



Appendix A. Radiated Spurious Emission

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|-----------------|-------------------------|---------------------|---------|
| Test Engineer : | Stan Hsieh and Karl Hou | Temperature : | 24~25°C |
| | | Relative Humidity : | 53~54% |

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. | |
|-------------------------|------|-----------|------------------|--------|--------|----------------|----------|--------|--------|--------|---------|---------|---------|---|
| | | (MHz) | (dB μ V/m) | (dB) | Limit | Level | Factor | Loss | Factor | Pos | Pos | Avg. | | |
| | | | | | Line | (dB μ V) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| BLE CH 00 2402MHz | | 2364.09 | 51.4 | -22.6 | 74 | 52.12 | 27.14 | 5.39 | 33.25 | 100 | 291 | P | H | |
| | | 2383.44 | 41.99 | -12.01 | 54 | 42.65 | 27.19 | 5.39 | 33.24 | 100 | 291 | A | H | |
| | * | 2402 | 94.55 | - | - | 95.15 | 27.23 | 5.39 | 33.22 | 100 | 291 | P | H | |
| | * | 2402 | 93.47 | - | - | 94.07 | 27.23 | 5.39 | 33.22 | 100 | 291 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2337.54 | 52.38 | -21.62 | 74 | 53.21 | 27.1 | 5.33 | 33.26 | 102 | 90 | P | V |
| | | | 2383.44 | 42.24 | -11.76 | 54 | 42.9 | 27.19 | 5.39 | 33.24 | 102 | 90 | A | V |
| | * | | 2402 | 91.68 | - | - | 92.28 | 27.23 | 5.39 | 33.22 | 102 | 90 | P | V |
| | * | | 2402 | 90.57 | - | - | 91.17 | 27.23 | 5.39 | 33.22 | 102 | 90 | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BLE CH 19 2440MHz | | 2385.24 | 51.36 | -22.64 | 74 | 52.02 | 27.19 | 5.39 | 33.24 | 117 | 297 | P | H | |
| | | 2364.36 | 42 | -12 | 54 | 42.71 | 27.14 | 5.39 | 33.24 | 117 | 297 | A | H | |
| | * | 2440 | 96.11 | - | - | 96.53 | 27.37 | 5.42 | 33.21 | 117 | 297 | P | H | |
| | * | 2440 | 94.93 | - | - | 95.35 | 27.37 | 5.42 | 33.21 | 117 | 297 | A | H | |
| | | | 2499.92 | 52.29 | -21.71 | 74 | 52.5 | 27.5 | 5.46 | 33.17 | 117 | 297 | P | H |
| | | | 2487.36 | 42.39 | -11.61 | 54 | 42.65 | 27.46 | 5.46 | 33.18 | 117 | 297 | A | H |
| | | | 2355.9 | 51.57 | -22.43 | 74 | 52.35 | 27.14 | 5.33 | 33.25 | 103 | 92 | P | V |
| | | | 2386.5 | 41.87 | -12.13 | 54 | 42.49 | 27.23 | 5.39 | 33.24 | 103 | 92 | A | V |
| | * | | 2440 | 90.06 | - | - | 90.48 | 27.37 | 5.42 | 33.21 | 103 | 92 | P | V |
| | * | | 2440 | 89.23 | - | - | 89.65 | 27.37 | 5.42 | 33.21 | 103 | 92 | A | V |
| | | | 2485.2 | 51.67 | -22.33 | 74 | 51.93 | 27.46 | 5.46 | 33.18 | 103 | 92 | P | V |
| | | | 2488.08 | 42.27 | -11.73 | 54 | 42.49 | 27.5 | 5.46 | 33.18 | 103 | 92 | A | V |



| | | | | | | | | | | | | | |
|----------------------------------|---|---------|-------|--------|----|-------|-------|------|-------|-----|-----|---|---|
| BLE CH 39 2480MHz | * | 2480 | 94.97 | - | - | 95.25 | 27.46 | 5.44 | 33.18 | 107 | 116 | P | H |
| | * | 2480 | 94.25 | - | - | 94.53 | 27.46 | 5.44 | 33.18 | 107 | 116 | A | H |
| | | 2489.6 | 51.55 | -22.45 | 74 | 51.77 | 27.5 | 5.46 | 33.18 | 107 | 116 | P | H |
| | | 2491 | 42.46 | -11.54 | 54 | 42.68 | 27.5 | 5.46 | 33.18 | 107 | 116 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 88.36 | - | - | 88.64 | 27.46 | 5.44 | 33.18 | 100 | 71 | P | V |
| | * | 2480 | 87.1 | - | - | 87.38 | 27.46 | 5.44 | 33.18 | 100 | 71 | A | V |
| | | 2493.36 | 51.96 | -22.04 | 74 | 52.17 | 27.5 | 5.46 | 33.17 | 100 | 71 | P | V |
| | | 2486.92 | 42.52 | -11.48 | 54 | 42.78 | 27.46 | 5.46 | 33.18 | 100 | 71 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

| BLE | Note | Frequency (MHz) | Level (dBµV/m) | Over Limit (dB) | Limit Line (dBµV/m) | Read Level (dBµV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) | |
|-------------------------|---|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|-------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| BLE CH 00 2402MHz | | 4805 | 38 | -36 | 74 | 59.64 | 31.42 | 7.58 | 60.64 | 100 | 0 | P | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4805 | 36.97 | -37.03 | 74 | 58.61 | 31.42 | 7.58 | 60.64 | 100 | 0 | P | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BLE CH 19 2440MHz | | 4880 | 37.43 | -36.57 | 74 | 58.69 | 31.56 | 7.7 | 60.52 | 100 | 0 | P | H | |
| | | 7320 | 41.54 | -32.46 | 74 | 56.81 | 36.22 | 9.49 | 60.98 | 100 | 0 | P | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4880 | 38.22 | -35.78 | 74 | 59.48 | 31.56 | 7.7 | 60.52 | 100 | 0 | P | V |
| | | | 7320 | 42.01 | -31.99 | 74 | 57.28 | 36.22 | 9.49 | 60.98 | 100 | 0 | P | V |
| | | | | | | | | | | | | | | V |
| BLE CH 39 2480MHz | | 4960 | 39.02 | -34.98 | 74 | 59.72 | 31.73 | 7.93 | 60.36 | 100 | 0 | P | H | |
| | | 7440 | 41.5 | -32.5 | 74 | 56.74 | 36.49 | 9.61 | 61.34 | 100 | 0 | P | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4960 | 39.39 | -34.61 | 74 | 60.09 | 31.73 | 7.93 | 60.36 | 100 | 0 | P | V |
| | | | 7440 | 41.77 | -32.23 | 74 | 57.01 | 36.49 | 9.61 | 61.34 | 100 | 0 | P | V |
| | | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | | |



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 BLE LF | | 71.04 | 22.74 | -17.26 | 40 | 47.71 | 6.82 | 0.93 | 32.72 | | | P | H | |
| | | 158.25 | 18.63 | -24.87 | 43.5 | 38.79 | 11.2 | 1.33 | 32.69 | | | P | H | |
| | | 186.33 | 34.15 | -9.35 | 43.5 | 55.99 | 9.4 | 1.48 | 32.72 | 163 | 55 | P | H | |
| | | 307.7 | 34.33 | -11.67 | 46 | 51.17 | 14.02 | 1.88 | 32.74 | | | P | H | |
| | | 414.8 | 35.52 | -10.48 | 46 | 49.46 | 16.75 | 2.16 | 32.85 | | | P | H | |
| | | 703.9 | 28.4 | -17.6 | 46 | 37.89 | 20.68 | 2.82 | 32.99 | | | P | H | |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | 62.94 | 34.68 | -5.32 | 40 | 60.21 | 6.28 | 0.93 | 32.74 | 115 | 325 | P | V |
| | | | 185.52 | 30.2 | -13.3 | 43.5 | 52.04 | 9.4 | 1.48 | 32.72 | | | P | V |
| | | | 197.94 | 34.13 | -9.37 | 43.5 | 55.42 | 9.96 | 1.48 | 32.73 | | | P | V |
| | | | 316.8 | 40.32 | -5.68 | 46 | 56.91 | 14.28 | 1.88 | 32.75 | | | P | V |
| | | | 424.6 | 37.82 | -8.18 | 46 | 51.62 | 16.9 | 2.16 | 32.86 | | | P | V |
| | | | 734.7 | 35.54 | -10.46 | 46 | 44.29 | 21.29 | 2.91 | 32.95 | | | 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. |
| ! | Test result is over limit line. |
| P/A | Peak or Average |
| H/V | Horizontal or Vertical |



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”.