

# 1 Maximum Permissible Exposure

## 1.1 Maximum Permissible Exposure

### 1.1.1 Limit of Maximum Permissible Exposure

| Limits for Occupational / Controlled Exposure                       |                                   |                                   |                                          |                                                                  |
|---------------------------------------------------------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| Frequency Range (MHz)                                               | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
| 0.3-3.0                                                             | 614                               | 1.63                              | (100)*                                   | 6                                                                |
| 3.0-30                                                              | 1,842 / f                         | 4.89 / f                          | (900 / f <sup>2</sup> )*                 | 6                                                                |
| 30-300                                                              | 61.4                              | 0.163                             | 1.0                                      | 6                                                                |
| 300-1,500                                                           |                                   |                                   | F/300                                    | 6                                                                |
| 1,500-100,000                                                       |                                   |                                   | 5                                        | 6                                                                |
| Limits for General Population / Uncontrolled Exposure               |                                   |                                   |                                          |                                                                  |
| Frequency Range (MHz)                                               | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
| 0.3-1.34                                                            | 614                               | 1.63                              | (100)*                                   | 30                                                               |
| 1.34-30                                                             | 824/f                             | 2.19/f                            | (180/f <sup>2</sup> )*                   | 30                                                               |
| 30-300                                                              | 27.5                              | 0.073                             | 0.2                                      | 30                                                               |
| 300-1,500                                                           |                                   |                                   | F/1500                                   | 30                                                               |
| 1,500-100,000                                                       |                                   |                                   | 1.0                                      | 30                                                               |
| Note 1: f = frequency in MHz ; *Plane-wave equivalent power density |                                   |                                   |                                          |                                                                  |
| Note 2: For the applicable limit, see FCC 1.1310                    |                                   |                                   |                                          |                                                                  |

### 1.1.2 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

**E** = Electric field (V/m)

**G** = EUT Antenna numeric gain (numeric)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**P** = RF output power (W)

**d** = Separation distance between radiator and human body (m)

### 1.1.3 Result of Maximum Permissible Exposure

| RF General Information 5150~5250MHz |                           |                     |                |                                              |                       |             |
|-------------------------------------|---------------------------|---------------------|----------------|----------------------------------------------|-----------------------|-------------|
| Frequency Range (MHz)               | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N <sub>TX</sub> ) | RF Output Power (dBm) | Co-location |
| 5150-5250                           | a                         | 5180-5240           | 36-48 [4]      | 1                                            | 14.68                 | Yes         |
| 5150-5250                           | n (HT20)                  | 5180-5240           | 36-48 [4]      | 1                                            | 14.67                 | Yes         |
| 5150-5250                           | n (HT40)                  | 5190-5230           | 38-46 [2]      | 1                                            | 16.71                 | Yes         |
| 5150-5250                           | ac (VHT20)                | 5180-5240           | 36-48 [4]      | 1                                            | 15.02                 | Yes         |
| 5150-5250                           | ac (VHT40)                | 5190-5230           | 38-46 [2]      | 1                                            | 16.69                 | Yes         |
| 5150-5250                           | ac (VHT80)                | 5210                | 42 [1]         | 1                                            | 16.92                 | Yes         |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.  
 Note 2: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)

| RF General Information 5725 MHz – 5850 MHz |                           |                     |                |                                              |                       |             |
|--------------------------------------------|---------------------------|---------------------|----------------|----------------------------------------------|-----------------------|-------------|
| Frequency Range (MHz)                      | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N <sub>TX</sub> ) | RF Output Power (dBm) | Co-location |
| 5725-5850                                  | a                         | 5745-5825           | 149-165 [5]    | 1                                            | 21.89                 | Yes         |
| 5725-5850                                  | n(HT20)                   | 5745-5825           | 149-165 [5]    | 1                                            | 21.81                 | Yes         |
| 5725-5850                                  | n(HT40)                   | 5755-5795           | 151-159 [2]    | 1                                            | 21.68                 | Yes         |
| 5725-5850                                  | ac(VHT20)                 | 5745-5825           | 149-165 [5]    | 1                                            | 21.21                 | Yes         |
| 5725-5850                                  | ac(VHT40)                 | 5755-5795           | 151-159 [2]    | 1                                            | 21.13                 | Yes         |
| 5725-5850                                  | ac(VHT80)                 | 5775                | 155 [1]        | 1                                            | 17.79                 | Yes         |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.  
 Note 2: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)

| RF General Information 2400 MHz – 2483.5 MHz |                           |                     |                |                                              |                       |             |
|----------------------------------------------|---------------------------|---------------------|----------------|----------------------------------------------|-----------------------|-------------|
| Frequency Range (MHz)                        | IEEE Std. 802.11 Protocol | Ch. Frequency (MHz) | Channel Number | Number of Transmit Chains (N <sub>TX</sub> ) | RF Output Power (dBm) | Co-location |
| 2400-2483.5                                  | b                         | 2412-2462           | 1-11 [11]      | 1                                            | 18.33                 | Yes         |
| 2400-2483.5                                  | g                         | 2412-2462           | 1-11 [11]      | 1                                            | 18.79                 | Yes         |
| 2400-2483.5                                  | n (HT20)                  | 2412-2462           | 1-11 [11]      | 2                                            | 22.16                 | Yes         |
| 2400-2483.5                                  | n (HT40)                  | 2422-2452           | 3-9 [7]        | 2                                            | 18.22                 | Yes         |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.  
 Note 2: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)



| Worst Maximum RF Output Power Result                     |                 |                                            |          |            |                                 |
|----------------------------------------------------------|-----------------|--------------------------------------------|----------|------------|---------------------------------|
| Exposure Environment                                     |                 | General Population / Uncontrolled Exposure |          |            |                                 |
| Separation Distance (cm)                                 |                 | 20                                         |          |            |                                 |
| Condition                                                |                 | RF Output Power (dBm)                      |          |            |                                 |
| Modulation Mode                                          | N <sub>TX</sub> | RF Output Power (dBm)                      | DG (dBi) | EIRP Power | PD (S)<br>(mW/cm <sup>2</sup> ) |
| 11N-VHT80                                                | 1               | 16.92                                      | 4.44     | 21.36      | 0.027                           |
| 11A                                                      | 1               | 21.89                                      | 4.44     | 26.33      | 0.085                           |
| 11N-HT20                                                 | 2               | 22.16                                      | 2.71     | 24.87      | 0.061                           |
| Co-location Total                                        |                 |                                            |          |            | 0.173                           |
| Maximum Permissible Exposure Limit (mW/cm <sup>2</sup> ) |                 |                                            |          |            | 1                               |
| Note 1: N <sub>TX</sub> = Number of Transmit Chains      |                 |                                            |          |            |                                 |