Appendix A. Radiated Spurious Emission

Test Engineer :	Kyle Jhuang, Citta Ke, and Karl Hou	Temperature :	25~26°C
		Relative Humidity :	50~51%

15C 2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2384.25	51.1	-22.9	74	47.41	32.73	4.62	33.66	154	125	P	H
		2381.55	40.22	-13.78	54	36.53	32.73	4.62	33.66	154	125	A	H
	*	2401.92	97.69	-	-	93.95	32.77	4.62	33.65	154	125	P	H
	*	2402.004	96.67	-	-	92.93	32.77	4.62	33.65	154	125	A	H
													H
													H
		2368.23	50.7	-23.3	74	47.08	32.7	4.6	33.68	100	96	P	V
		2341.32	40.27	-13.73	54	36.73	32.66	4.57	33.69	100	96	A	V
	*	2401.92	90.79	-	-	87.05	32.77	4.62	33.65	100	96	P	V
	*	2402.004	89.79	-	-	86.05	32.77	4.62	33.65	100	96	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 19 2440MHz		2341.86	51.39	-22.61	74	47.85	32.66	4.57	33.69	122	127	P	H
		2387.94	40.21	-13.79	54	36.47	32.77	4.62	33.65	122	127	A	H
	*	2439.997	97.72	-	-	93.75	32.89	4.68	33.6	122	127	P	H
	*	2439.997	96.79	-	-	92.82	32.89	4.68	33.6	122	127	A	H
		2487.92	51.2	-22.8	74	47.03	33	4.73	33.56	122	127	P	H
		2498.16	40.6	-13.4	54	36.43	33	4.73	33.56	122	127	A	H
		2337.99	50.78	-23.22	74	47.24	32.66	4.57	33.69	100	69	P	V
		2381.19	40.22	-13.78	54	36.53	32.73	4.62	33.66	100	69	A	V
	*	2439.997	90.99	-	-	87.02	32.89	4.68	33.6	100	69	P	V
	*	2439.997	90.06	-	-	86.09	32.89	4.68	33.6	100	69	A	V
		2493.48	51.67	-22.33	74	47.5	33	4.73	33.56	100	69	P	V
		2483.84	40.67	-13.33	54	36.55	32.96	4.73	33.57	100	69	A	V
BLE CH 39 2480MHz	*	2480.243	91.48	-	-	87.36	32.96	4.73	33.57	146	132	P	H
	*	2480.076	90.42	-	-	86.3	32.96	4.73	33.57	146	132	A	H
		2496	50.72	-23.28	74	46.55	33	4.73	33.56	146	132	P	H
		2494.8	40.62	-13.38	54	36.45	33	4.73	33.56	146	132	A	H
													H
													H
	*	2480.243	85.86	-	-	81.74	32.96	4.73	33.57	153	74	P	V
	*	2479.993	84.86	-	-	80.74	32.96	4.73	33.57	153	74	A	V
		2493.8	51.48	-22.52	74	47.31	33	4.73	33.56	153	74	P	V
		2489.56	40.56	-13.44	54	36.39	33	4.73	33.56	153	74	A	V
													V
													V
Remark	3. No other spurious found. 4. All results are PASS against Peak and Average limit line.												

15C 2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		4803	39.83	-34.17	74	56.91	35.04	6.52	58.64	100	0	P	H
													H
													H
													H
		4803	39.54	-34.46	74	56.62	35.04	6.52	58.64	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4881	40.17	-33.83	74	57.09	35.02	6.58	58.52	100	0	P	H
		7320	41.29	-32.71	74	54.84	36.4	8.24	58.19	100	0	P	H
													H
													H
		4881	41.07	-32.93	74	57.99	35.02	6.58	58.52	100	0	P	V
		7320	41.99	-32.01	74	55.54	36.4	8.24	58.19	100	0	P	V
													V
													V
BLE CH 39 2480MHz		4959	39.74	-34.26	74	56.48	35.01	6.61	58.36	100	0	P	H
		7440	42.32	-31.68	74	55.9	36.47	8.36	58.41	100	0	P	H
													H
													H
		4959	39.75	-34.25	74	56.49	35.01	6.61	58.36	100	0	P	V
		7440	41.52	-32.48	74	55.1	36.47	8.36	58.41	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15C Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		89.94	25.45	-18.05	43.5	47.39	8.8	1.04	31.78	-	-	P	H
		151.77	32.52	-10.98	43.5	52.22	10.8	1.28	31.78	101	129	P	H
		212.52	31.69	-11.81	43.5	52.73	9.22	1.52	31.78	-	-	P	H
		365.8	24.86	-21.14	46	39.96	14.76	1.93	31.79	-	-	P	H
		576.5	19.28	-26.72	46	29.23	19.68	2.38	32.01	-	-	P	H
		726.3	22.21	-23.79	46	29.8	21.72	2.7	32.01	-	-	P	H
													H
													H
													H
													H
													H
													H
		55.38	31.3	-8.7	40	55.86	6.4	0.84	31.8	100	150	P	V
		142.59	30.45	-13.05	43.5	49.47	11.5	1.26	31.78	-	-	P	V
		203.07	28.76	-14.74	43.5	49.93	9.13	1.48	31.78	-	-	P	V
		545	22.12	-23.88	46	32.66	19.1	2.32	31.96	-	-	P	V
		749.4	22.17	-23.83	46	29.21	22.2	2.74	31.98	-	-	P	V
		904.8	22.94	-23.06	46	27.87	23.45	3.01	31.39	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency per 15.209(c).
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

15C 2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 19 2440MHz		2389.2	51.37	-22.63	74	47.63	32.77	4.62	33.65	100	177	P	H
		2347.71	40.2	-13.8	54	36.66	32.66	4.57	33.69	100	177	A	H
	*	2439.997	88.15	-	-	84.18	32.89	4.68	33.6	100	177	P	H
	*	2439.997	87.02	-	-	83.05	32.89	4.68	33.6	100	177	A	H
		2492.6	51.75	-22.25	74	47.58	33	4.73	33.56	100	177	P	H
		2492.08	40.46	-13.54	54	36.29	33	4.73	33.56	100	177	A	H
		2363.73	51.56	-22.44	74	47.94	32.7	4.6	33.68	100	94	P	V
		2336.46	40.19	-13.81	54	36.65	32.66	4.57	33.69	100	94	A	V
	*	2439.997	93.12	-	-	89.15	32.89	4.68	33.6	100	94	P	V
	*	2439.997	92.11	-	-	88.14	32.89	4.68	33.6	100	94	A	V
		2485.56	50.95	-23.05	74	46.83	32.96	4.73	33.57	100	94	P	V
		2499.16	40.64	-13.36	54	36.47	33	4.73	33.56	100	94	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15C 2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 19 2440MHz		4881	42.14	-31.86	74	59.06	35.02	6.58	58.52	100	0	P	H
		7320	42.49	-31.51	74	56.04	36.4	8.24	58.19	100	0	P	H
													H
													H
		4881	40.39	-33.61	74	57.31	35.02	6.58	58.52	100	0	P	V
		7320	42.53	-31.47	74	56.08	36.4	8.24	58.19	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15C Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		121.8	18.25	-25.25	43.5	37.3	11.54	1.19	31.78	-	-	P	H
		169.32	17.59	-25.91	43.5	38.3	9.7	1.37	31.78	-	-	P	H
		242.76	13.92	-32.08	46	32.47	11.6	1.62	31.77	-	-	P	H
		547.1	19.36	-26.64	46	29.66	19.34	2.32	31.96	-	-	P	H
		737.5	22.57	-23.43	46	29.73	22.11	2.72	31.99	-	-	P	H
		849.5	24.31	-21.69	46	29.86	23.2	2.92	31.67	121	288	P	H
													H
													H
													H
													H
													H
													H
		57	25.72	-14.28	40	50.47	6.2	0.85	31.8	148	5	P	V
		92.64	12.28	-31.22	43.5	33.96	9.04	1.06	31.78	-	-	P	V
		163.38	19.46	-24.04	43.5	39.96	9.94	1.34	31.78	-	-	P	V
		534.5	18.32	-27.68	46	29.62	18.34	2.3	31.94	-	-	P	V
		719.3	24.43	-21.57	46	32.36	21.4	2.69	32.02	-	-	P	V
		794.9	25.03	-20.97	46	32.14	22	2.82	31.93	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency per 15.209(c).
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".