



## Appendix A. Radiated Spurious Emission

|                 |   |                     |         |
|-----------------|---|---------------------|---------|
| Test Engineer : | Stan Hsieh, Ken Wu, Nick Yu, and James Chiu | Temperature :       | 21~23°C |
|                 |   | Relative Humidity : | 47~49%  |

### 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 |      | 2355      | 49.95      | -24.05 | 74         | 44.39    | 32.13    | 7.68   | 34.25  | 202    | 142     | P       | H       |   |
|                         |      | 2379.75   | 37.04      | -16.96 | 54         | 31.47    | 32.16    | 7.68   | 34.27  | 202    | 142     | A       | H       |   |
|                         | *    | 2402.171  | 101.3      | -      | -          | 95.67    | 32.18    | 7.75   | 34.3   | 202    | 142     | P       | H       |   |
|                         | *    | 2402.004  | 100.6      | -      | -          | 94.97    | 32.18    | 7.75   | 34.3   | 202    | 142     | A       | H       |   |
|                         |      |           |            |        |            |          |          |        |        |        |         |         | H       |   |
|                         |      |           |            |        |            |          |          |        |        |        |         |         |         | H |
|                         |      |           | 2389.29    | 49.31  | -24.69     | 74       | 43.65    | 32.18  | 7.75   | 34.27  | 112     | 223     | P       | V |
|                         |      |           | 2377.32    | 37.28  | -16.72     | 54       | 31.71    | 32.16  | 7.68   | 34.27  | 112     | 223     | A       | V |
|                         | *    |           | 2402.254   | 101.77 | -          | -        | 96.14    | 32.18  | 7.75   | 34.3   | 112     | 223     | P       | V |
|                         | *    |           | 2402.004   | 101.08 | -          | -        | 95.45    | 32.18  | 7.75   | 34.3   | 112     | 223     | A       | V |
|                         |      |           |            |        |            |          |          |        |        |        |         |         |         | V |
|                         |      |           |            |        |            |          |          |        |        |        |         |         | V       |   |
| BLE<br>CH 19<br>2440MHz |      | 2354.01   | 49.56      | -24.44 | 74         | 44       | 32.13    | 7.68   | 34.25  | 174    | 145     | P       | H       |   |
|                         |      | 2378.4    | 37.11      | -16.89 | 54         | 31.54    | 32.16    | 7.68   | 34.27  | 174    | 145     | A       | H       |   |
|                         | *    | 2440.331  | 101.69     | -      | -          | 95.97    | 32.24    | 7.83   | 34.35  | 174    | 145     | P       | H       |   |
|                         | *    | 2439.997  | 100.99     | -      | -          | 95.27    | 32.24    | 7.83   | 34.35  | 174    | 145     | A       | H       |   |
|                         |      |           | 2494.2     | 49.65  | -24.35     | 74       | 43.92    | 32.3   | 7.91   | 34.48  | 174     | 145     | P       | H |
|                         |      |           | 2488.2     | 37.19  | -16.81     | 54       | 31.41    | 32.3   | 7.91   | 34.43  | 174     | 145     | A       | H |
|                         |      |           | 2369.13    | 49.6   | -24.4      | 74       | 44.03    | 32.16  | 7.68   | 34.27  | 114     | 221     | P       | V |
|                         |      |           | 2364.99    | 37.19  | -16.81     | 54       | 31.65    | 32.13  | 7.68   | 34.27  | 114     | 221     | A       | V |
|                         | *    |           | 2440.331   | 102.81 | -          | -        | 97.09    | 32.24  | 7.83   | 34.35  | 114     | 221     | P       | V |
|                         | *    |           | 2439.997   | 102.11 | -          | -        | 96.39    | 32.24  | 7.83   | 34.35  | 114     | 221     | A       | V |
|                         |      |           | 2488.8     | 50.33  | -23.67     | 74       | 44.55    | 32.3   | 7.91   | 34.43  | 114     | 221     | P       | V |
|                         |      | 2491.56   | 37.2       | -16.8  | 54         | 31.42    | 32.3     | 7.91   | 34.43  | 114    | 221     | A       | V       |   |



|                                  |   |          |        |        |    |       |       |      |       |     |     |   |   |
|----------------------------------|---|----------|--------|--------|----|-------|-------|------|-------|-----|-----|---|---|
| <b>BLE<br/>CH 39<br/>2480MHz</b> | *   | 2480.327 | 100.92 | -      | -  | 95.16 | 32.28 | 7.91 | 34.43 | 198 | 144 | P | H |
|                                  | *   | 2479.993 | 100.2  | -      | -  | 94.44 | 32.28 | 7.91 | 34.43 | 198 | 144 | A | H |
|                                  |   | 2483.6   | 50.21  | -23.79 | 74 | 44.45 | 32.28 | 7.91 | 34.43 | 198 | 144 | P | H |
|                                  |   | 2483.52  | 37.78  | -16.22 | 54 | 32.02 | 32.28 | 7.91 | 34.43 | 198 | 144 | A | H |
|                                  |   |          |        |        |    |       |       |      |       |     |     |   | H |
|                                  |   |          |        |        |    |       |       |      |       |     |     |   | H |
|                                  | *   | 2479.826 | 102.97 | -      | -  | 97.21 | 32.28 | 7.91 | 34.43 | 104 | 207 | P | V |
|                                  | *   | 2479.993 | 102.23 | -      | -  | 96.47 | 32.28 | 7.91 | 34.43 | 104 | 207 | A | V |
|                                  |   | 2484.24  | 50.97  | -23.03 | 74 | 45.21 | 32.28 | 7.91 | 34.43 | 104 | 207 | P | V |
|                                  |   | 2483.52  | 38.19  | -15.81 | 54 | 32.43 | 32.28 | 7.91 | 34.43 | 104 | 207 | A | V |
|                                  |   |          |        |        |    |       |       |      |       |     |     |   | V |
|                                  |   |          |        |        |    |       |       |      |       |     |     |   | V |
| <b>Remark</b>                    | <ol style="list-style-type: none"> <li>1. No other spurious found.</li> <li>2. All results are PASS against Peak and Average limit line.</li> </ol> |          |        |        |    |       |       |      |       |     |     |   |   |



**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 |   | 4804      | 54.69      | -19.31 | 74         | 68.29    | 34.25    | 11.11  | 58.96  | 179    | 303     | P       | H       |   |
|                         |   | 4804      | 50.52      | -3.48  | 54         | 64.12    | 34.25    | 11.11  | 58.96  | 179    | 303     | A       | H       |   |
|                         |   |           |            |        |            |          |          |        |        |        |         |         | H       |   |
|                         |   |           |            |        |            |          |          |        |        |        |         |         | H       |   |
|                         |   | 4806      | 49.14      | -24.86 | 74         | 62.74    | 34.25    | 11.11  | 58.96  | 100    | 0       | P       | V       |   |
|                         |   |           |            |        |            |          |          |        |        |        |         |         |         | V |
|                         |   |           |            |        |            |          |          |        |        |        |         |         |         | V |
|                         |   |           |            |        |            |          |          |        |        |        |         |         |         | V |
| BLE<br>CH 19<br>2440MHz |   | 4878      | 55.12      | -18.88 | 74         | 68.44    | 34.3     | 11.21  | 58.83  | 164    | 313     | P       | H       |   |
|                         |   | 4878      | 51.58      | -2.42  | 54         | 64.9     | 34.3     | 11.21  | 58.83  | 164    | 313     | A       | H       |   |
|                         |   | 7320      | 56.95      | -17.05 | 74         | 64.01    | 35.6     | 15.08  | 57.74  | 105    | 314     | P       | H       |   |
|                         |   | 7320      | 50.72      | -3.28  | 54         | 57.78    | 35.6     | 15.08  | 57.74  | 105    | 314     | A       | H       |   |
|                         |   | 4878      | 49.84      | -24.16 | 74         | 63.16    | 34.3     | 11.21  | 58.83  | 100    | 0       | P       | V       |   |
|                         |   | 7320      | 56.86      | -17.14 | 74         | 63.92    | 35.6     | 15.08  | 57.74  | 102    | 325     | P       | V       |   |
|                         |   | 7320      | 50.71      | -3.29  | 54         | 57.77    | 35.6     | 15.08  | 57.74  | 102    | 325     | A       | V       |   |
|                         |   |           |            |        |            |          |          |        |        |        |         |         |         | V |
| BLE<br>CH 39<br>2480MHz |   | 4962      | 56.86      | -17.14 | 74         | 69.83    | 34.37    | 11.32  | 58.66  | 178    | 319     | P       | H       |   |
|                         |   | 4962      | 53.02      | -0.98  | 54         | 65.99    | 34.37    | 11.32  | 58.66  | 178    | 319     | A       | H       |   |
|                         |   | 7440      | 54.44      | -19.56 | 74         | 61.56    | 35.6     | 15.13  | 57.85  | 100    | 314     | P       | H       |   |
|                         |   | 7440      | 50.21      | -3.79  | 54         | 57.33    | 35.6     | 15.13  | 57.85  | 100    | 314     | A       | H       |   |
|                         |   | 4962      | 50.23      | -23.77 | 74         | 63.2     | 34.37    | 11.32  | 58.66  | 100    | 0       | P       | V       |   |
|                         |   | 7440      | 55.19      | -18.81 | 74         | 62.31    | 35.6     | 15.13  | 57.85  | 142    | 347     | P       | V       |   |
|                         |   | 7440      | 52.1       | -1.9   | 54         | 59.22    | 35.6     | 15.13  | 57.85  | 142    | 347     | A       | 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.  |   |
|---------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|-------|-------|---|
|                     |  | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |   |
| 2.4GHz<br>BLE<br>LF |  | 42.96     | 22.61      | -17.39 | 40         | 40.14    | 11.9     | 1.77   | 31.2   | 105    | 52      | P     | H     |   |
|                     |  | 125.04    | 20.6       | -22.9  | 43.5       | 37.72    | 11.6     | 2.38   | 31.1   |        |         | P     | H     |   |
|                     |  | 200.1     | 19.14      | -24.36 | 43.5       | 38.45    | 9.1      | 2.69   | 31.1   |        |         | P     | H     |   |
|                     |  | 374.9     | 24.14      | -21.86 | 46         | 36.77    | 15       | 3.39   | 31.02  |        |         | P     | H     |   |
|                     |  | 717.9     | 16.27      | -29.73 | 46         | 20.94    | 21.32    | 4.41   | 30.4   |        |         | P     | H     |   |
|                     |  | 869.1     | 18.34      | -27.66 | 46         | 21.02    | 23.02    | 4.66   | 30.36  |        |         | P     | H     |   |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | H |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | H |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | H |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | H |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | H |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | H |
|                     |  |           | 49.98      | 24.96  | -15.04     | 40       | 45.99    | 8.4    | 1.77   | 31.2   | 119     | 154   | P     | V |
|                     |  |           | 125.04     | 22.75  | -20.75     | 43.5     | 39.87    | 11.6   | 2.38   | 31.1   |         |       | P     | V |
|                     |  |           | 273.54     | 13.01  | -32.99     | 46       | 27.95    | 12.86  | 3.16   | 30.96  |         |       | P     | V |
|                     |  |           | 366.5      | 17.49  | -28.51     | 46       | 30.34    | 14.83  | 3.39   | 31.07  |         |       | P     | V |
|                     |  |           | 624.8      | 21.47  | -24.53     | 46       | 27.51    | 20.29  | 4.22   | 30.55  |         |       | P     | V |
|                     |  |           | 865.6      | 22.22  | -23.78     | 46       | 24.83    | 23.1   | 4.66   | 30.37  |         |       | P     | V |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | V |
|                     |  |           |            |        |            |          |          |        |        |        |         |       |       | V |
|                     |  |           |            |        |            |          |          |        |        |        |         |       | V     |   |
|                     |  |           |            |        |            |          |          |        |        |        |         |       | V     |   |
|                     |  |           |            |        |            |          |          |        |        |        |         |       | 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     |

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

**For Peak Limit @ 2390MHz:**

- 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)
- Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 55.45(dBμV/m) – 74(dBμV/m)  
= -18.55(dB)

**For Average Limit @ 2390MHz:**

- 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)
- 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”.**