# RF Exposure Compliance for simultaneous operations

- **Configurations for simultaneous operations**

  - **Configuration 1:** CDMA 1x + 2.4GHz WLAN + Bluetooth

  - **Configuration 2:** CDMA EVDO + 2.4GHz WLAN + Bluetooth

  - **Configuration 3:** CDMA 1x + 2.4GHz WLAN

  - **Configuration 4:** CDMA EVDO + 2.4GHz WLAN

  - **Configuration 5:** CDMA 1x + Bluetooth

  - **Configuration 6:** CDMA EVDO + Bluetooth

  - **Configuration 7:** 2.4GHz WLAN + Bluetooth

- **Result**

| RF function | CDMA EVDO | | CDMA 1x | | 802.11b | 802.11g | 802.11n (HT40) | BT | Total Power Density (mW/cm$^2$) |
|---|---|---|---|---|---|---|---|---|---|
| Band | Cellular | **PCS** | Cellular | **PCS** | 2.4GHz | 2.4GHz | 2.4GHz | 2.4GHz | |
| Power Density (mW/cm$^2$) | 0.064082 | **0.117417** | 0.064082 | **0.117417** | 0.037475 | **0.105617** | 0.094131 | **0.000237** | |
| Configuration 1 | | | | O 0.117417 | | O 0.105617 | | O 0.000237 | **0.223271** |
| Configuration 2 | | O 0.117417 | | | | O 0.105617 | | O 0.000237 | **0.223271** |

Note 1:  The maximum power density in each RF function was used for above table.

And the worst case configuration is calculated.

# MPE Calculation : CDMA 1x

- **Frequency range :**   824.70   MHz  ~  848.31   MHz

- **Maximum antenna gain(PK):**   0.08   dBi

- **EIRP calculation using target power and tolerance**
  - Target power :   24   dBm  ±  1   dB ( Max.   25   dBm  &  Min.   23   dBm )
  - **EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB   25.08   dBm**

- **Measured ERP :**   24.33   dBm
  - Conversion EIRP = Measured ERP + 2.1 =   26.48   dBm
  - Measured conducted output power   24.34   dBm
  - **Max. EIRP :**   24.99   dBm
    ( Max. EIRP = Conversion EIRP + ( Target power + Positive tolerance - Measured conducted output power

  $$\boxed{\textbf{Maximum EIRP = } \quad \textbf{25.08} \quad \textbf{dBm = } \quad \textbf{322.107} \quad \textbf{mW}}$$

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user.

The MPE calculation for this exposure is shown below.

- **Calculation of power density at the specific separation**

| | |
|---|---|
| - **S** = EIRP / ( 4 $R^2$ π ) <br><br> = **322.107** / ( 4 X $20^2$ X π ) <br><br> = <u>0.064082</u> mW/cm$^2$ | - **Note** <br><br> S = Maximum power density(mW/cm$^2$) <br><br> EIRP = Equivalent Isotropic Radiated Power(mW) <br><br> R = Distance to the center of the radiation of <br>      the antenna(20cm) |

- **Requirment = 0.549 mW/cm²**
  (FCC Part 1.1310 Table 1 Limits for maximum permissible exposure(MPE)

# Conclusion : The exposure condition of this device is compliant with FCC rules.

# MPE Calculation : CDMA 1x

- **Frequency range :**   1851.25   MHz  ~   1908.75   MHz

- **Maximum antenna gain(PK):**   2.71   dBi

- **EIRP calculation using target power and tolerance**
  - Target power :   24   dBm  **±**   1   dB  ( Max.   25   dBm  &  Min.   23   dBm )
  - **EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB   27.71   dBm**

- **Measured EIRP :**   24.90   dBm
  - Measured conducted output power   24.22   dBm
  - **Max. EIRP :**   25.68   dBm
    ( Max. EIRP = Measured EIRP + ( Target power + Positive tolerance - Measured conducted output power )

> **Maximum EIRP =**   **27.71**   **dBm =**   **590.202**   **mW**

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user.

The MPE calculation for this exposure is shown below.

- **Calculation of power density at the specific separation**

| | |
|---|---|
| - **S** = EIRP / ( 4 R$^2$ π )<br><br>    =   **590.202**   / ( 4 X 20$^2$ X π )<br><br>    =   **0.117417**   mW/cm$^2$ | **- Note**<br><br>S = Maximum power density(mW/cm$^2$)<br><br>EIRP = Equivalent Isotropic Radiated Power(mW)<br><br>R = Distance to the center of the radiation of<br>      the antenna(20cm) |

- **Requirment =   1.000   mW/cm²**
  (FCC Part 1.1310 Table 1 Limits for maximum permissible exposure(MPE)

# Conclusion :  The exposure condition of this device is compliant with FCC rules.

# MPE Calculation : CDMA EVDO

- **Frequency range :**    824.70   MHz  ~  848.31   MHz

- **Maximum antenna gain(PK):**    0.08   **dBi**

- **EIRP calculation using target power and tolerance**
  - Target power :    24   dBm  ±  1   dB  ( Max.   25   dBm  & Min.   23   dBm )
  - **EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB**   25.08   **dBm**

- **Measured ERP :**    24.48   **dBm**
  - Conversion EIRP = Measured ERP + 2.1 =   26.63   dBm
  - Measured conducted output power   24.48   dBm
  - **Max. EIRP :**   25.00   **dBm**
    ( Max. EIRP = Conversion EIRP + ( Target power + Positive tolerance - Measured conducted output power

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**Maximum EIRP =**   **25.08**   **dBm =**   **322.107**   **mW**

</div>

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user.

The MPE calculation for this exposure is shown below.

- **Calculation of power density at the specific separation**

| | |
|---|---|
| - **S** = EIRP / ( 4 $R^2 \pi$ ) <br><br>     =   **322.107**   / ( 4 X $20^2$ X $\pi$ ) <br><br>     =   **0.064082**   mW/cm$^2$ | - **Note** <br><br> S = Maximum power density(mW/cm$^2$) <br><br> EIRP = Equivalent Isotropic Radiated Power(mW) <br><br> R = Distance to the center of the radiation of <br>       the antenna(20cm) |

- **Requirment = 0.549   mW/cm²**
  (FCC Part 1.1310 Table 1 Limits for maximum permissible exposure(MPE)

# Conclusion : The exposure condition of this device is compliant with FCC rules.

# MPE Calculation : CDMA EVDO

- **Frequency range :**   1851.25   MHz  ~   1908.75   MHz

- **Maximum antenna gain(PK):**   2.71   dBi

- **EIRP calculation using target power and tolerance**
  - Target power :   24   dBm  **±**   1   dB  ( Max.   25   dBm  &  Min.   23   dBm )
  - **EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB   27.71   dBm**

- **Measured EIRP :**   25.02   dBm
  - Measured conducted output power   24.43   dBm
  - **Max. EIRP :**   25.59   dBm
  
  ( Max. EIRP = Measured EIRP + ( Target power + Positive tolerance - Measured conducted output power )

  | **Maximum EIRP =   27.71   dBm =   590.202   mW** |
  |---|

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user.

The MPE calculation for this exposure is shown below.

- **Calculation of power density at the specific separation**

| | |
|---|---|
| ▪ **S**  = EIRP / ( 4 $R^2 \pi$ )<br><br>   =   **590.202**   / ( 4 X $20^2$ X $\pi$ )<br><br>   =   0.117417   mW/$cm^2$ | **- Note**<br><br>S = Maximum power density(mW/$cm^2$)<br><br>EIRP = Equivalent Isotropic Radiated Power(mW)<br><br>R = Distance to the center of the radiation of<br>      the antenna(20cm) |

- **Requirment =   1.000   mW/cm²**
  (FCC Part 1.1310 Table 1 Limits for maximum permissible exposure(MPE)

# Conclusion :  The exposure condition of this device is compliant with FCC rules.

# MPE Calculations(WLAN: 802.11b)

- Frequency range :    2412    MHz   ~    2462    MHz
- Measured RF output power :   18   dBm
- Target Power & Tolerance :   17.50   dBm   **±**   1   dB   ( Max.    18.5    dBm   &   Min.     16.5    dBm )
- Maximum antenna peak gain :    4.25    dBi

- **Maximum output power for the calculatio   18.50   dBm**

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the

The MPE calculation for this exposure is shown below.

| | |
|---|---|
| ▪ **EIRP** =   P    +    G <br><br> =   18.50   dBm   +    4.25    dBi <br><br> =   **22.75**   **dBm**   =    **188.365**    **mW** | **- Note** <br><br> P = Power input to the antenna(dBm) <br><br> G = Power gain of the antenna(dBi) |

- **Power density at the specific separation**

| | |
|---|---|
| ▪ **S**   =   EIRP / ( 4 $R^2 \pi$ ) <br><br> =   **188.365**   / ( 4 X $20^2$ X $\pi$ ) <br><br> =   **0.037475**   mW/cm$^2$ | **- Note** <br><br> S = Maximum power dencity(mW/cm$^2$) <br><br> EIRP = Equivalent Isotropic Radiated Power(mW) <br><br> R = Distance to the center of the radiation of <br>      the antenna(20cm) |

# Conclusion : The exposure condition of this device is compliant with FCC rules.

The maximum permissible exposure(MPE) of the general population/Uncontrolled for this device is 1.0 mW/cm$^2$.

# MPE Calculations(WLAN: 802.11g)

- Frequency range :      2412     MHz   ~     2462     MHz
- Measured RF output power :   22.54   dBm
- Target Power & Tolerance :   22.00   dBm  **±**  1   dB  ( Max.    23    dBm  &  Min.    21    dBm )
- Maximum antenna peak gain :    4.25   dBi

- **Maximum output power for the calculatio   23.00   dBm**

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the

The MPE calculation for this exposure is shown below.

| | |
|---|---|
| ▪ **EIRP** = P + G | - **Note** |
| = 23.00 dBm + 4.25 dBi | P = Power input to the antenna(dBm) |
| = **27.25 dBm** = **530.885 mW** | G = Power gain of the antenna(dBi) |

- **Power density at the specific separation**

| | |
|---|---|
| ▪ **S** = EIRP / ( 4 $R^2 \pi$ ) | - **Note** |
| = **530.885** / ( 4 X $20^2$ X $\pi$ ) | S = Maximum power dencity(mW/cm$^2$) |
| = **0.105617** mW/cm$^2$ | EIRP = Equivalent Isotropic Radiated Power(mW) |
| | R = Distance to the center of the radiation of |
| | the antenna(20cm) |

## Conclusion :  The exposure condition of this device is compliant with FCC rules.

The maximum permissible exposure(MPE) of the general population/Uncontrolled for this device is 1.0 mW/cm$^2$.

# MPE Calculations(WLAN: 802.11n HT20)

- Frequency range :   2412   MHz   ~   2462   MHz
- Measured RF output power : 22.36   dBm
- Target Power & Tolerance :   21.50   dBm   ±   1   dB   ( Max.   22.5   dBm   &   Min.   20.5   dBm )
- Maximum antenna peak gain :   4.25   dBi

- **Maximum output power for the calculatio   22.50   dBm**

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the

The MPE calculation for this exposure is shown below.

| | |
|---|---|
| ▪ **EIRP** =   P   +   G | **- Note** |
|    =   22.50   dBm   +   4.25   dBi | P = Power input to the antenna(dBm) |
|    =   **26.75**   **dBm**   =   **473.152**   **mW** | G = Power gain of the antenna(dBi) |

- **Power density at the specific separation**

| | |
|---|---|
| ▪ **S**   =   EIRP / ( 4 $R^2 \pi$ ) | **- Note** |
|    =   **473.152**   / ( 4 X $20^2$ X $\pi$ ) | S = Maximum power dencity(mW/cm$^2$) |
|    =   **0.094131**   mW/cm$^2$ | EIRP = Equivalent Isotropic Radiated Power(mW) |
| | R = Distance to the center of the radiation of |
| |      the antenna(20cm) |

# Conclusion : The exposure condition of this device is compliant with FCC rules.

The maximum permissible exposure(MPE) of the general population/Uncontrolled for this device is 1.0 mW/cm$^2$.

# MPE Calculations(Bluetooth)

- Frequency range :    2402    MHz ~    2480    MHz
- Measured RF output power :  3.84  dBm
- Target Power & Tolerance :  2.50  dBm **±**  1.5  dB ( Max.    4    dBm & Min.    1    dBm )
- Maximum antenna peak gain :   -3.26   dBi

- **Maximum output power for the calculatio    4.00    dBm**

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the

The MPE calculation for this exposure is shown below.

| | |
|---|---|
| ▪ **EIRP**  =    P    +    G | **- Note** |
| =    4.00    dBm +   -3.26    dBi | P = Power input to the antenna(dBm) |
| =    **0.75**    **dBm**  =     **1.188**     **mW** | G = Power gain of the antenna(dBi) |

- **Power density at the specific separation**

| | |
|---|---|
| ▪ **S**  =  EIRP / ( 4 $R^2$ π ) | **- Note** |
| =    **1.188**    / ( 4 X $20^2$ X π ) | S = Maximum power dencity(mW/$cm^2$) |
| =   **0.000237**   mW/$cm^2$ | EIRP = Equivalent Isotropic Radiated Power(mW) |
| | R = Distance to the center of the radiation of |
| | the antenna(20cm) |

# Conclusion :  The exposure condition of this device is compliant with FCC rules.

The maximum permissible exposure(MPE) of the general population/Uncontrolled for this device is 1.0 mW/$cm^2$.