Prediction of MPE

The device is designed as module to be installed in other devices. This device is to be used only for fixed and mobile applications. If the final product after integration is intended for portable use, a new application and FCC is required.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE) and Health Canada Safety Code 6, Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm^2)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

Based on the above table the limits are:

For 850 MHz frequency band device: 0.57 mW/cm2
For 1700 /1900 MHz frequency band device: 1 mW/cm2

FCC § 2.1091 / IC RSS102, section 2.5.2
The limit for 850 MHz mobile operations where no routine evaluation is required is: 1.5W ERP
The limit for 1700 / 1900 MHz mobile operations where no routine evaluation is required is: 3W EIRP

Max permissive power according to §24.232 and RSS133: 2W EIRP
Max permissive power according to §§22.913(a) and RSS132: 7W ERP

Using the equation from page 19 of OET Bulletin 65, Edition 97-01:

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (in appropriate units, e.g. mW/cm2)
 P = power input to the antenna (in appropriate units, e.g., mW)
 G = power gain of the antenna in the direction of interest relative to an isotropic radiator
 R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

850 MHz frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (W)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)
GPRS	32,67	1,849	50%	925
EDGE	27,3	0,537	50%	269
WCDMA	23,15	0,207	100%	207

P	Maximum power input to the antenna:	925	mW
R	Distance:	20	cm
S	MPE limit for uncontrolled exposure:	0,57	mW/cm^2

G$_1$	Antenna gain (dBi) to comply with MPE limits:	**4,91**	dBi

ERP power limit according to §2.1091:	1,50	W ERP

G$_2$	Antenna gain (dBi) to comply with ERP limits:	**4,25**	dBi

(ERP[dB] = Maximum conducted output power [dB]x Antenna gain [dBi]-2,15)

ERP power limit according to §22.913:	7,00	W ERP

G$_3$	Antenna gain (dBi) to comply with ERP limits:	**7,93**	dBi

(ERP = Maximum conducted output power x Antenna gain / 1,64)

G$_{850\ MHz\ band}$	Min (G$_1$, G$_2$, G$_3$)		**4,25**	dBi

Therefore the maximum antenna gain for mobile operation to comply with MPE and ERP limits shall not exceed: 4,25 dBi

1900 MHz frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (W)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)
GPRS	30,27	1,064	50%	532
EDGE	26,47	0,444	50%	222
WCDMA	23,73	0,236	100%	236

P	Maximum power input to the antenna:	532	mW
R	Distance:	20	cm
S	MPE limit for uncontrolled exposure:	1,00	mW/cm^2

G_1	Antenna gain (dBi) to comply with MPE limits:	**9,75**	dBi

	ERP power limit according to §2.1091:	3,00	W ERP

G_2	Antenna gain (dBi) to comply with ERP limits:	**9,66**	dBi

(ERP[dB] = Maximum conducted output power [dB]x Antenna gain [dBi]-2,15)

	ERP power limit according to §24.232	2,00	W EIRP

G_3	Antenna gain (dBi) to comply with EIRP limits:	**2,74**	dBi

(EIRP = Maximum conducted output power x Antenna gain)

$G_{1900\ MHz\ band}$	Min (G_1, G_2, G_3)		2,74	dBi

Therefore the maximum antenna gain for mobile operation to comply with MPE and EIRP limits shall not exceed:

2,74 dBi