

MPE Calculation : LTE Band 13

- Frequency range : 782 MHz

- Maximum antenna gain(PK): 0.59 dBi

- EIRP calculation using target power and tolerance

- Target power : 21 dBm \pm 1 dB (Max. 22 dBm & Min. 20 dBm)

- EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB) 22.59 dBm

- Measured EIRP : 20.94 dBm

- Conversion EIRP = Measured EIRP + 2.1 = 23.09 dBm

- Measured conducted output power 21.12 dBm

- Max. EIRP : 21.82 dBm

(Max. EIRP = Conversion EIRP + (Target power + Positive tolerance - Measured conducted output power)

$$\boxed{\text{Maximum EIRP} = 22.59 \text{ dBm} = 181.552 \text{ mW}}$$

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

<ul style="list-style-type: none"> $S = \text{EIRP} / (4 R^2 \pi)$ $= 181.552 / (4 \times 20^2 \times \pi)$ $= 0.036119 \text{ mW/cm}^2$ 	<ul style="list-style-type: none"> Note
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S = Maximum power density(mW/cm²)

EIRP = Equivalent Isotropic Radiated Power(mW)

R = Distance to the center of the radiation of the antenna(20cm)

- Requirement = 0.521 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 : LTE Band 4

- Frequency range : 1715 MHz ~ 1750 MHz
- Maximum antenna gain(PK): 2.50 dBi
- EIRP calculation using target power and tolerance
 - Target power : 20 dBm \pm 1 dB (Max. 21 dBm & Min. 19 dBm)
 - EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB) 23.50 dBm
- Measured EIRP : 22.28 dBm
 - Measured conducted output power 20.77 dBm
 - Max. EIRP : 22.51 dBm
 - (Max. EIRP = Measured EIRP + (Target power + Positive tolerance - Measured conducted output power)

$$\boxed{\text{Maximum EIRP} = 23.50 \text{ dBm} = 223.873 \text{ mW}}$$

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

$$\begin{aligned} S &= \text{EIRP} / (4 R^2 \pi) \\ &= 223.873 / (4 \times 20^2 \times \pi) \\ &= \underline{\underline{0.044539 \text{ mW/cm}^2}} \end{aligned}$$

- Note

S = Maximum power density(mW/cm²)

EIRP = Equivalent Isotropic Radiated Power(mW)

R = Distance to the center of the radiation of the antenna(20cm)

- Requirement = 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 : LTE Band 25

- Frequency range : 1855 MHz ~ 1910 MHz
- Maximum antenna gain(PK): 3.14 dBi
- EIRP calculation using target power and tolerance
 - Target power : 19 dBm \pm 1 dB (Max. 20 dBm & Min. 18 dBm)
 - $\text{EIRP} = \text{Target power} + \text{positive tolerance} + \text{Maximum antenna peak gain(dB)}$ 23.14 dBm
- Measured EIRP : 20.99 dBm
 - Measured conducted output power 19.17 dBm
 - Max. EIRP : 21.82 dBm
 - (Max. EIRP = Measured EIRP + (Target power + Positive tolerance - Measured conducted output power)

$$\text{Maximum EIRP} = 23.14 \text{ dBm} = 206.063 \text{ mW}$$

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

$$\begin{aligned} S &= \text{EIRP} / (4 R^2 \pi) \\ &= 206.063 / (4 \times 20^2 \times \pi) \\ &= 0.040995 \text{ mW/cm}^2 \end{aligned}$$

- Note

S = Maximum power density(mW/cm²)

EIRP = Equivalent Isotropic Radiated Power(mW)

R = Distance to the center of the radiation of the antenna(20cm)

- Requirement = **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 1x

- Frequency range : 824.70 MHz ~ 848.31 MHz
- Maximum antenna gain(PK): 0.81 dBi
- EIRP calculation using target power and tolerance**
 - Target power : 23 dBm ± 1 dB (Max. 24 dBm & Min. 22 dBm)
 - EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB) 24.81 dBm**
- Measured ERP : 24.66 dBm**
 - Conversion EIRP = Measured ERP + 2.1 = 26.81 dBm
 - Measured conducted output power 23.82 dBm
 - Max. EIRP : 24.84 dBm**

(Max. EIRP = Conversion EIRP + (Target power + Positive tolerance - Measured conducted output power))

$$\boxed{\text{Maximum EIRP} = 24.84 \text{ dBm} = 304.79 \text{ mW}}$$

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**

$$\begin{aligned}
 S &= \text{EIRP} / (4 R^2 \pi) \\
 &= 304.790 / (4 \times 20^2 \times \pi) \\
 &= \underline{\underline{0.060637 \text{ mW/cm}^2}}
 \end{aligned}$$

Note

S = Maximum power density(mW/cm^2)
EIRP = Equivalent Isotropic Radiated Power(mW)
R = Distance to the center of the radiation of the antenna(20cm)

- Requirement = 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): 3.27 dBi
- EIRP calculation using target power and tolerance
 - Target power : 23 dBm ± 1 dB (Max. 24 dBm & Min. 22 dBm)
 - EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB) 27.27 dBm
- Measured EIRP : 25.15 dBm
 - Measured conducted output power 23.93 dBm
 - Max. EIRP : 25.22 dBm
 - (Max. EIRP = Measured EIRP + (Target power + Positive tolerance - Measured conducted output power)

$$\boxed{\text{Maximum EIRP} = 27.27 \text{ dBm} = 533.335 \text{ mW}}$$

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

$$\begin{aligned} S &= \text{EIRP} / (4 R^2 \pi) \\ &= 533.335 / (4 \times 20^2 \times \pi) \\ &= \underline{\underline{0.106104 \text{ mW/cm}^2}} \end{aligned}$$

- Note

S = Maximum power density(mW/cm²)

EIRP = Equivalent Isotropic Radiated Power(mW)

R = Distance to the center of the radiation of the antenna(20cm)

- Requirement = 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): 1.23 dBi
- EIRP calculation using target power and tolerance**
 - Target power : 23 dBm ± 1 dB (Max. 24 dBm & Min. 22 dBm)
 - EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB) 25.23 dBm**
- Measured ERP : 23.44 dBm**
 - Conversion EIRP = Measured ERP + 2.1 = 25.59 dBm
 - Measured conducted output power 23.25 dBm
 - Max. EIRP : 24.19 dBm**

(Max. EIRP = Conversion EIRP + (Target power + Positive tolerance - Measured conducted output power))

$$\boxed{\text{Maximum EIRP} = 25.23 \text{ dBm} = 333.427 \text{ mW}}$$

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**

$\begin{aligned} S &= \text{EIRP} / (4 R^2 \pi) \\ &= 333.427 / (4 \times 20^2 \times \pi) \\ &= 0.066334 \text{ mW/cm}^2 \end{aligned}$	Note $S = \text{Maximum power density}(\text{mW/cm}^2)$ $\text{EIRP} = \text{Equivalent Isotropic Radiated Power}(\text{mW})$ $R = \text{Distance to the center of the radiation of the antenna}(20\text{cm})$
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Note

$S = \text{Maximum power density}(\text{mW/cm}^2)$

$\text{EIRP} = \text{Equivalent Isotropic Radiated Power}(\text{mW})$

$R = \text{Distance to the center of the radiation of the antenna}(20\text{cm})$

- Requirement = 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): 3.14 dBi
- EIRP calculation using target power and tolerance
 - Target power : 21 dBm ± 1.5 dB (Max. 22.5 dBm & Min. 19.5 dBm)
 - EIRP = Target power + positive tolerance + Maximum antenna peak gain(dB) 25.64 dBm
- Measured EIRP : 23.54 dBm
 - Measured conducted output power 22.26 dBm
 - Max. EIRP : 23.78 dBm
 - (Max. EIRP = Measured EIRP + (Target power + Positive tolerance - Measured conducted output power)

$$\boxed{\text{Maximum EIRP} = 25.64 \text{ dBm} = 366.438 \text{ mW}}$$

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

$$\begin{aligned} S &= \text{EIRP} / (4 R^2 \pi) \\ &= 366.438 / (4 \times 20^2 \times \pi) \\ &= \underline{0.072901} \text{ mW/cm}^2 \end{aligned}$$

- Note

S = Maximum power density(mW/cm²)

EIRP = Equivalent Isotropic Radiated Power(mW)

R = Distance to the center of the radiation of the antenna(20cm)

- Requirement = 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 : 21.42 dBm
- Target Power & Tolerance : 21.00 dBm \pm 1.5 dB (Max. 22.5 dBm & Min. 19.5 dBm)
- Maximum antenna peak gain : 1.73 dBi
- **Maximum output power for the calculation** 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 device. The MPE calculation for this exposure is shown below.

$ \begin{aligned} \text{▪ EIRP} &= P + G \\ &= 22.50 \text{ dBm} + 1.73 \text{ dBi} \\ &= \mathbf{24.23 \text{ dBm} = 264.851 \text{ mW}} \end{aligned} $	- Note P = Power input to the antenna(dBm) G = Power gain of the antenna(dBi)
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- Power density at the specific separation

$ \begin{aligned} \text{▪ S} &= \text{EIRP} / (4 R^2 \pi) \\ &= \mathbf{264.851} / (4 \times 20^2 \times \pi) \\ &= \mathbf{0.052691 \text{ mW/cm}^2} \end{aligned} $	- Note S = Maximum power density(mW/cm ²) EIRP = Equivalent Isotropic Radiated Power(mW) R = Distance to the center of the radiation of the antenna(20cm)
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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/cm².

MPE Calculations(WLAN: 802.11g)

- Frequency range : 2412 MHz ~ 2462 MHz
- Measured RF output power : 24.01 dBm
- Target Power & Tolerance : 23.00 dBm \pm 1.5 dB (Max. 24.5 dBm & Min. 21.5 dBm)
- Maximum antenna peak gain : 1.73 dBi
- **Maximum output power for the calculation** 24.50 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the device. The MPE calculation for this exposure is shown below.

$ \begin{aligned} \text{▪ EIRP} &= P + G \\ &= 24.50 \text{ dBm} + 1.73 \text{ dBi} \\ &= \mathbf{26.23 \text{ dBm} = 419.759 \text{ mW}} \end{aligned} $	- Note P = Power input to the antenna(dBm) G = Power gain of the antenna(dBi)
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- Power density at the specific separation

$ \begin{aligned} \text{▪ S} &= \text{EIRP} / (4 R^2 \pi) \\ &= \mathbf{419.759} / (4 \times 20^2 \times \pi) \\ &= \mathbf{0.083509 \text{ mW/cm}^2} \end{aligned} $	- Note S = Maximum power density(mW/cm ²) EIRP = Equivalent Isotropic Radiated Power(mW) R = Distance to the center of the radiation of the antenna(20cm)
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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/cm².

MPE Calculations(WLAN: 802.11n HT20)

- Frequency range : 2412 MHz ~ 2462 MHz
- Measured RF output power : 25.34 dBm
- Target Power & Tolerance : 24.50 dBm \pm 1.5 dB (Max. 26 dBm & Min. 23 dBm)
- Maximum antenna peak gain : 1.73 dBi
- **Maximum output power for the calculation** 26.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the device. The MPE calculation for this exposure is shown below.

$ \begin{aligned} \text{▪ EIRP} &= P + G \\ &= 26.00 \text{ dBm} + 1.73 \text{ dBi} \\ &= \mathbf{27.73 \text{ dBm} = 592.926 \text{ mW}} \end{aligned} $	- Note P = Power input to the antenna(dBm) G = Power gain of the antenna(dBi)
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- Power density at the specific separation

$ \begin{aligned} \text{▪ S} &= \text{EIRP} / (4 R^2 \pi) \\ &= \mathbf{592.926} / (4 \times 20^2 \times \pi) \\ &= \mathbf{0.117959} \text{ mW/cm}^2 \end{aligned} $	- Note S = Maximum power density(mW/cm ²) EIRP = Equivalent Isotropic Radiated Power(mW) R = Distance to the center of the radiation of the antenna(20cm)
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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/cm².

MPE Calculations(WLAN: 802.11n HT40)

- Frequency range : 2422 MHz ~ 2452 MHz
- Measured RF output power : 25.29 dBm
- Target Power & Tolerance : 24.50 dBm \pm 1.5 dB (Max. 26 dBm & Min. 23 dBm)
- Maximum antenna peak gain : 1.73 dBi
- **Maximum output power for the calculation** 26.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the device. The MPE calculation for this exposure is shown below.

$ \begin{aligned} \text{▪ EIRP} &= P + G \\ &= 26.00 \text{ dBm} + 1.73 \text{ dBi} \\ &= \mathbf{27.73 \text{ dBm} = 592.926 \text{ mW}} \end{aligned} $	- Note P = Power input to the antenna(dBm) G = Power gain of the antenna(dBi)
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- Power density at the specific separation

$ \begin{aligned} \text{▪ S} &= \text{EIRP} / (4 R^2 \pi) \\ &= \mathbf{592.926} / (4 \times 20^2 \times \pi) \\ &= \mathbf{0.117959} \text{ mW/cm}^2 \end{aligned} $	- Note S = Maximum power density(mW/cm ²) EIRP = Equivalent Isotropic Radiated Power(mW) R = Distance to the center of the radiation of the antenna(20cm)
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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/cm².

RF Exposure Compliance for simultaneous operations

- Configurations for simultaneous operations

- Configuration 1:** LTE + CDMA 1x + 2.4GHz WLAN
- Configuration 2:** CDMA EVDO + CDMA 1x + 2.4GHz WLAN
- Configuration 3:** LTE + 2.4GHz WLAN
- Configuration 4:** CDMA EVDO + 2.4GHz WLAN
- Configuration 5:** CDMA 1x + 2.4GHz WLAN

Note: Above configuration was declared from applicant.

- Result :

RF function	LTE			CDMA EVDO		CDMA 1x		802.11b	802.11g	802.11n (HT20)	802.11n (HT40)	Total Power Density (mW/cm ²)
Band	Band 13	Band 4	Band 25	Cellular	PCS	Cellular	PCS	2.4GHz	2.4GHz	2.4GHz	2.4GHz	
Power Density (mW/cm ²)	0.036119	0.044539	0.040995	0.066334	0.072901	0.060637	0.106104	0.052691	0.083509	0.117959	0.117959	
Configuration 1		O 0.044539					O 0.106104				O 0.117959	0.268602
Configuration 2					O 0.072901		O 0.106104				O 0.117959	0.296964

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

And the worst case configuration is calculated.