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

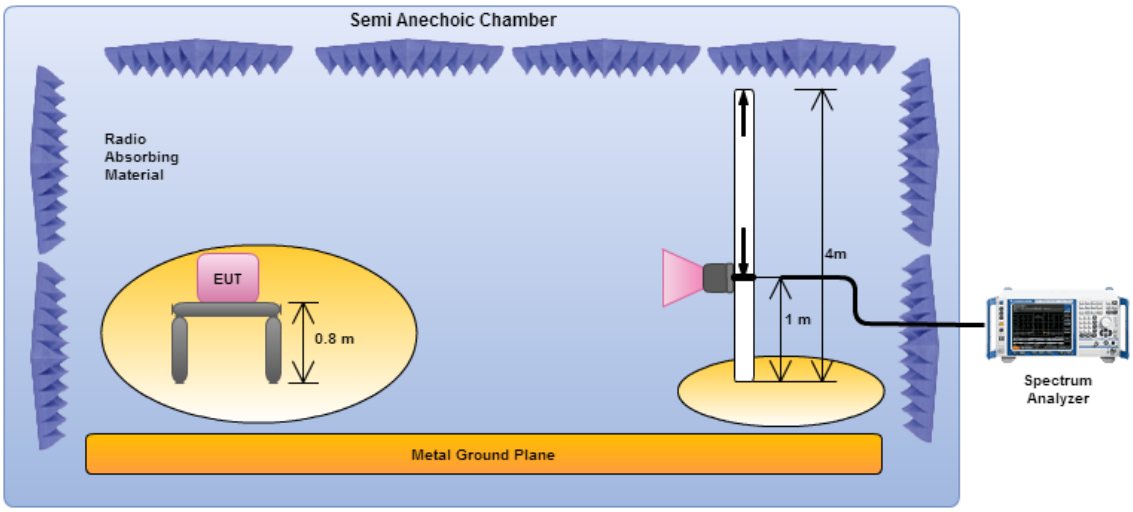
Refer a test equipment and calibration data table in this test report.

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).		
	☒	Measurements in the frequency range 10 GHz - 18GHz are typically made at a closer distance 1m, because the instrumentation noise floor is typically close to the radiated emission limit.	
	☒	Measurements in the frequency range above 18 GHz - 25GHz are typically made at a closer distance 0.5m, because the instrumentation noise floor is typically close to the radiated emission limit.	
☒	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 4.2.3.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐	Refer as ANSI C63.10, clause 4.2.3.2.4 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 from below 30 MHz.	
	☒	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1000 MHz.	
	☒	Refer as ANSI C63.10, clause 6.6 for radiated emissions from above 1 GHz.	
☐	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



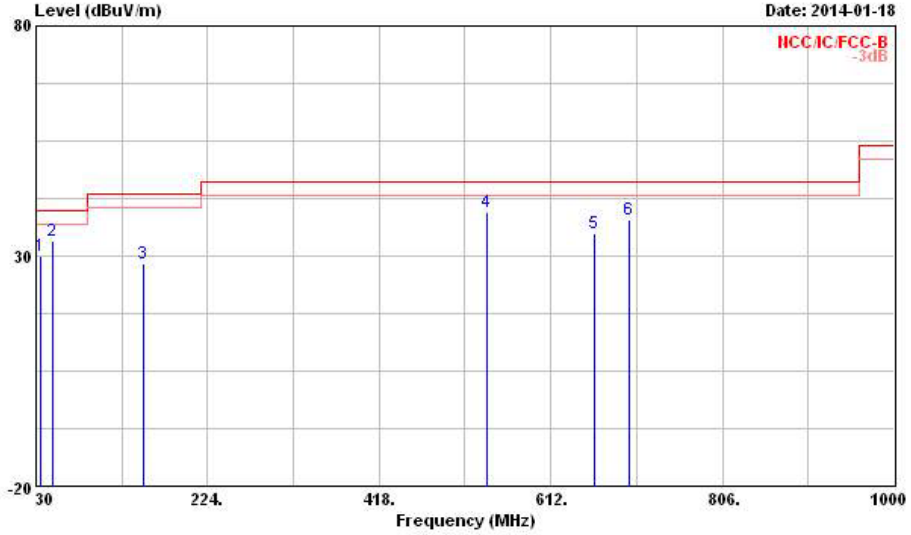
Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna and the frequency range of 1 GHz to 40 GHz using a calibrated horn antenna.

1.1.5 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.

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

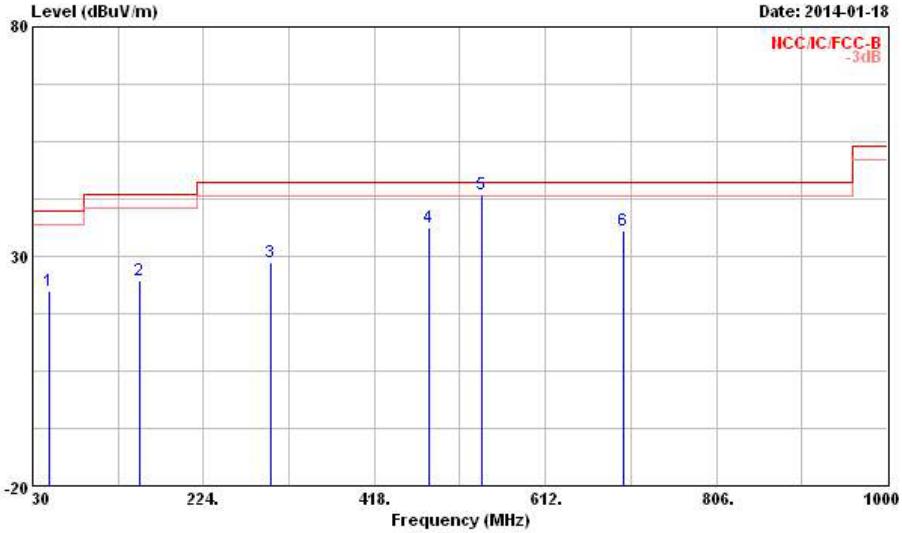
Transmitter Radiated Unwanted Emissions			
Operating Mode	EUT without ERT via AC Power & Radio link	**Polarization**	V
Operating Function	2.4GHz WiFi 1TX 11b (2437MHz) + Zigbee 1TX (2440MHz)		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @	35.820	29.91	-10.09	40.00	41.22	15.59	0.82	27.72	Peak	---	---
2 @	48.430	33.15	-6.85	40.00	50.82	8.87	0.99	27.53	Peak	---	---
3 @	152.220	28.24	-15.26	43.50	43.54	10.53	1.75	27.58	Peak	---	---
4 @	540.220	39.48	-6.52	46.00	46.12	18.30	3.52	28.46	Peak	---	---
5 @	660.500	35.05	-10.95	46.00	40.58	18.92	3.93	28.38	Peak	---	---
6 @	700.270	37.83	-8.17	46.00	43.08	19.02	4.03	28.30	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			
Operating Mode	EUT without ERT via AC Power & Radio link	**Polarization**	H
Operating Function	2.4GHz WiFi 1TX 11b (2437MHz) + Zigbee 1TX (2440MHz)		

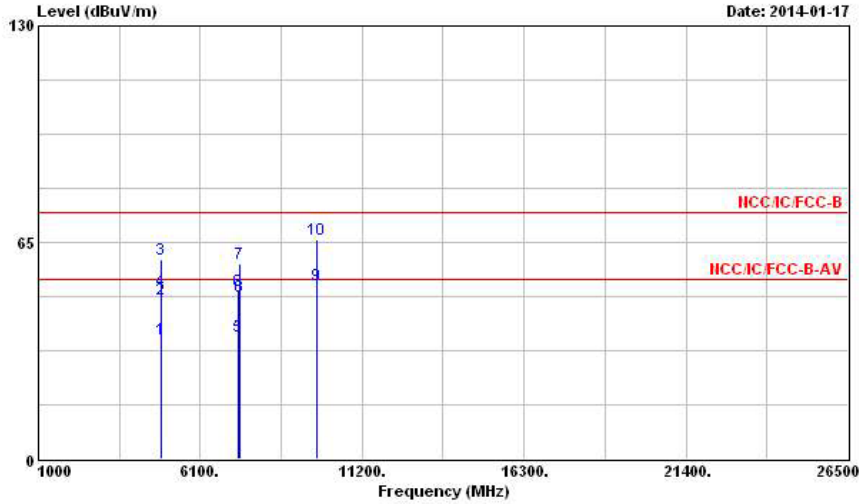


	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	48.430	22.27	-17.73	40.00	39.94	8.87	0.99	27.53	Peak	---	---
2	152.220	24.64	-18.86	43.50	39.94	10.53	1.75	27.58	Peak	---	---
3 @	299.660	28.79	-17.21	46.00	40.14	13.25	2.55	27.15	Peak	---	---
4 @	479.110	36.16	-9.84	46.00	43.62	17.56	3.31	28.33	Peak	---	---
5 @	540.220	43.43	-2.57	46.00	50.07	18.30	3.52	28.46	QP	---	---
6 @	700.270	35.57	-10.43	46.00	40.82	19.02	4.03	28.30	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)

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

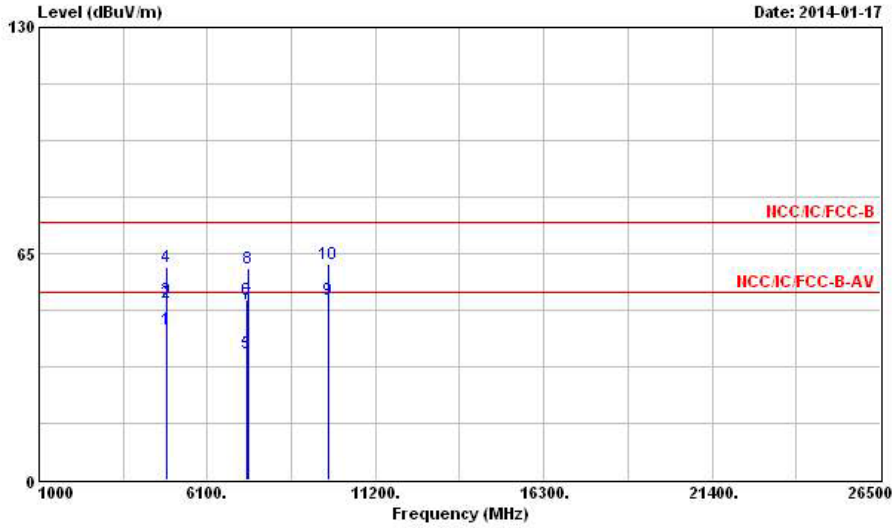
Transmitter Radiated Unwanted Emissions			
Operating Mode	AC Power & Radio link	**Polarization**	V
Operating Function	2.4GHz WiFi 1TX 11b (2437MHz) + Zigbee 1TX (2440MHz)		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1	4874.000	35.77	-18.23	54.00	31.39	34.32	4.73	34.67	Average	---	---
2	4874.000	47.73	-26.27	74.00	43.35	34.32	4.73	34.67	Peak	---	---
3 @	4880.000	59.84	-14.16	74.00	55.46	34.32	4.73	34.67	Peak	---	---
4 @	4880.000	50.62	-3.38	54.00	46.24	34.32	4.73	34.67	Average	---	---
5	7311.000	36.62	-17.38	54.00	30.22	35.88	5.47	34.95	Average	---	---
6	7311.000	50.36	-23.64	74.00	43.96	35.88	5.47	34.95	Peak	---	---
7 @	7320.000	58.78	-15.22	74.00	52.40	35.87	5.47	34.96	Peak	---	---
8 @	7320.000	48.82	-5.18	54.00	42.44	35.87	5.47	34.96	Average	---	---
9	9748.000	52.16	-21.84	74.00	44.40	36.71	6.41	35.36	Peak	---	---
10 @	9760.000	66.01	-7.99	74.00	58.22	36.71	6.44	35.36	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 shall be attenuated by at least 20 dB relative to the maximum measured in-band level.

Transmitter Radiated Unwanted Emissions			
Operating Mode	AC Power & Radio link	**Polarization**	H
Operating Function	2.4GHz WiFi 1TX 11b (2437MHz) + Zigbee 1TX (2440MHz)		



	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB		cm	deg
1 @	4874.000	43.16	-10.84	54.00	38.78	34.32	4.73	34.67	Average	---	---
2	4874.000	50.93	-23.07	74.00	46.55	34.32	4.73	34.67	Peak	---	---
3 @	4880.000	51.56	-2.44	54.00	47.18	34.32	4.73	34.67	Average	---	---
4 @	4880.000	61.14	-12.86	74.00	56.76	34.32	4.73	34.67	Peak	---	---
5	7311.000	36.50	-17.50	54.00	30.10	35.88	5.47	34.95	Average	---	---
6	7311.000	51.69	-22.31	74.00	45.29	35.88	5.47	34.95	Peak	---	---
7 @	7320.000	50.55	-3.45	54.00	44.17	35.87	5.47	34.96	Average	---	---
8 @	7320.000	60.73	-13.27	74.00	54.35	35.87	5.47	34.96	Peak	---	---
9	9748.000	51.74	-22.26	74.00	43.98	36.71	6.41	35.36	Peak	---	---
10 @	9760.000	61.96	-12.04	74.00	54.17	36.71	6.44	35.36	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 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
Spectrum Analyzer	R&S	FSP40	100593	9kHz ~ 40GHz	Oct. 03, 2013	Radiation (03CH02-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz ~ 1GHz 3m	May 11, 2013	Radiation (03CH02-HY)
Amplifier	Agilent	8447D	2944A11149	100kHz ~ 1.3GHz	Jul. 18, 2013	Radiation (03CH02-HY)
Amplifier	Agilent	8449B	3008A02373	1GHz ~ 26.5GHz	Aug. 28, 2013	Radiation (03CH02-HY)
Horn Antenna	ETS-LINDGREN	3117	00091920	1GHz ~ 18GHz	Nov. 25, 2013	Radiation (03CH02-HY)
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz ~ 40GHz	Jan. 10, 2014	Radiation (03CH02-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	Nov. 09, 2013	Radiation (03CH02-HY)
RF Cable-high	SUHNER	SUCOFLEX106	03CH02-HY	1GHz ~ 40GHz	Mar. 05, 2013	Radiation (03CH02-HY)
Bilog Antenna	SCHAFFNER	CBL61128	2723	30MHz ~ 2GHz	Oct. 10, 2013	Radiation (03CH02-HY)
Turn Table	Chaintek Instruments	3000	MF7802058	0~ 360 degree	N/A	Radiation (03CH02-HY)
Antenna Mast	MF	MF7802	MF780208205	1 ~ 4 m	N/A	Radiation (03CH02-HY)

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

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz - 30 MHz	Dec. 02, 2012	Radiation (03CH02-HY)

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