Federal Communication Commission
Equipment Authorization Division, Application Processing Branch
7435 Oakland Mills Road
Columbia, MD 21048

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TO WHOM IT MAY CONCERN

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), 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/cm^2
For 1700 /1900 MHz frequency band device: 1 mW/cm^2

§ 2.1091:
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 ERP

Max permissive power according to §24.232 : 2W EIRP
Max permissive power according to §27.50 : 1W EIRP
Max permissive power according to §§22.913 (a): 7W EIRP

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/cm^2)
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)

Compliance with MPE limits can be guaranteed as the calculation below shows:

850 MHz frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (mW)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)
GPRS	32,2 dBm	1660	50%	830
EDGE	27.8 dBm	603	50%	302
WCDMA	22.1 dBm	163	100%	163
HSDPA	22.0 dBm	159	100%	159
HSUPA	22.0 dBm	159	100%	159

P	Maximum power input to the antenna:	830	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:	5,4	dBi
ERP power limit according to §2.1091:		1,5	W ERP
G_2	Antenna gain (dBi) to comply with ERP limits: (ERP = Maximum conducted output power x Antenna gain / 1,64)	4.7	dBi
ERP power limit according to §22.913:		7	W ERP
G_3	Antenna gain (dBi) to comply with ERP limits: (ERP = Maximum conducted output power x Antenna gain / 1,64)	11.4	dBi
$G_{850\ MHz\ band}$	Min (G_1, G_2, G_3)	4.7	dBi

Therefore the maximum antenna gain for mobile operation to comply with MPE and ERP limits shall not exceed **4.7 dBi**.

1900 MHz frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (mW)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)
GPRS	29.5 dBm	892	50%	446

EDGE	27.1 dBm	513	50%	257

P	Maximum power input to the antenna:	446	mW
R	Distance:	20	cm
S	MPE limit for uncontrolled exposure:	1	mW/cm^2
G_1	Antenna gain (dBi) to comply with MPE limits:	18.4	dBi
	EIRP power limit according to §2.1091:	3	W ERP
G_2	Antenna gain (dBi) to comply with ERP limits: (ERP = Maximum conducted output power x Antenna gain / 1,64)	10.8	dBi
	ERP power limit according to §24.232:	2	W EIRP
G_3	Antenna gain (dBi) to comply with ERP limits: (ERP = Maximum conducted output power x Antenna gain)	6.5	dBi
$G_{1900\ MHz\ band}$	Min (G_1, G_2, G_3)	6.5	dBi

Therefore the maximum antenna gain for mobile operation to comply with MPE and ERP limits shall not exceed **6.5 dBi**.

1700 MHz frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (mW)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)
WCDMA	23 dBm	200	100%	200
HSDPA	23 dBm	200	100%	200
HSUPA	22.7 dBm	187	100%	187

P	Maximum power input to the antenna:	200	mW
R	Distance:	20	cm
S	MPE limit for uncontrolled exposure:	1	mW/cm^2
G_1	Antenna gain (dBi) to comply with MPE limits:	14	dBi
	ERP power limit according to §2.1091:	3	W ERP
G_2	Antenna gain (dBi) to comply with ERP limits: (ERP = Maximum conducted output power x Antenna gain / 1,64)	13.9	dBi
	ERP power limit according to §27.50:	1	W EIRP

G_3	Antenna gain (dBi) to comply with ERP limits: (ERP = Maximum conducted output power x Antenna gain)	7	dBi
$G_{1900\ MHz\ band}$	Min (G_1, G_2, G_3)	7	dBi

Therefore the maximum antenna gain for mobile operation to comply with MPE and ERP limits shall not exceed **7 dBi**.

SIGNATURE

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