

RF EXPOSURE EVALUATION

EUT Specification

| | |
|-----------------------------------|---|
| EUT | WIFI Bluetooth module |
| Frequency band (Operating) | <input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input checked="" type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input checked="" type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input checked="" type="checkbox"/> Others(Bluetooth: 2.402GHz ~ 2.480GHz) |
| Device category | <input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others ____ |
| Antenna diversity | <input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity |
| Max. output power | BDR+EDR: 5.341dBm (3.42 mw) BLE: 3.62dBm (2.30 mw) WLAN: 17.04 dBm (50.58 mw) RLAN U-NII-1 Band: 13.72dBm (23.55 mw) RLAN U-NII-2A Band: 14.06 dBm (25.47 mw) RLAN U-NII-2C Band: 13.78 dBm (23.88 mw) RLAN U-NII-3 Band: 12.51 dBm (17.82 mw) |
| Antenna gain | 2.3 dBi |
| Directional gain | 5.31dBi |
| Evaluation applied | <input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation |

Note: BT function and WIFI(2.4G,5G) function can work simultaneously, but 2.4G WIFI and 5G WIFI can't work simultaneously.

Limits for Maximum Permissible Exposure (MPE)

| Frequency Range(MHz) | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density(mW/cm ²) | Average Time |
|--|------------------------------|------------------------------|------------------------------------|--------------|
| (A) Limits for Occupational/Control Exposures | | | | |
| 300-1500 | -- | -- | F/300 | 6 |
| 1500-100000 | -- | -- | 5 | 6 |
| (B) Limits for General Population/Uncontrol Exposures | | | | |
| 300-1500 | -- | -- | F/1500 | 6 |
| 1500-100000 | -- | -- | 1 | 30 |

Friis transmission formula: $P_d = \frac{P_{out} * G}{4 * \pi * R^2}$

Where

P_d = Power density in mW/cm^2

P_{out} = output power to antenna in Mw

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

Measurement Result

| Channel | Channel Frequency (MHz) | Max Output power (dBm) | Tolerance | Max Tune-UP power (mW) | Power density at 20cm (mW/cm^2) | Power density Limits (mW/cm^2) |
|---------------------------|-------------------------|------------------------|-----------|------------------------|-------------------------------------|------------------------------------|
| Test mode: GFSK | | | | | | |
| Low | 2402 | 2.784 | ± 0.1 | 1.943 | 0.00066 | 1 |
| Middle | 2441 | 2.439 | ± 0.1 | 1.794 | 0.00061 | 1 |
| High | 2480 | 0.689 | ± 0.1 | 1.199 | 0.00041 | 1 |
| Test mode: $\pi/4$ -DQPSK | | | | | | |
| Low | 2402 | 5.068 | ± 0.1 | 3.287 | 0.00111 | 1 |
| Middle | 2441 | 4.562 | ± 0.1 | 2.925 | 0.00099 | 1 |
| High | 2480 | 2.934 | ± 0.1 | 2.011 | 0.00068 | 1 |
| Test mode: 8DPSK | | | | | | |
| Low | 2402 | 5.341 | ± 0.1 | 3.500 | 0.00118 | 1 |
| Middle | 2441 | 4.793 | ± 0.1 | 3.085 | 0.00104 | 1 |
| High | 2480 | 3.195 | ± 0.1 | 2.136 | 0.00072 | 1 |
| Test mode: BLE | | | | | | |
| Low | 2402 | 3.62 | ± 0.1 | 2.355 | 0.00080 | 1 |
| Middle | 2441 | 2.96 | ± 0.1 | 2.023 | 0.00068 | 1 |
| High | 2480 | 1.01 | ± 0.1 | 1.291 | 0.00044 | 1 |

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| Channel | Channel Frequency (MHz) | Max Output power (dBm) | Tolerance | Max Tune-UP power (mW) | Power density at 20cm (mW/cm ²) | Power density Limits (mW/cm ²) |
|-------------------------------|-------------------------|------------------------|-----------|------------------------|---|--|
| Test mode: IEEE 802.11b | | | | | | |
| Low | 2412 | 13.16 | ±0.1 | 21.184 | 0.00716 | 1 |
| Middle | 2437 | 12.93 | ±0.1 | 20.091 | 0.00679 | 1 |
| High | 2462 | 13.11 | ±0.1 | 20.941 | 0.00708 | 1 |
| Test mode: IEEE 802.11g | | | | | | |
| Low | 2412 | 15.39 | ±0.1 | 35.400 | 0.01196 | 1 |
| Middle | 2437 | 14.82 | ±0.1 | 31.046 | 0.01049 | 1 |
| High | 2462 | 14.93 | ±0.1 | 31.842 | 0.01076 | 1 |
| Test mode: IEEE 802.11n(HT20) | | | | | | |
| Low | 2412 | 17.04 | ±0.1 | 51.761 | 0.03497 | 1 |
| Middle | 2437 | 16.51 | ±0.1 | 45.814 | 0.03095 | 1 |
| High | 2462 | 16.76 | ±0.1 | 48.529 | 0.03279 | 1 |
| Test mode: IEEE 802.11n(HT40) | | | | | | |
| Low | 2422 | 16.21 | ±0.1 | 42.756 | 0.02889 | 1 |
| Middle | 2437 | 15.41 | ±0.1 | 35.563 | 0.02403 | 1 |
| High | 2452 | 15.49 | ±0.1 | 36.224 | 0.02448 | 1 |

Note: Directional gain for IEEE 802.11n

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| Channel | Channel Frequency (MHz) | Max Output power (dBm) | Tolerance | Max Tune-UP power (mW) | Power density at 20cm (mW/cm ²) | Power density Limits (mW/cm ²) |
|----------------------------------|-------------------------|------------------------|-----------|------------------------|---|--|
| Test mode: IEEE 802.11a | | | | | | |
| Low | 5180 | 12.77 | ±0.1 | 19.364 | 0.00654 | 1 |
| Middle | 5200 | 12.08 | ±0.1 | 16.520 | 0.00558 | 1 |
| High | 5240 | 11.85 | ±0.1 | 15.668 | 0.00529 | 1 |
| Test mode: IEEE 802.11n(HT20) | | | | | | |
| Low | 5180 | 13.72 | ±0.1 | 24.099 | 0.01628 | 1 |
| Middle | 5200 | 13.71 | ±0.1 | 24.044 | 0.01625 | 1 |
| High | 5240 | 13.45 | ±0.1 | 22.646 | 0.01530 | 1 |
| Test mode: IEEE 802.11n(HT40) | | | | | | |
| Low | 5190 | 13.27 | ±0.1 | 21.727 | 0.01468 | 1 |
| High | 5230 | 12.48 | ±0.1 | 18.113 | 0.01224 | 1 |
| Test mode: IEEE 802.11 ac(VHT20) | | | | | | |
| Low | 5180 | 13.53 | ±0.1 | 23.067 | 0.01559 | 1 |
| Middle | 5200 | 13.62 | ±0.1 | 23.550 | 0.01591 | 1 |
| High | 5240 | 13.42 | ±0.1 | 22.491 | 0.01520 | 1 |
| Test mode: IEEE 802.11 ac(VHT40) | | | | | | |
| Low | 5190 | 12.95 | ±0.1 | 20.184 | 0.01364 | 1 |
| High | 5230 | 12.58 | ±0.1 | 18.535 | 0.01252 | 1 |
| Test mode: IEEE 802.11 ac(VHT80) | | | | | | |
| Low | 5210 | 12.21 | ±0.1 | 17.022 | 0.01150 | 1 |

Note: Directional gain for IEEE 802.11n/ac

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| Channel | Channel Frequency (MHz) | Max Output power (dBm) | Tolerance | Max Tune-UP power (mW) | Power density at 20cm (mW/cm ²) | Power density Limits (mW/cm ²) |
|----------------------------------|-------------------------|------------------------|-----------|------------------------|---|--|
| Test mode: IEEE 802.11a | | | | | | |
| Low | 5260 | 12.66 | ±0.1 | 18.880 | 0.00638 | 1 |
| Middle | 5300 | 10.46 | ±0.1 | 11.376 | 0.00384 | 1 |
| High | 5320 | 10.64 | ±0.1 | 11.858 | 0.00401 | 1 |
| Test mode: IEEE 802.11n(HT20) | | | | | | |
| Low | 5260 | 14.06 | ±0.1 | 26.062 | 0.01761 | 1 |
| Middle | 5300 | 13.11 | ±0.1 | 20.941 | 0.01415 | 1 |
| High | 5320 | 12.78 | ±0.1 | 19.409 | 0.01311 | 1 |
| Test mode: IEEE 802.11n(HT40) | | | | | | |
| Low | 5270 | 12.78 | ±0.1 | 19.409 | 0.01311 | 1 |
| High | 5310 | 11.54 | ±0.1 | 14.588 | 0.00986 | 1 |
| Test mode: IEEE 802.11 ac(VHT20) | | | | | | |
| Low | 5260 | 13.74 | ±0.1 | 24.210 | 0.01636 | 1 |
| Middle | 5300 | 12.41 | ±0.1 | 17.824 | 0.01204 | 1 |
| High | 5320 | 12.34 | ±0.1 | 17.539 | 0.01185 | 1 |
| Test mode: IEEE 802.11 ac(VHT40) | | | | | | |
| Low | 5270 | 13.02 | ±0.1 | 20.512 | 0.01386 | 1 |
| High | 5310 | 11.68 | ±0.1 | 15.066 | 0.01018 | 1 |
| Test mode: IEEE 802.11 ac(VHT80) | | | | | | |
| Low | 5290 | 11.84 | ±0.1 | 15.631 | 0.01056 | 1 |

Note: Directional gain for IEEE 802.11n/ac

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| Channel | Channel Frequency (MHz) | Max Output power (dBm) | Tolerance | Max Tune-UP power (mW) | Power density at 20cm (mW/cm ²) | Power density Limits (mW/cm ²) |
|----------------------------------|-------------------------|------------------------|-----------|------------------------|---|--|
| Test mode: IEEE 802.11a | | | | | | |
| Low | 5500 | 11.57 | ±0.1 | 14.689 | 0.00496 | 1 |
| Middle | 5600 | 10.14 | ±0.1 | 10.568 | 0.00357 | 1 |
| High | 5700 | 10.17 | ±0.1 | 10.641 | 0.00360 | 1 |
| Test mode: IEEE 802.11n(HT20) | | | | | | |
| Low | 5500 | 13.24 | ±0.1 | 21.577 | 0.01458 | 1 |
| Middle | 5600 | 12.08 | ±0.1 | 16.520 | 0.01116 | 1 |
| High | 5700 | 12.05 | ±0.1 | 16.406 | 0.01108 | 1 |
| Test mode: IEEE 802.11n(HT40) | | | | | | |
| Low | 5510 | 13.54 | ±0.1 | 23.121 | 0.01562 | 1 |
| High | 5670 | 12.63 | ±0.1 | 18.750 | 0.01267 | 1 |
| Test mode: IEEE 802.11 ac(VHT20) | | | | | | |
| Low | 5500 | 13.46 | ±0.1 | 22.699 | 0.01534 | 1 |
| Middle | 5600 | 12.33 | ±0.1 | 17.498 | 0.01182 | 1 |
| High | 5700 | 12.32 | ±0.1 | 17.458 | 0.01180 | 1 |
| Test mode: IEEE 802.11 ac(VHT40) | | | | | | |
| Low | 5510 | 13.78 | ±0.1 | 24.434 | 0.01651 | 1 |
| High | 5670 | 12.96 | ±0.1 | 20.230 | 0.01367 | 1 |
| Test mode: IEEE 802.11 ac(VHT80) | | | | | | |
| Low | 5610 | 12.06 | ±0.1 | 16.444 | 0.01111 | 1 |

Note: Directional gain for IEEE 802.11n/ac

| Channel | Channel Frequency (MHz) | Max Output power (dBm) | Tolerance | Max Tune-UP power (mW) | Power density at 20cm (mW/cm ²) | Power density Limits (mW/cm ²) |
|----------------------------------|-------------------------|------------------------|-----------|------------------------|---|--|
| Test mode: IEEE 802.11a | | | | | | |
| Low | 5745 | 9.89 | ±0.1 | 9.977 | 0.00337 | 1 |
| Middle | 5785 | 10.50 | ±0.1 | 11.482 | 0.00388 | 1 |
| High | 5825 | 10.42 | ±0.1 | 11.272 | 0.00381 | 1 |
| Test mode: IEEE 802.11n(HT20) | | | | | | |
| Low | 5745 | 12.25 | ±0.1 | 17.179 | 0.01161 | 1 |
| Middle | 5785 | 12.26 | ±0.1 | 17.219 | 0.01163 | 1 |
| High | 5825 | 12.49 | ±0.1 | 18.155 | 0.01227 | 1 |
| Test mode: IEEE 802.11n(HT40) | | | | | | |
| Low | 5755 | 12.18 | ±0.1 | 16.904 | 0.01142 | 1 |
| High | 5795 | 12.51 | ±0.1 | 18.239 | 0.01232 | 1 |
| Test mode: IEEE 802.11 ac(VHT20) | | | | | | |
| Low | 5745 | 12.24 | ±0.1 | 17.140 | 0.01158 | 1 |
| Middle | 5785 | 12.29 | ±0.1 | 17.338 | 0.01171 | 1 |
| High | 5825 | 12.48 | ±0.1 | 18.113 | 0.01224 | 1 |
| Test mode: IEEE 802.11 ac(VHT40) | | | | | | |
| Low | 5755 | 12.27 | ±0.1 | 17.258 | 0.01166 | 1 |
| High | 5795 | 12.46 | ±0.1 | 18.030 | 0.01218 | 1 |
| Test mode: IEEE 802.11 ac(VHT80) | | | | | | |
| Low | 5775 | 12.46 | ±0.1 | 18.030 | 0.01218 | 1 |

Note: Directional gain for IEEE 802.11n/ac

When bluetooth and WiFi(2.4G) work together:

| Power density at 20cm (mW/ cm2) BT | Power density at 20cm (mW/ cm2) 2.4G WIFI | Power density at 20cm (mW/ cm2) Total | Power density Limits (mW/cm2) |
|--|---|---|--------------------------------|
| 0.00118 | 0.03497 | 0.03615 | 1 |

When bluetooth and WiFi(5G) work together:

| Power density at 20cm (mW/ cm2) BT | Power density at 20cm (mW/ cm2) 5G WIFI | Power density at 20cm (mW/ cm2) Total | Power density Limits (mW/cm2) |
|--|---|---|--------------------------------|
| 0.00118 | 0.01761 | 0.01879 | 1 |

According to KDB447498 D01 V06, no simultaneous SAR measurement is required.