Radio frequency exposure

LIMIT

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

EUT Specification

EUT	Industrial Cellular Router
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.725GHz ~ 5.850GHz ☒ HSDPA/HSUPA: 826.4 – 846.6 MHz, 1852.4 – 1907.6 MHz
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)

Antenna diversity	☒ Single antenna
	 ☐ Multiple antennas
	    ☐ Tx diversity
	    ☐ Rx diversity
	    ☐ Tx/Rx diversity

Max. output power	HSDPA 850, CH 4183, Frequency 836.6 Mhz:21.89dBm HSDPA 1900,CH9400, Frequency 1880 Mhz:22.38dBm
Antenna gain (Max)	3.0dBi(Numeric gain:1.995)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A

Remark:

1. *The maximum output power is 21.89dBm (154.52mW) at 836.6 MHz (with numeric 1.995 antenna gain).*
2. *The maximum output power is 22.38 dBm (172.98 mW) at 1880 MHz (with numeric 1.995 antenna gain).*
3. *DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.*
4. *For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.*

TEST RESULTS

No non-compliance noted.

Calculation

Given $\quad E = \dfrac{\sqrt{30 \times P \times G}}{d}$ & $S = \dfrac{E^2}{3770}$

> *Where* $\quad$ *E = Field strength in Volts / meter*
> *P = Power in Watts*
> *G = Numeric antenna gain*
> *d = Distance in meters*
> *S = Power density in milliwatts / square centimeter*

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

> *P (mW) = P (W) / 1000 and*
> *d (cm) = d(m) / 100*

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \qquad \textbf{\textit{Equation 1}}$$

> *Where* $\quad$ *d = Distance in cm*
> *P = Power in mW*
> *G = Numeric antenna gain*
> *S = Power density in mW / cm²*

Maximum Permissible Exposure

For 850 MHz

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
HSDPA	836.6	21.89	3.00	20	0.061	1

NOTE:

Total(Chain0+Chain1) , the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

For 1900 MHz

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
HSDPA	1880	22.38	3.00	20	0.069	1

NOTE:

Total(Chain0+Chain1) , the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density