

# 1 Human Exposure Assessment

## 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                                                              | 1842 / f                          | 4.89 / f                          | (900 / f)*                               | 6                                                                |
| 30-300                                                              | 61.4                              | 0.163                             | 1.0                                      | 6                                                                |
| 300-1500                                                            | -                                 | -                                 | F/300                                    | 6                                                                |
| 1500-100,000                                                        | -                                 | -                                 | 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)*                                 | 30                                                               |
| 30-300                                                              | 27.5                              | 0.073                             | 0.2                                      | 30                                                               |
| 300-1500                                                            | -                                 | -                                 | F/1500                                   | 30                                                               |
| 1500-100,000                                                        | -                                 | -                                 | 1.0                                      | 30                                                               |
| Note 1: f = frequency in MHz ; *Plane-wave equivalent power density |                                   |                                   |                                          |                                                                  |
| Note 2: For the applicable limit, see FCC 1.1310                    |                                   |                                   |                                          |                                                                  |

| RF Field Strength Limits for Controlled Use Devices (Controlled Environment)               |                               |                                                 |                                   |                                 |
|--------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------|-----------------------------------|---------------------------------|
| Frequency Range (MHz)                                                                      | Electric Field (V/m rms)      | Magnetic Field (A/m rms)                        | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes)        |
| 0.003-1                                                                                    | 600                           | 4.9                                             | -                                 | 6                               |
| 1-10                                                                                       | 600/ <i>f</i>                 | 4.9/ <i>f</i>                                   | -                                 | 6                               |
| 10-30                                                                                      | 60                            | 4.9/ <i>f</i>                                   | -                                 | 6                               |
| 30-300                                                                                     | 60                            | 0.163                                           | 10*                               | 6                               |
| 300-1500                                                                                   | 3.54 <i>f</i> <sup>0.5</sup>  | 0.0094 <i>f</i> <sup>0.5</sup>                  | <i>f</i> /30                      | 6                               |
| 1500-15000                                                                                 | 137                           | 0.364                                           | 50                                | 6                               |
| 15000-150000                                                                               | 137                           | 0.364                                           | 50                                | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000                                                                              | 0.354 <i>f</i> <sup>0.5</sup> | 9.4 × 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>  | 3.33 × 10 <sup>-4</sup> <i>f</i>  | 616000/ <i>f</i> <sup>1.2</sup> |
| RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment) |                               |                                                 |                                   |                                 |
| Frequency Range (MHz)                                                                      | Electric Field (V/m rms)      | Magnetic Field (A/m rms)                        | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes)        |
| 0.003-1                                                                                    | 280                           | 2.19                                            | -                                 | 6                               |
| 1-10                                                                                       | 280/ <i>f</i>                 | 2.19/ <i>f</i>                                  | -                                 | 6                               |
| 10-30                                                                                      | 28                            | 2.19/ <i>f</i>                                  | -                                 | 6                               |
| 30-300                                                                                     | 28                            | 0.073                                           | 2*                                | 6                               |
| 300-1500                                                                                   | 1.585 <i>f</i> <sup>0.5</sup> | 0.0042 <i>f</i> <sup>0.5</sup>                  | <i>f</i> /150                     | 6                               |
| 1500-15000                                                                                 | 61.4                          | 0.163                                           | 10                                | 6                               |
| 15000-150000                                                                               | 61.4                          | 0.163                                           | 10                                | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000                                                                              | 0.158 <i>f</i> <sup>0.5</sup> | 4.21 × 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup> | 6.67 × 10 <sup>-5</sup> <i>f</i>  | 616000/ <i>f</i> <sup>1.2</sup> |
| Note 1: <i>f</i> is frequency in MHz.                                                      |                               |                                                 |                                   |                                 |
| Note 2: For the applicable limit, see IC RSS-102                                           |                               |                                                 |                                   |                                 |

### 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-(5.3G~5.6G)**

| RF General Information                                                                                                                                                                                                     |                  |                 |                |                                    |                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|----------------|------------------------------------|-----------------------|
| Frequency Range (MHz)                                                                                                                                                                                                      | IEEE Std. 802.11 | Ch. Freq. (MHz) | Channel Number | Transmit Chains (N <sub>TX</sub> ) | RF Output Power (dBm) |
| 5250-5350                                                                                                                                                                                                                  | a                | 5260-5320       | 52-64 [4]      | 1                                  | 21.92                 |
| 5470-5725                                                                                                                                                                                                                  |                  | 5500-5700       | 100-140 [8]    | 1                                  | 21.88                 |
| 5250-5350                                                                                                                                                                                                                  | n (HT20)         | 5260-5320       | 52-64 [4]      | 1                                  | 21.99                 |
| 5470-5725                                                                                                                                                                                                                  |                  | 5500-5700       | 100-140 [8]    | 1                                  | 22.03                 |
| 5250-5350                                                                                                                                                                                                                  | n (HT40)         | 5270-5310       | 54-62 [2]      | 1                                  | 23.24                 |
| 5470-5725                                                                                                                                                                                                                  |                  | 5510-5670       | 102-134 [3]    | 1                                  | 23.28                 |
| 5250-5350                                                                                                                                                                                                                  | n (HT20)         | 5260-5320       | 52-64 [4]      | 3                                  | 21.05                 |
| 5470-5725                                                                                                                                                                                                                  |                  | 5500-5700       | 100-140 [8]    | 3                                  | 21.25                 |
| 5250-5350                                                                                                                                                                                                                  | n (HT40)         | 5270-5310       | 54-62 [2]      | 3                                  | 23.91                 |
| 5470-5725                                                                                                                                                                                                                  |                  | 5510-5670       | 102-134 [3]    | 3                                  | 23.92                 |
| 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.) |                  |                 |                |                                    |                       |

| <b>Worst Maximum Permissible Exposure Result</b>              |                       |                                            |                     |                     |                  |                 |                   |                                 |
|---------------------------------------------------------------|-----------------------|--------------------------------------------|---------------------|---------------------|------------------|-----------------|-------------------|---------------------------------|
| <b>Exposure Environment</b>                                   |                       | General Population / Uncontrolled Exposure |                     |                     |                  |                 |                   |                                 |
| <b>Separation Distance (cm)</b>                               |                       | 20                                         |                     |                     |                  |                 |                   |                                 |
| <b>Condition</b>                                              |                       | <b>RF Output Power (dBm)</b>               |                     |                     |                  |                 |                   |                                 |
| <b>Modulation Mode</b>                                        | <b>N<sub>TX</sub></b> | <b>Chain-Port 1</b>                        | <b>Chain-Port 2</b> | <b>Chain-Port 3</b> | <b>Sum Chain</b> | <b>DG (dBi)</b> | <b>EIRP Power</b> | <b>PD (S) (W/m<sup>2</sup>)</b> |
| 11A5.3G-20M                                                   | 1                     | -                                          | 21.92               | -                   | 21.92            | 2.08            | 24.00             | 0.05000                         |
| 11A5.6G-20M                                                   | 1                     | -                                          | 21.88               | -                   | 21.88            | 2.08            | 23.96             | 0.04950                         |
| 11N5.3G-20M                                                   | 1                     | -                                          | 21.99               | -                   | 21.99            | 2.08            | 24.07             | 0.05081                         |
| 11N5.6G-20M                                                   | 1                     | -                                          | 22.03               | -                   | 22.03            | 2.08            | 24.11             | 0.05128                         |
| 11N5.3G-40M                                                   | 1                     | -                                          | 23.24               | -                   | 23.24            | 2.08            | 25.32             | 0.06776                         |
| 11N5.6G-40M                                                   | 1                     | -                                          | 23.28               | -                   | 23.28            | 2.08            | 25.36             | 0.06838                         |
| 11N5.3G-20M                                                   | 3                     | 15.27                                      | 17.91               | 15.06               | 21.05            | 2.08            | 23.13             | 0.04092                         |
| 11N5.6G-20M                                                   | 3                     | 16.46                                      | 16.55               | 16.42               | 21.25            | 2.08            | 23.33             | 0.04285                         |
| 11N5.3G-40M                                                   | 3                     | 18.23                                      | 20.79               | 17.76               | 23.91            | 2.08            | 25.99             | 0.07906                         |
| 11N5.6G-40M                                                   | 3                     | 19.08                                      | 19.74               | 18.57               | 23.92            | 2.08            | 26.00             | 0.07924                         |
| <b>Maximum Permissible Exposure Limit (mW/cm<sup>2</sup>)</b> |                       |                                            |                     |                     |                  |                 |                   | <b>1</b>                        |