	11	-49.3	-50.2	-35.4	-27	8.41
HT/VHT20 Beam Forming, M8 to M15	2	8	-45.3	-46.9	-34.7	-27	7.71
HT/VHT20 STBC, M8 to M15	2	8	-45.3	-46.9	-34.7	-27	7.71
HE20, M0 to M11 1ss	1	8	-43.4		-35.2	-27	8.19
HE20, M0 to M11 1ss	2	8	-45.8	-43.5	-33.3	-27	6.28
HE20, M0 to M11 2ss	2	8	-45.8	-43.5	-33.3	-27	6.28
HE20 Beam Forming, M0 to M11 1ss	2	11	-48.7	-48.4	-34.3	-27	7.33
HE20 Beam Forming, M0 to M11 2ss	2	8	-45.8	-43.5	-33.3	-27	6.28
HE20 STBC, M0 to M11 2ss	2	8	-45.8	-43.5	-33.3	-27	6.28

Frequency 5190 MHz

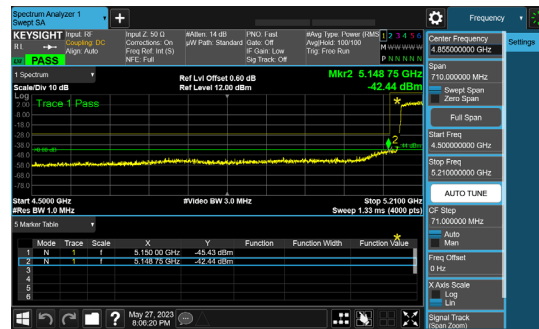
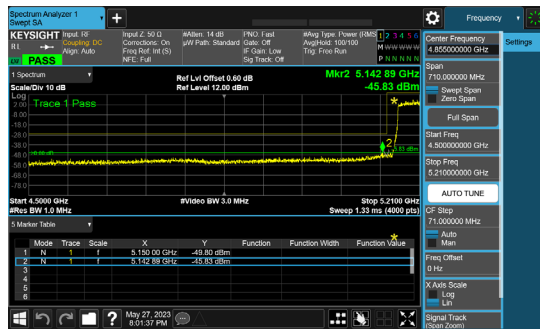
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT40, 6 to 54 Mbps	1	8	-49.4		-40.9	-27	13.94
Non HT40, 6 to 54 Mbps	2	8	-46.9	-45.7	-34.8	-27	7.79
HT/VHT40, M0 to M7	1	8	-43.9		-35.4	-27	8.35
HT/VHT40, M0 to M7	2	8	-44.0	-45.8	-33.2	-27	6.25
HT/VHT40, M8 to M15	2	8	-44.0	-45.8	-33.2	-27	6.25
HT/VHT40 Beam Forming, M0 to M7	2	11	-56.3	-51.7	-38.9	-27	11.86
HT/VHT40 Beam Forming, M8 to M15	2	8	-44.0	-45.8	-33.2	-27	6.25
HT/VHT40 STBC, M8 to M15	2	8	-44.0	-45.8	-33.2	-27	6.25
HE40, M0 to M11 1ss	1	8	-50.6		-42.3	-27	15.34
HE40, M0 to M11 1ss	2	8	-47.4	-43.6	-33.8	-27	6.83
HE40, M0 to M11 2ss	2	8	-47.4	-43.6	-33.8	-27	6.83
HE40 Beam Forming, M0 to M11 1ss	2	11	-54.0	-47.9	-35.7	-27	8.69
HE40 Beam Forming, M0 to M11 2ss	2	8	-47.4	-43.6	-33.8	-27	6.83
HE40 STBC, M0 to M11 2ss	2	8	-47.4	-43.6	-33.8	-27	6.83

Frequency 5210 MHz

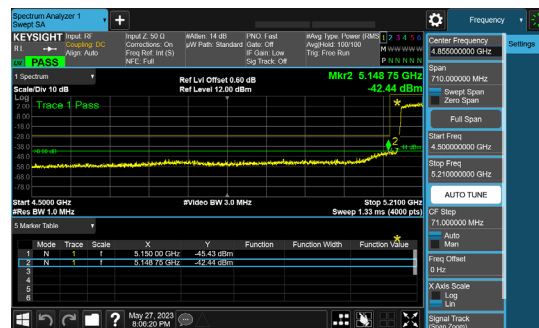
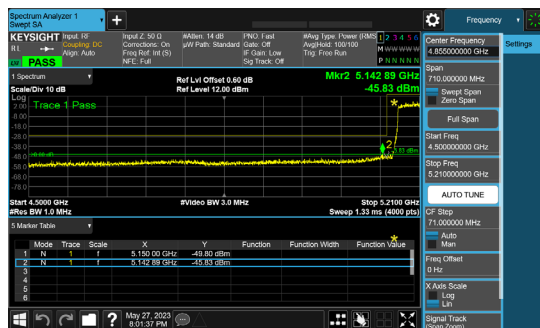
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT80, 6 to 54 Mbps	1	8	-51.5		-43.3	-27	16.27
Non HT80, 6 to 54 Mbps	2	8	-46.6	-43.7	-33.7	-27	6.67
VHT80, M0 to M11 1ss	1	8	-44.7		-36.2	-27	9.15
VHT80, M0 to M11 1ss	2	8	-55.4	-44.2	-35.3	-27	8.34
VHT80, M0 to M11 2ss	2	8	-55.4	-44.2	-35.3	-27	8.34
VHT80 Beam Forming, M0 to M11 1ss	2	11	-56.4	-47.6	-35.5	-27	8.51
VHT80 Beam Forming, M0 to M11 2ss	2	8	-55.4	-44.2	-35.3	-27	8.34
VHT80 STBC, M0 to M11 2ss	2	8	-55.4	-44.2	-35.3	-27	8.34
HE80, M0 to M11 1ss	1	8	-44.6		-36.4	-27	9.37
HE80, M0 to M11 1ss	2	8	-45.8	-42.4	-32.5	-27	5.53
HE80, M0 to M11 2ss	2	8	-45.8	-42.4	-32.5	-27	5.53
HE80 Beam Forming, M0 to M11 1ss	2	11	-57.2	-47.1	-35.5	-27	8.46
HE80 Beam Forming, M0 to M11 2ss	2	8	-45.8	-42.4	-32.5	-27	5.53
HE80 STBC, M0 to M11 2ss	2	8	-45.8	-42.4	-32.5	-27	5.53

Data Screenshots – Antenna gain 8dBi peak.

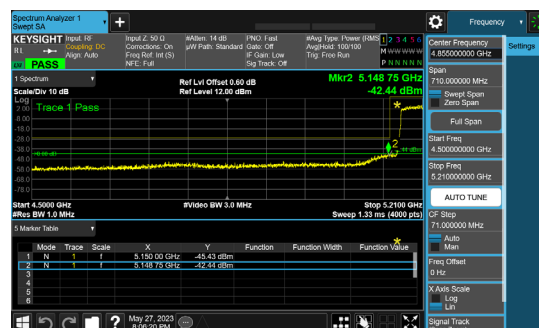
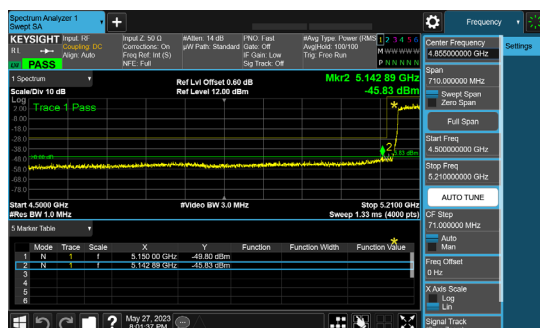
5210 MHz: HE80, M0 to M11 1ss



5210 MHz: HE80, M0 to M11 2ss



5210 MHz: HE80 Beam Forming, M0 to M11 2ss.



Conducted Band Edge Peak – Antenna gain 15dBi.**Frequency 5180 MHz**

Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT20, 6 to 54 Mbps	1	15	-43.0		-27.6	-27	0.59
Non HT20, 6 to 54 Mbps	2	15	-43.9	-48.4	-27.2	-27	0.17
Non HT20 Beam Forming, 6 to 54 Mbps	2	15	-43.9	-48.4	-27.2	-27	0.17
HT/VHT20, M0 to M7	1	15	-43.7		-28.4	-27	1.39
HT/VHT20, M0 to M7	2	15	-45.3	-46.9	-27.7	-27	0.71
HT/VHT20, M8 to M15	2	15	-45.3	-46.9	-27.7	-27	0.71
HT/VHT20 Beam Forming, M0 to M7	2	15	-45.3	-46.9	-27.7	-27	0.71
HT/VHT20 Beam Forming, M8 to M15	2	15	-45.3	-46.9	-27.7	-27	0.71
HT/VHT20 STBC, M8 to M15	2	15	-45.3	-46.9	-27.7	-27	0.71
HE20, M0 to M11 1ss	1	15	-43.4		-28.2	-27	1.19
HE20, M0 to M11 1ss	2	15	-48.3	-46.2	-28.9	-27	1.91
HE20, M0 to M11 2ss	2	15	-48.3	-46.2	-28.9	-27	1.91
HE20 Beam Forming, M0 to M11 1ss	2	15	-48.3	-46.2	-28.9	-27	1.91
HE20 Beam Forming, M0 to M11 2ss	2	15	-48.3	-46.2	-28.9	-27	1.91
HE20 STBC, M0 to M11 2ss	2	15	-48.3	-46.2	-28.9	-27	1.91

Frequency 5190 MHz

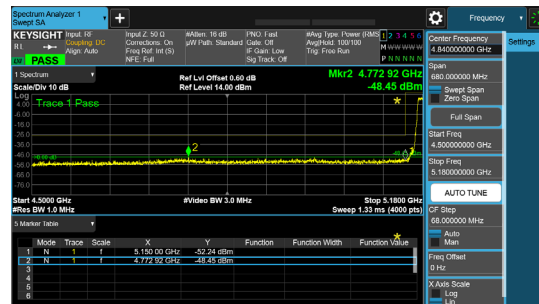
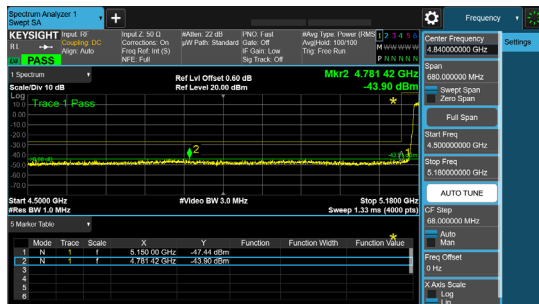
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT40, 6 to 54 Mbps	1	15	-49.4		-33.9	-27	6.94
Non HT40, 6 to 54 Mbps	2	15	-46.9	-45.7	-27.8	-27	0.79
HT/VHT40, M0 to M7	1	15	-43.9		-28.4	-27	1.35
HT/VHT40, M0 to M7	2	15	-55.4	-48.5	-32.1	-27	5.15
HT/VHT40, M8 to M15	2	15	-55.4	-48.5	-32.1	-27	5.15
HT/VHT40 Beam Forming, M0 to M7	2	15	-55.4	-48.5	-32.1	-27	5.15
HT/VHT40 Beam Forming, M8 to M15	2	15	-55.4	-48.5	-32.1	-27	5.15
HT/VHT40 STBC, M8 to M15	2	15	-55.4	-48.5	-32.1	-27	5.15
HE40, M0 to M11 1ss	1	15	-50.6		-35.3	-27	8.34
HE40, M0 to M11 1ss	2	15	-53.4	-45.3	-29.4	-27	2.42
HE40, M0 to M11 2ss	2	15	-53.4	-45.3	-29.4	-27	2.42
HE40 Beam Forming, M0 to M11 1ss	2	15	-53.4	-45.3	-29.4	-27	2.42
HE40 Beam Forming, M0 to M11 2ss	2	15	-53.4	-45.3	-29.4	-27	2.42
HE40 STBC, M0 to M11 2ss	2	15	-53.4	-45.3	-29.4	-27	2.42

Frequency 5210 MHz

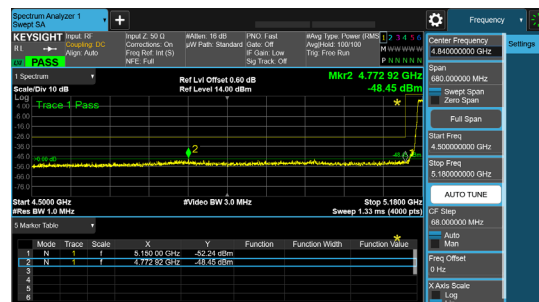
Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Band Edge Level (dBm)	Tx 2 Band Edge Level (dBm)	Total Tx Band Edge Level (dBm)	Limit (dB)	Margin (dB)
Non HT80, 6 to 54 Mbps	1	15	-51.5		-36.3	-27	9.27
Non HT80, 6 to 54 Mbps	2	15	-55.0	-44.8	-29.2	-27	2.17
VHT80, M0 to M11 1ss	1	15	-44.7		-29.2	-27	2.15
VHT80, M0 to M11 1ss	2	15	-55.4	-44.2	-28.3	-27	1.34
VHT80, M0 to M11 2ss	2	15	-55.4	-44.2	-28.3	-27	1.34
VHT80 Beam Forming, M0 to M11 1ss	2	15	-55.4	-44.2	-28.3	-27	1.34
VHT80 Beam Forming, M0 to M11 2ss	2	15	-55.4	-44.2	-28.3	-27	1.34
VHT80 STBC, M0 to M11 2ss	2	15	-55.4	-44.2	-28.3	-27	1.34
HE80, M0 to M11 1ss	1	15	-44.6		-29.4	-27	2.37
HE80, M0 to M11 1ss	2	15	-56.4	-45.0	-29.5	-27	2.47
HE80, M0 to M11 2ss	2	15	-56.4	-45.0	-29.5	-27	2.47
HE80 Beam Forming, M0 to M11 1ss	2	15	-56.4	-45.0	-29.5	-27	2.47
HE80 Beam Forming, M0 to M11 2ss	2	15	-56.4	-45.0	-29.5	-27	2.47
HE80 STBC, M0 to M11 2ss	2	15	-56.4	-45.0	-29.5	-27	2.47

Data Screenshots – Antenna gain 15dBi peak.

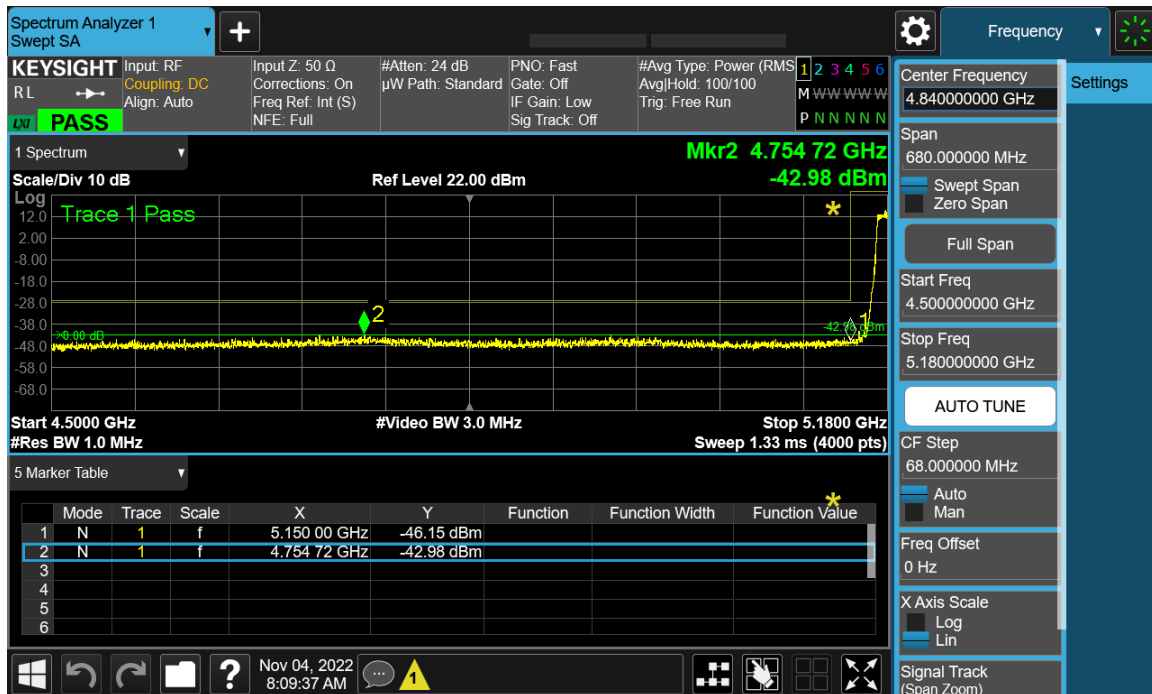
5180 MHz: Non HT20, 6 to 54 Mbps



5180 MHz: Non HT20 Beam Forming, 6 to 54 Mbps



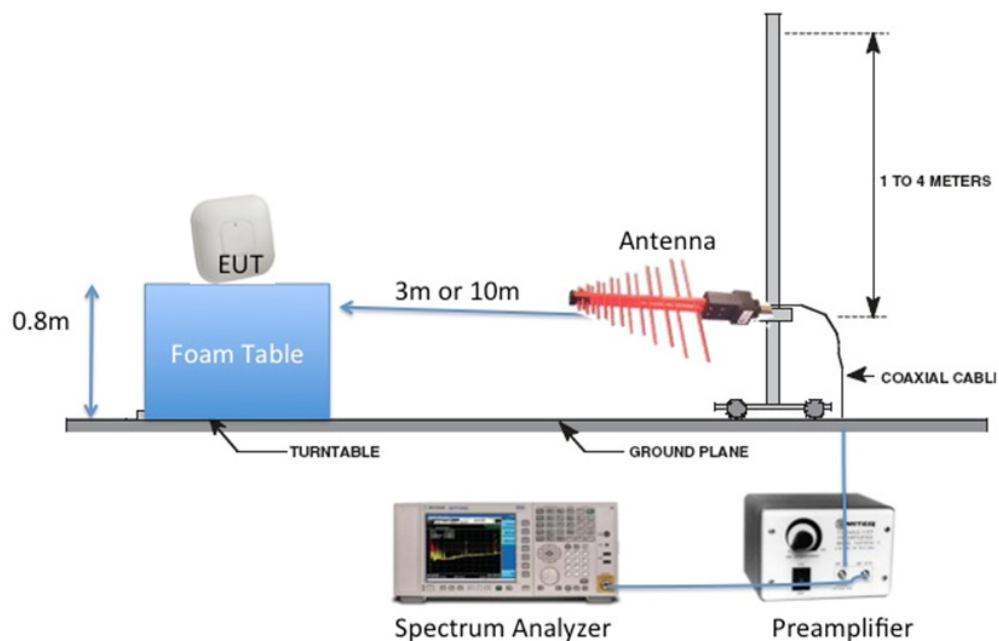
5180 MHz: Non HT20, 6 to 54 Mbps



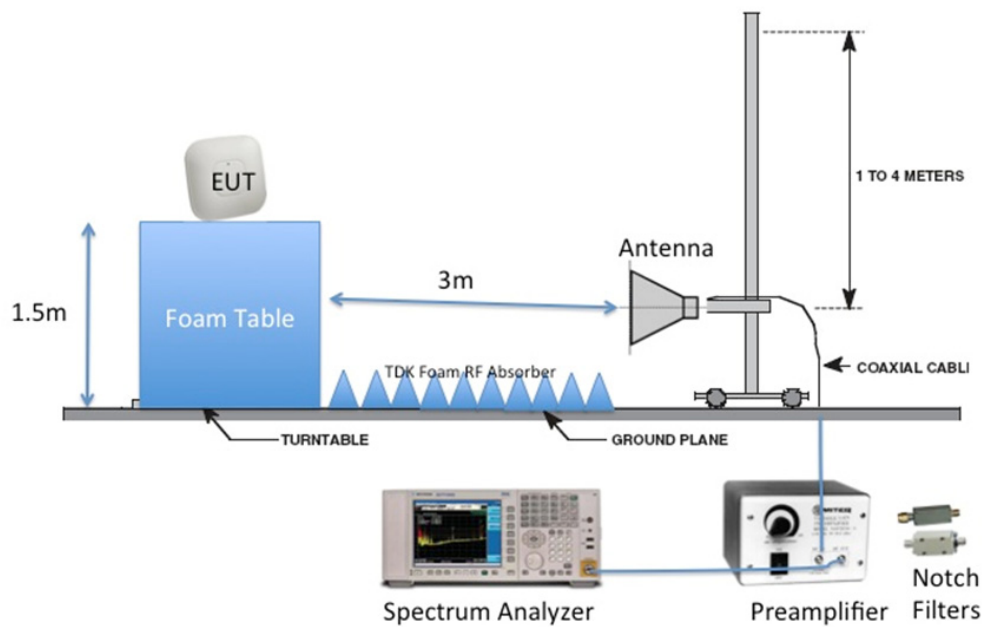
Appendix B: Emission Test Results

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

FCC 15.205 | 15.407 | LP0002 (2018-01-10) (3.6)

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Radiated emissions test results are covered in EDCS # 24346978.

Note: Although 100kHz RBW is required for emissions below 1GHz, 1MHz RBW was used in order to show compliance under worst-case setting

Note: emissions above 12GHz are only noise floor and that data can be additionally shown in radiated report

B.2: Radiated Emissions 30MHz to 1GHz

FCC 15.209 | 15.205 | 15.407

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), 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 6.5

Radiated emissions test results are covered in EDCS # 24346978.

B.3: AC Conducted Emissions

FCC 15.207 | LP0002 (2020-07-01) (3.3)

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.

Measurement Procedure

Accordance with ANSI C63.10:2013 section 6.2

Case Details

Test Case ID: 5088 Test Type: Conducted Emissions			
Product Standard	Port Type	Test Details	Comments
FCC CFR 15.207	DC (Indoor)	Start Freq: 0.15MHz - Stop Freq: 30MHz Power: DC Range: 150KHz to 30MHz. Class: N/A Measure: Voltage(dBuV) Detector(s): Quasi-Peak and Average 150kHz - 500kHz - 89dBuV (QP) 76(AV) 500kHz - 30MHz - 83dBuV (QP) 70(AV)	
Basic Standard	CISPR16 Series		
Overall Result	Pass		
Deviation	NA		

Subtest Details

Subtest Number: 5088-1 Subtest Date: 1/25/2023		
Engineer	Jose Huamani	
Lab Information	Bldg. P - Shield Room 1	
Subtest Results		
Subtest Title	5088-1	
Port Reference	[J] DC Input	
Measured Voltage	48VDC	
Transducer	LISN	
Subtest Result	Pass	
Comments on the above Test Results	Powered by 48VDC. DC Input port is under test.	
Environmental Conditions		
Temperature: (59 to 95) °F	72	
Humidity: (10 to 75) %	41	
Test Result File	Start Freq [MHz]	Stop Freq [MHz]
plce_150k-30m_lisn_m22e_48vdc [24-1-2023 15.53]	.15	30

Operation Mode

Mode#	Title	Description
1	Formal Test	EUT is set to auto-boot with Linux version 4.4.60 (root@137067b22dab) (gcc version 5.2.0 (OpenWrt GCC 5.2.0 c17576669+r49254)) #41 SMP PREEMPT Tue Oct 25 15:03:29 UTC 2022

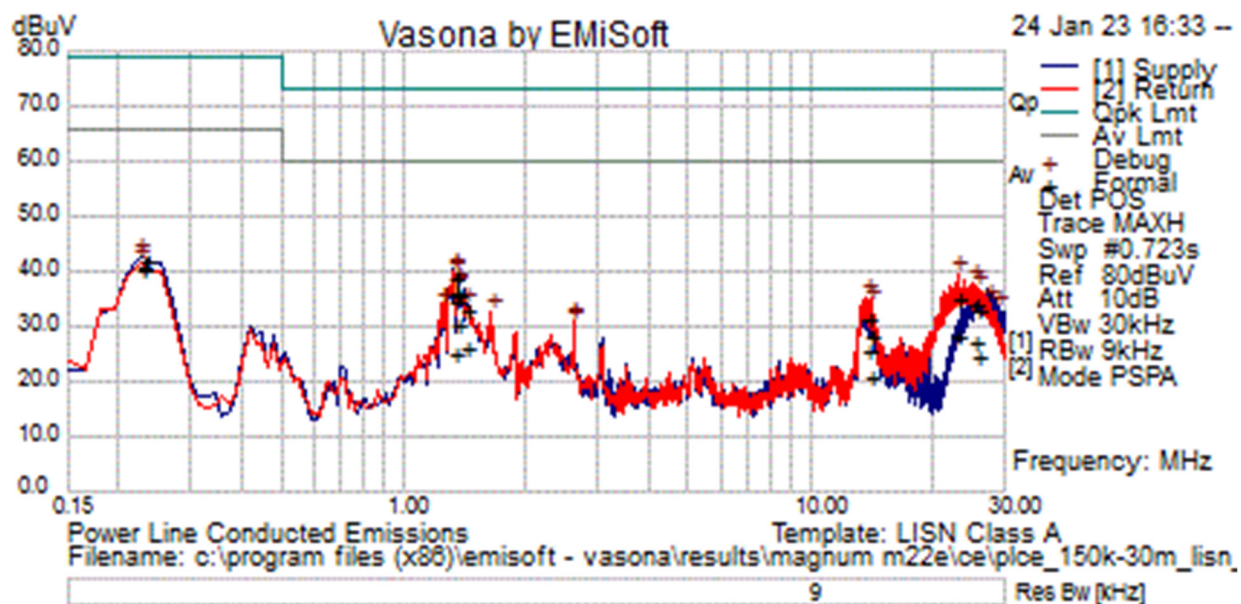
Hardware Configuration

Config#	Title	Description
1	Mode-1 (DC Generator)	M22E powered up directly through a DC generator

Systems Details

System Number	Description	Samples	System under Test
5	IXIA Traffic Generator (Support)	1, 3, 2	No
3	Support - 2.4GHz & 5GHz Clients, Switch, and Laptop	4, 5, 8, 9	No

System Number	Description	Samples	System under Test
1	EUT - Config. 1: M22E powered up through DC Generator, without M12	1	Yes

Test Results Details

Formal Data											
No	Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
1	1.333	16.1	19.9	.0	36.1	Average	Supply	60.0	-23.9	Pass	
2	1.333	16.1	19.9	.0	36.0	Average	Return	60.0	-24.0	Pass	
3	.231	21.7	20.1	.0	41.8	Average	Supply	66.0	-24.2	Pass	
4	.230	20.5	20.1	.0	40.6	Average	Return	66.0	-25.4	Pass	
5	1.365	10.6	19.9	.0	30.5	Average	Supply	60.0	-29.5	Pass	
6	23.014	7.5	20.5	.1	28.1	Average	Return	60.0	-31.9	Pass	
7	25.218	6.8	20.5	.2	27.4	Average	Return	60.0	-32.6	Pass	
8	1.416	6.4	19.9	.0	26.4	Average	Supply	60.0	-33.6	Pass	
9	1.333	18.9	19.9	.0	38.8	Quasi Peak	Supply	73.0	-34.2	Pass	
10	1.333	18.8	19.9	.0	38.8	Quasi Peak	Return	73.0	-34.2	Pass	

11	13.789	5.3	20.2	.1	25.7	Average	Return	60.0	-34.3	Pass	
12	1.341	5.0	19.9	.0	24.9	Average	Return	60.0	-35.1	Pass	
13	25.564	3.8	20.5	.2	24.5	Average	Supply	60.0	-35.5	Pass	
14	.231	22.0	20.1	.0	42.1	Quasi Peak	Supply	79.0	-36.9	Pass	
15	1.365	15.7	19.9	.0	35.7	Quasi Peak	Supply	73.0	-37.3	Pass	
16	23.014	14.6	20.5	.1	35.2	Quasi Peak	Return	73.0	-37.8	Pass	
17	.230	21.0	20.1	.0	41.1	Quasi Peak	Return	79.0	-37.9	Pass	
18	1.341	14.4	19.9	.0	34.4	Quasi Peak	Return	73.0	-38.6	Pass	
19	14.125	.7	20.2	.1	21.1	Average	Supply	60.0	-38.9	Pass	
20	25.218	13.3	20.5	.2	34.0	Quasi Peak	Return	73.0	-39.0	Pass	
21	1.416	13.1	19.9	.0	33.0	Quasi Peak	Supply	73.0	-40.0	Pass	
22	25.564	12.1	20.5	.2	32.8	Quasi Peak	Supply	73.0	-40.2	Pass	
23	13.789	10.9	20.2	.1	31.2	Quasi Peak	Return	73.0	-41.8	Pass	
24	14.125	7.7	20.2	.1	28.1	Quasi Peak	Supply	73.0	-44.9	Pass	

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

Equipment #	Manufacturer/ Model	Description	Last Cal	Next Due	Test Item
Test Equipment used for conducted tests – Rack 11					
58721	Cisco/Automation Test Insertion Loss	Rack 11	Verify Before Use	Verify Before Use	A.1-A.6
58785	Keysight (Agilent/HP)/ N9030B-550 OPT LNP EP0	PXA Signal Analyzer, 2Hz-50GHz with Options LNP and EP0	20 th July 2022	20 th July 2023	A.1-A.6
58803	NATIONAL INSTRUMENTS / PXIe-1085	CHASSIS	Cal Required Not	Cal Required Not	A.1-A.6
58787	NATIONAL INSTRUMENTS / PXIe-8840	Up to 2.6 GHz Quad-Core PXI Express Controller	Cal Required Not	Cal Required Not	A.1-A.6
58788	NATIONAL INSTRUMENTS / PXI-2796	40 GHz Dual 6x1 Multiplexer (SP6T)	Verify Before Use	Verify Before Use	A.1-A.6
58789	NATIONAL INSTRUMENTS / PXI-2796	40 GHz Dual 6x1 Multiplexer (SP6T)	Verify Before Use	Verify Before Use	A.1-A.6
58786	NATIONAL INSTRUMENTS / PXI-2799	Switch 1x1	Verify Before Use	Verify Before Use	A.1-A.6
54235	PASTERNAK/ PE5019-1	Torque Wrench	23 rd March 2022	23 rd March 2023	A.1-A.6
58256	COMET/ T7611-4	WEB SENSOR FOR REMOTE THERMOMETER HYGROMETER	2 nd Feb 2023	2 nd Feb 2024	A.1-A.6
56122	PASTERNAK/PE6072	SMA 50 Ohm Termination	1 st Sep 2022	1 st Sep 2023	A.1-A.6
56127	PASTERNAK/PE6072	SMA 50 Ohm Termination	1 st Sep 2022	1 st Sep 2023	A.1-A.6

Test Equipment used for AC line Conducted emissions.

Cis-Id	Manufacturer	Model	Description	Calibrated Date	Calibration Due Date
008187	Fischer Communications Custom	FCC-450B-2.4-N	Instrumentation Limiter	2/12/2022	2/12/2023
008478	Bird	5-T-MB	5W,50 Ohm Terminator, Type BNC	6/23/2022	6/23/2023
018960	York	CNE V	Comparison Noise Emitter, 30 - 1000MHz	NA	NA
035242	Klein Tools	926-8ME	8 Meter Tape Measure	NA	NA
044022	Fischer Communications Custom	FCC-801-M2-32A	Power Line Coupling Decoupling Network	3/4/2022	3/4/2023
045982	Fischer Communications Custom	F-090527-1009-1	Line Impedance Stabilization Network	12/21/2022	12/21/2023
045983	Fischer Communications Custom	F-090527-1009-2	LISN Adapter	12/21/2022	12/21/2023
002125	FLUKE	79 II	MULTIMETER	11/18/2022	11/18/2023
058276	ROHDE & SCHWARZ	ESR3	EMI Receiver	7/29/2022	7/29/2023
058663	Vibration Research Corp	VR9500	Controller	7/18/2022	7/18/2023
062419	TTE	H785-150K-50-21378	150kHz Hi Pass Filter	2/12/2022	2/12/2023
063067	COMET	T7611-4	Temperature/Relative Humidity/Barometric Pressure Gauge/Transmitter	7/13/2022	7/13/2023

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

EUT Photos have been omitted from this test report. Photos can be found in the supplementary exhibit included in the submission and EDCS# 24347009 (5GHz and BLE Conducted test setup pictures) . All radiated test setup pictures are included in the Radiated emissions test report

Appendix F: Software Used to Perform Testing

Cisco Internal LabView Radio Test Automation Software:

RF Automation Main versions: 208, 218
RF Domain Report Generation - version 3

Appendix G: Test Procedures

Measurements were made in accordance with:

- LP0002 (2020-07-01)
- KDB Publication No. 789033 - D02 General UNII Test Procedures New Rules v02r01
- KDB Publication No. 662911 - MIMO
- ANSI C63.4 2014 Unintentional Radiators
- 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 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>

Appendix I: Test Assessment Plan

Compliance Test Plan (Excel) EDCS# 24086914
Target Power Tables EDCS# 23409888

Appendix J: Worst Case Justification

N/A

End