



# 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 <sup>2</sup> )*                 | 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 <sup>2</sup> )*                   | 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                    |                                   |                                   |                                          |                                                                  |

### 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 (2.4G)**

| Transmitter Chains & Receiver Chains Information |                                              |                                             |                                                   |                       |
|--------------------------------------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------------|-----------------------|
| IEEE Std. 802.11 Protocol                        | Number of Transmit Chains (N <sub>TX</sub> ) | Number of Receive Chains (N <sub>RX</sub> ) | Correlation Signals with Multiple N <sub>TX</sub> | RF Output Power (dBm) |
| b                                                | 1                                            | 1                                           | Correlated                                        | 20.39                 |
| g                                                | 1                                            | 1                                           | Correlated                                        | 20.57                 |
| n (HT20)                                         | 1                                            | 1                                           | Correlated                                        | 20.52                 |
| n (HT40)                                         | 1                                            | 1                                           | Correlated                                        | 16.15                 |

Note 1: RF output power specifies that Maximum Conducted (Average) Output Power.

| 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                            | DG (dBi) | EIRP Power | PD (S) (mW/cm <sup>2</sup> ) |
| g                                                             | 1               | 20.57                                      | 1.91     | 22.48      | 0.03522                      |
| <b>Maximum Permissible Exposure Limit (mW/cm<sup>2</sup>)</b> |                 |                                            |          |            | <b>1</b>                     |

Note 1: N<sub>TX</sub> = Number of Transmit Chains