



## Appendix A. Radiated Spurious Emission

|                 |                                    |                     |         |
|-----------------|------------------------------------|---------------------|---------|
| Test Engineer : | Jet Lui, Kyle Jhuang, and Karl Hou | Temperature :       | 23~24°C |
|                 |                                    | Relative Humidity : | 45~46%  |

### 15C 2.4GHz 2400~2483.5MHz

#### BLE (Band Edge @ 3m)

| BLE                     | Note | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Cable  | Preamp | Ant    | Table   | Peak    | Pol.    |
|-------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                         |      |           |            | Limit  | Line       | Level    | Factor   | Loss   | Factor | Pos    | Pos     | Avg.    |         |
|                         |      | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| BLE<br>CH 00<br>2402MHz |      | 2335.29   | 51.33      | -22.67 | 74         | 47.97    | 31.91    | 6.1    | 34.65  | 183    | 148     | P       | H       |
|                         |      | 2385.15   | 40.45      | -13.55 | 54         | 37       | 31.93    | 6.17   | 34.65  | 183    | 148     | A       | H       |
|                         | *    | 2402.254  | 95.34      | -      | -          | 91.83    | 31.94    | 6.21   | 34.64  | 183    | 148     | P       | H       |
|                         | *    | 2402.004  | 94.45      | -      | -          | 90.94    | 31.94    | 6.21   | 34.64  | 183    | 148     | A       | H       |
|                         |      |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |      |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |      | 2382.09   | 53.09      | -20.91 | 74         | 49.64    | 31.93    | 6.17   | 34.65  | 102    | 293     | P       | V       |
|                         |      | 2326.29   | 40.34      | -13.66 | 54         | 36.99    | 31.9     | 6.1    | 34.65  | 102    | 293     | A       | V       |
|                         | *    | 2402.254  | 94.26      | -      | -          | 90.75    | 31.94    | 6.21   | 34.64  | 102    | 293     | P       | V       |
|                         | *    | 2401.92   | 93.38      | -      | -          | 89.87    | 31.94    | 6.21   | 34.64  | 102    | 293     | A       | V       |
|                         |      |           |            |        |            |          |          |        |        |        |         |         | V       |
|                         |      |           |            |        |            |          |          |        |        |        |         |         | V       |
| BLE<br>CH 19<br>2440MHz |      | 2318.1    | 51.77      | -22.23 | 74         | 48.42    | 31.9     | 6.1    | 34.65  | 186    | 189     | P       | H       |
|                         |      | 2321.07   | 40.43      | -13.57 | 54         | 37.08    | 31.9     | 6.1    | 34.65  | 186    | 189     | A       | H       |
|                         | *    | 2440.247  | 90.42      | -      | -          | 86.85    | 31.97    | 6.24   | 34.64  | 186    | 189     | P       | H       |
|                         | *    | 2439.997  | 89.56      | -      | -          | 85.99    | 31.97    | 6.24   | 34.64  | 186    | 189     | A       | H       |
|                         |      | 2494.88   | 51.58      | -22.42 | 74         | 47.87    | 32       | 6.34   | 34.63  | 186    | 189     | P       | H       |
|                         |      | 2489.2    | 40.66      | -13.34 | 54         | 36.99    | 32       | 6.3    | 34.63  | 186    | 189     | A       | H       |
|                         |      | 2372.73   | 51.41      | -22.59 | 74         | 47.96    | 31.93    | 6.17   | 34.65  | 100    | 283     | P       | V       |
|                         |      | 2371.56   | 40.4       | -13.6  | 54         | 36.95    | 31.93    | 6.17   | 34.65  | 100    | 283     | A       | V       |
|                         | *    | 2439.746  | 95.44      | -      | -          | 91.87    | 31.97    | 6.24   | 34.64  | 100    | 283     | P       | V       |
|                         | *    | 2440.08   | 94.62      | -      | -          | 91.05    | 31.97    | 6.24   | 34.64  | 100    | 283     | A       | V       |
|                         |      | 2499.16   | 51.22      | -22.78 | 74         | 47.51    | 32       | 6.34   | 34.63  | 100    | 283     | P       | V       |
|                         |      | 2499.6    | 40.55      | -13.45 | 54         | 36.84    | 32       | 6.34   | 34.63  | 100    | 283     | A       | V       |



|                                  |                                                                                             |          |       |        |    |       |       |     |       |     |     |   |   |
|----------------------------------|---------------------------------------------------------------------------------------------|----------|-------|--------|----|-------|-------|-----|-------|-----|-----|---|---|
| <b>BLE<br/>CH 39<br/>2480MHz</b> | *                                                                                           | 2480.243 | 97.27 | -      | -  | 93.61 | 31.99 | 6.3 | 34.63 | 107 | 113 | P | H |
|                                  | *                                                                                           | 2480.076 | 96.41 | -      | -  | 92.75 | 31.99 | 6.3 | 34.63 | 107 | 113 | A | H |
|                                  |                                                                                             | 2484.88  | 55.96 | -18.04 | 74 | 52.3  | 31.99 | 6.3 | 34.63 | 107 | 113 | P | H |
|                                  |                                                                                             | 2484.96  | 45.92 | -8.08  | 54 | 42.26 | 31.99 | 6.3 | 34.63 | 107 | 113 | A | H |
|                                  |                                                                                             |          |       |        |    |       |       |     |       |     |     |   | H |
|                                  |                                                                                             |          |       |        |    |       |       |     |       |     |     |   | H |
|                                  | *                                                                                           | 2480.327 | 96.12 | -      | -  | 92.46 | 31.99 | 6.3 | 34.63 | 100 | 48  | P | V |
|                                  | *                                                                                           | 2480.076 | 95.33 | -      | -  | 91.67 | 31.99 | 6.3 | 34.63 | 100 | 48  | A | V |
|                                  |                                                                                             | 2484.92  | 56.13 | -17.87 | 74 | 52.47 | 31.99 | 6.3 | 34.63 | 100 | 48  | P | V |
|                                  |                                                                                             | 2485.12  | 45.23 | -8.77  | 54 | 41.57 | 31.99 | 6.3 | 34.63 | 100 | 48  | A | V |
|                                  |                                                                                             |          |       |        |    |       |       |     |       |     |     |   | V |
|                                  |                                                                                             |          |       |        |    |       |       |     |       |     |     |   | V |
| Remark                           | 1. No other spurious found.<br>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.    |
|-------------------------|---------------------------------------------------------------------------------------------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                         |                                                                                             |           |            | Limit  | Line       | Level    | Factor   | Loss   | Factor | Pos    | Pos     | Avg.    |         |
|                         |                                                                                             | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| BLE<br>CH 00<br>2402MHz |                                                                                             | 4803      | 42.64      | -31.36 | 74         | 60.63    | 34.35    | 8.52   | 60.86  | 100    | 0       | P       | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             | 4803      | 39.67      | -34.33 | 74         | 57.66    | 34.35    | 8.52   | 60.86  | 100    | 0       | P       | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
| BLE<br>CH 19<br>2440MHz |                                                                                             | 4880      | 40.79      | -33.21 | 74         | 58.31    | 34.4     | 8.77   | 60.69  | 100    | 0       | P       | H       |
|                         |                                                                                             | 7320      | 43.91      | -30.09 | 74         | 56.76    | 35.73    | 11.95  | 60.53  | 100    | 0       | P       | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             | 4880      | 40.43      | -33.57 | 74         | 57.95    | 34.4     | 8.77   | 60.69  | 100    | 0       | P       | V       |
|                         |                                                                                             | 7320      | 42.94      | -31.06 | 74         | 55.79    | 35.73    | 11.95  | 60.53  | 100    | 0       | P       | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
| BLE<br>CH 39<br>2480MHz |                                                                                             | 4962      | 45.99      | -28.01 | 74         | 62.98    | 34.47    | 9.02   | 60.48  | 100    | 0       | P       | H       |
|                         |                                                                                             | 7440      | 40.96      | -33.04 | 74         | 53.82    | 35.71    | 12.01  | 60.58  | 100    | 0       | P       | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | H       |
|                         |                                                                                             | 4962      | 41.53      | -32.47 | 74         | 58.52    | 34.47    | 9.02   | 60.48  | 100    | 0       | P       | V       |
|                         |                                                                                             | 7440      | 40.58      | -33.42 | 74         | 53.44    | 35.71    | 12.01  | 60.58  | 100    | 0       | P       | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
|                         |                                                                                             |           |            |        |            |          |          |        |        |        |         |         | V       |
| Remark                  | 1. No other spurious found.<br>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.  |
|---------------------|----------------------------------------------------------------------------|-----------|------------|--------|------------|--------|----------|--------|--------|--------|---------|-------|-------|
|                     |                                                                            |           |            | Limit  | Line       | Level  | Factor   | Loss   | Factor | Pos    | Pos     | Avg.  |       |
|                     |                                                                            | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | (dBμV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 2.4GHz<br>BLE<br>LF |                                                                            | 142.05    | 35.6       | -7.9   | 43.5       | 55.18  | 10.85    | 1.32   | 31.75  |        |         | P     | H     |
|                     |                                                                            | 152.04    | 35.52      | -7.98  | 43.5       | 55.4   | 10.5     | 1.37   | 31.75  |        |         | P     | H     |
|                     |                                                                            | 285.15    | 40.73      | -5.27  | 46         | 57.7   | 12.9     | 1.85   | 31.72  | 125    | 15      | P     | H     |
|                     |                                                                            | 310.5     | 38.34      | -7.66  | 46         | 54.73  | 13.4     | 1.94   | 31.73  |        |         | P     | H     |
|                     |                                                                            | 462.4     | 34.71      | -11.29 | 46         | 47.02  | 17.25    | 2.33   | 31.89  |        |         | P     | H     |
|                     |                                                                            | 772.5     | 40.66      | -5.34  | 46         | 49.46  | 20.12    | 3.05   | 31.97  |        |         | P     | H     |
|                     |                                                                            | 42.96     | 26.72      | -13.28 | 40         | 46.84  | 10.92    | 0.75   | 31.79  |        |         | P     | V     |
|                     |                                                                            | 151.77    | 38.96      | -4.54  | 43.5       | 58.84  | 10.5     | 1.37   | 31.75  | 100    | 248     | P     | V     |
|                     |                                                                            | 285.15    | 34.08      | -11.92 | 46         | 51.05  | 12.9     | 1.85   | 31.72  |        |         | P     | V     |
|                     |                                                                            | 305.6     | 31.61      | -14.39 | 46         | 48.11  | 13.31    | 1.92   | 31.73  |        |         | P     | V     |
|                     |                                                                            | 442.1     | 33.58      | -12.42 | 46         | 46.34  | 16.82    | 2.29   | 31.87  |        |         | P     | V     |
|                     |                                                                            | 758.5     | 34         | -12    | 46         | 42.73  | 20.2     | 3.05   | 31.98  |        |         | P     | V     |
| Remark              | 1. No other spurious found.<br>2. All results are PASS against limit line. |           |            |        |            |        |          |        |        |        |         |       |       |

**Note symbol**

|     |                                                                                                                                                                        |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *   | <b>Fundamental Frequency</b> 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 <b>over limit</b> line.                                                                                                                                 |
| P/A | <b>Peak</b> or <b>Average</b>                                                                                                                                          |
| H/V | <b>Horizontal</b> or <b>Vertical</b>                                                                                                                                   |



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 |      | 2390      | 55.45      | -18.55 | 74         | 54.51    | 32.22    | 4.58   | 35.86  | 103    | 308     | P       | H       |
| CH 01   |      |           |            |        |            |          |          |        |        |        |         |         |         |
| 2412MHz |      | 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”.**