1 CO-LOCATION

1.1 Transmitter Radiated Unwanted Emissions

1.1.1 Transmitter Radiated Unwanted Emissions Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Un-restricted Band Emissions Limit	
RF output power procedure	**Limit (dB)**
Peak output power procedure	20
Average output power procedure	30

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

1.1.2 Measuring Instruments

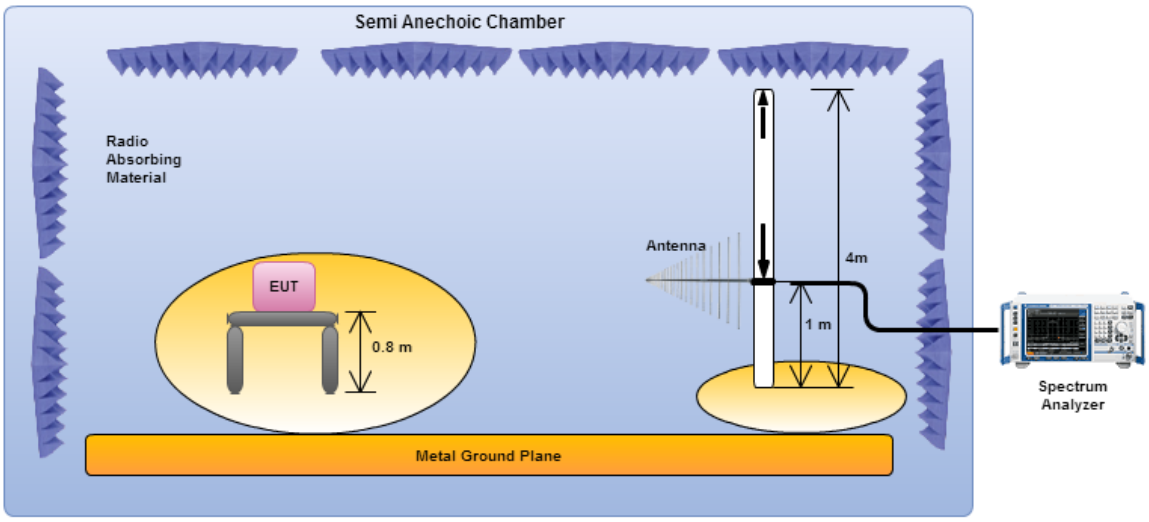
Refer a test equipment and calibration data table in this test report.

1.1.3 Test Procedures

Test Method			
☒	Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).		
☒	The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].		
☒	For the transmitter unwanted emissions shall be measured using following options below:		
	☒	Refer as FCC KDB 558074, clause 10.1 for unwanted emissions into non-restricted bands.	
	☒	Refer as FCC KDB 558074, clause 10.2 for unwanted emissions into restricted bands.	
		☐	Refer as FCC KDB 558074, clause 10.2.3.3 and 8.2.1 Option 1 (spectral trace averaging)
		☐	Refer as FCC KDB 558074, clause 10.2.3.3 and 8.2.1 Option 2 (slow sweep speed).
		☒	Refer as ANSI C63.10, clause 4.1.4.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐	Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
		☒	Refer as FCC KDB 558074, clause 10.2.3.2 and 8.1.1 measurement procedure peak limit.
		☐	Refer as FCC KDB 558074, clause 10.2.3.1 measurement procedure Quasi-Peak limit.
☒	For radiated measurement, refer as FCC KDB 558074, clause 10.2.1.		
	☒	Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.	
	☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.	
	☒	Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1 GHz and test distance is 3m.	
☒	For conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 10.2.2.		
	☒	For conducted unwanted emissions into non-restricted bands (relative emission limits). Devices with multiple transmit chains: Refer as FCC KDB 662911, when testing out-of-band and spurious emissions against relative emission limits, tests may be performed on each output individually without summing or adding 10 log(N) if the measurements are made relative to the in-band emissions on the individual outputs.	
	☒	For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB	

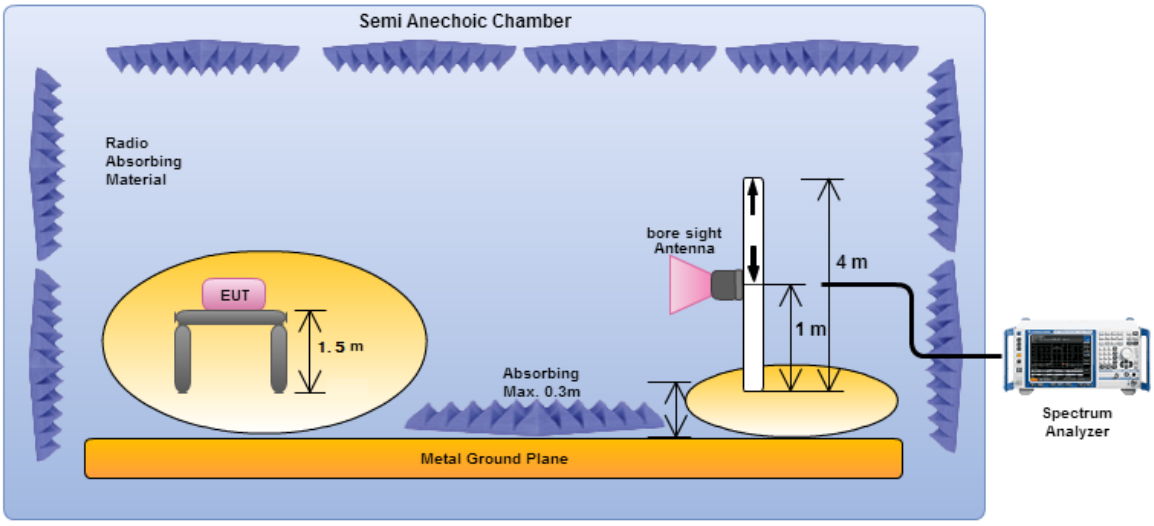
1.1.4 Test Setup

Transmitter Radiated Unwanted Emissions (below 1GHz)



Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna.

Transmitter Radiated Unwanted Emissions (Above 1GHz)



Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

1.1.5 Test Mode

	Operating Band
I	2.4GHz + 5GHz (U-NII-2A + U-NII-2C)

Worst Maximum Power Tablet			
Modulation Mode	**Test Freq (MHz)**	**Antenna Gain (dBi)**	**Average output Power (dBm)**
2.4GHz WLAN 802.11n 20MHz	2437	3.15	29.36
5GHz U-NII-2A + U-NII-2C 802.11ac 40MHz	5310	6.11	23.41

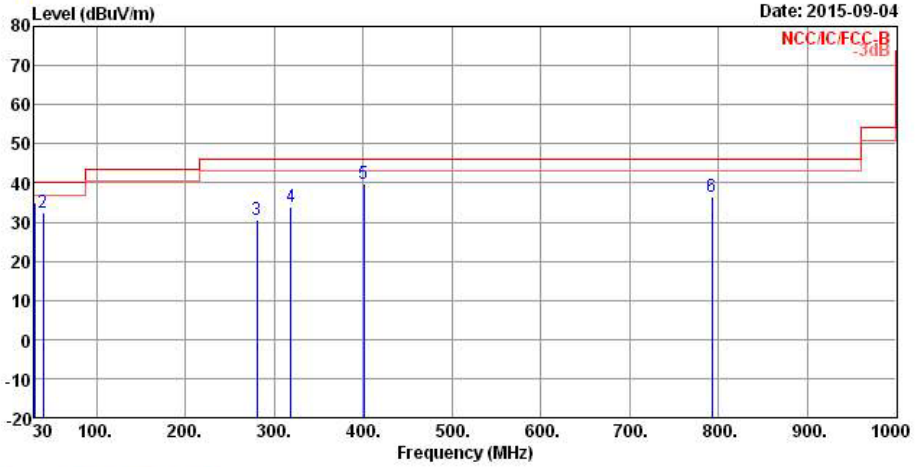
Note: We selected maximum power of each constituting band as worst case.

1.1.6 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

1.1.7 Results of Radiated Emissions (30MHz~1GHz)

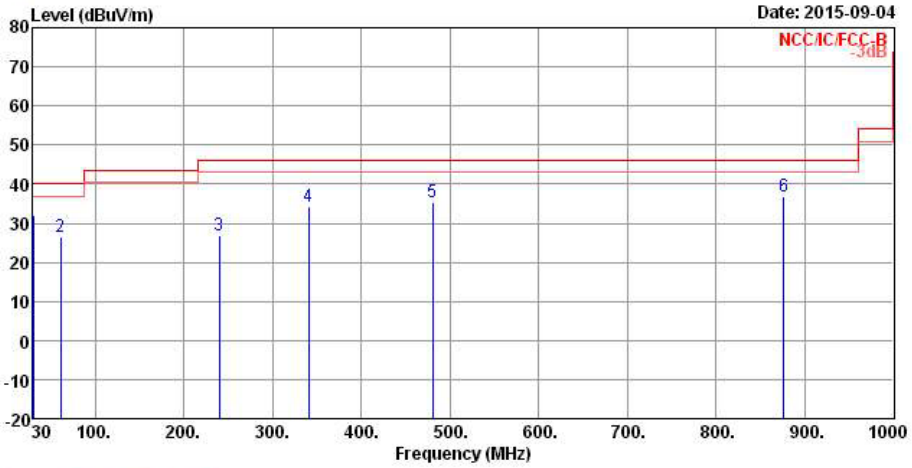
Transmitter Radiated Unwanted Emissions (Below 1GHz)			
Operating Mode	AC Power & Radio link	**Polarization**	V
Operating Function	WLAN 2TX 2437MHz 11n20M and 4TX 5310MHz 11ac40M		



	Freq	Level	Over Limit	Limit Line	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	30.000	35.08	-4.92	40.00	43.89	17.94	0.82	27.57	Peak
2	39.700	32.48	-7.52	40.00	46.28	12.72	1.02	27.54	Peak
3	280.260	30.73	-15.27	46.00	42.25	12.42	2.78	26.72	Peak
4	319.060	33.77	-12.23	46.00	44.30	13.27	2.98	26.78	Peak
5	400.540	39.63	-6.37	46.00	48.30	15.32	3.34	27.33	Peak
6	792.420	36.30	-9.70	46.00	39.74	19.48	4.88	27.80	Peak

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

Transmitter Radiated Unwanted Emissions (Below 1GHz)			
Operating Mode	AC Power & Radio link	**Polarization**	H
Operating Function	WLAN 2TX 2437MHz 11n20M and 4TX 5310MHz 11ac40M		

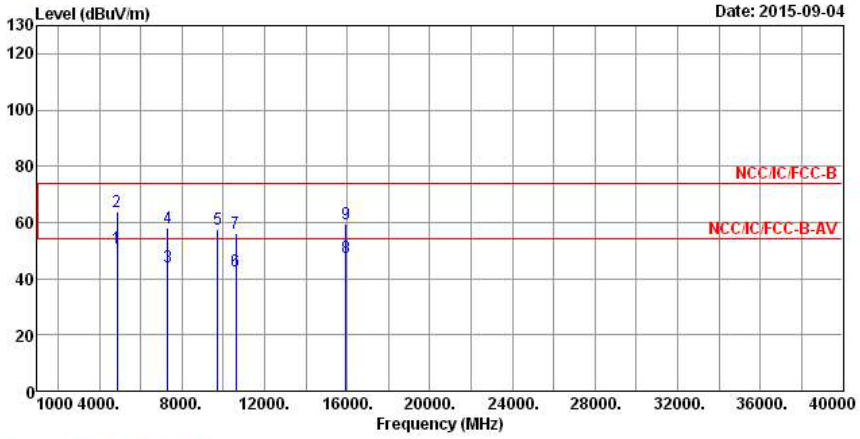


	Freq	Level	Over Limit	Limit Line	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	30.000	32.08	-7.92	40.00	40.89	17.94	0.82	27.57	Peak
2	61.040	26.38	-13.62	40.00	46.29	6.31	1.26	27.48	Peak
3	239.520	26.90	-19.10	46.00	40.05	11.14	2.55	26.84	Peak
4	340.400	34.22	-11.78	46.00	44.53	13.54	3.08	26.93	Peak
5	480.080	35.49	-10.51	46.00	42.75	16.81	3.67	27.74	Peak
6	875.840	36.72	-9.28	46.00	39.22	20.08	5.07	27.65	Peak

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

1.1.8 Results for Radiated Emissions (1GHz~10th Harmonic)

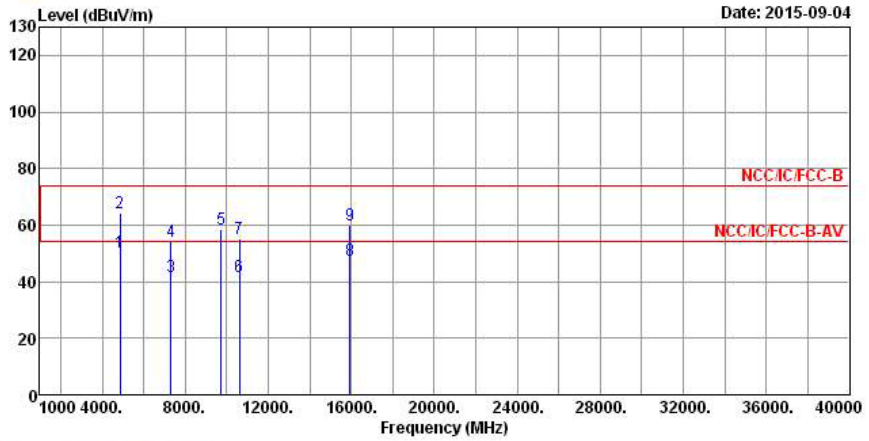
Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Operating Mode	AC Power & Radio link	**Polarization**	V
Operating Function	WLAN 2TX 2437MHz 11n20M and 4TX 5310MHz 11ac40M		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4874.000	50.83	-3.17	54.00	43.33	33.16	6.79	32.45	Average
2	4874.000	63.80	-10.20	74.00	56.30	33.16	6.79	32.45	Peak
3	7311.000	43.99	-10.01	54.00	32.74	36.01	7.91	32.67	Average
4	7311.000	58.03	-15.97	74.00	46.78	36.01	7.91	32.67	Peak
5	9748.000	57.47			43.44	38.42	8.75	33.14	Peak
6	10620.000	42.90	-11.10	54.00	28.01	38.80	8.71	32.62	Average
7	10620.000	56.34	-17.66	74.00	41.45	38.80	8.71	32.62	Peak
8	15930.000	47.34	-6.66	54.00	33.11	37.04	9.56	32.37	Average
9	15930.000	59.44	-14.56	74.00	45.21	37.04	9.56	32.37	Peak

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions (items 3 ~5) shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Transmitter Radiated Unwanted Emissions (Above 1GHz)			
Operating Mode	AC Power & Radio link	**Polarization**	H
Operating Function	WLAN 2TX 2437MHz 11n20M and 4TX 5310MHz 11ac40M		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	
1	4874.000	50.37	-3.63	54.00	42.87	33.16	6.79	32.45	Average
2	4874.000	64.17	-9.83	74.00	56.67	33.16	6.79	32.45	Peak
3	7311.000	41.79	-12.21	54.00	30.54	36.01	7.91	32.67	Average
4	7311.000	53.99	-20.01	74.00	42.74	36.01	7.91	32.67	Peak
5	9748.000	58.40			44.37	38.42	8.75	33.14	Peak
6	10620.000	41.74	-12.26	54.00	26.85	38.80	8.71	32.62	Average
7	10620.000	55.01	-18.99	74.00	40.12	38.80	8.71	32.62	Peak
8	15930.000	47.67	-6.33	54.00	33.44	37.04	9.56	32.37	Average
9	15930.000	60.07	-13.93	74.00	45.84	37.04	9.56	32.37	Peak

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions (items 3 ~5) shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

2 TEST EQUIPMENT AND CALIBRATION DATA

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	Nov. 29, 2014	Radiation Emission
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May 11, 2015	Radiated Emission
Amplifier	Agilent	8449B	3008A02602	1 GHz ~ 26.5 GHz	Oct. 20, 2014	Radiation Emission
Spectrum	R&S	FSP40	100004	9kHz ~ 40GHz	Apr. 02, 2015	Radiated Emission
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 20, 2014	Radiation Emission
Horn Antenna	AARONIA AG	POWERLOG 70180	05192	1GHz ~ 18GHz	May 01, 2015	Radiated Emission
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	18GHz ~ 40GHz	Jan. 27, 2015	Radiated Emission
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	Nov. 15, 2014	Radiation Emission
RF Cable-high	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz ~ 40GHz	Dec. 12, 2014	Radiation Emission
Turn Table	EM Electronics	EM Electronics	060615	0 ~ 360 degree	N/A	Radiation Emission
Antenna Mast	MF	MF-7802	MF780208179	1 ~ 4 m	N/A	Radiation Emission

Note: Calibration Interval of instruments listed above is one year.

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Amplifier	EM	EM18G40G	060604	18GHz ~ 40GHz	Oct. 17, 2013	Radiation Emission
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9kHz ~ 30MHz	Jul. 28, 2014	Radiation Emission

Note: Calibration Interval of instruments listed above is two years.