Maximum Permissible Exposure (MPE)

Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section Part 22, subpart H and Part 24, subpart E of the FCC CFR 47 Rules. For 47 CFR 1.1310 Radio frequency Radiation Exposure requirement.

Special Accessories

Not available for this EUT intended for grant.

Equipment Modifications

Not available for this EUT intended for grant.

Limitation

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

Maximum Permissible Exposure (MPE) Evaluation

In this application we seek approval to the 3G Data Module. Based on the FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, we have concluded that the SIM340 module will comply with the FCC rules on RF exposure for mobile devices in cellular band and PCS band. The following analysis will demonstrate such compliance. The analysis will be done in two US bands.

Operation in GPRS 850 band (824 – 850 MHz)

The ERP of 3G Data Module in cellular band is31.95dBm max atGPRS mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
GSM 850	824.20	128	E2	V	119.41	33.02	-7.87	3.62	21.52	38.40
				H	129.72	43.45	-7.87	3.62	31.95	38.40
	836.60	190	E2	V	119.94	33.69	-7.88	3.65	22.16	38.40
				H	129.32	43.09	-7.88	3.65	31.56	38.40
	848.80	251	E2	V	119.94	33.82	-7.88	3.68	22.26	38.40
				H	129.30	43.11	-7.88	3.68	31.55	38.40

ERP = 31.95 dBm

EIRP = 31.95 + 2.14 = 34.09dBm = 2564 mW

Power Density = ERP*Duty Cycle/($4\pi R^2$)

=2564*0.25/(4* π *20^2) = 0.51045 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 824/1500 = 0.55 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in cellular band is compliant with the FCC rules on RF exposure.

Operation in GPRS 1900 band (1850 – 1910 MHz)

The EIRP of 3G Data Module in GPRS 1900 band is 25.53 dBm max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
GPRS 1900	1850.20	512	E2	V	117.05	12.66	9.90	5.56	17.00	33.00
				H	125.18	21.00	9.90	5.56	25.34	33.00
	1880.00	661	E2	V	118.12	13.76	9.99	5.61	18.14	33.00
				H	124.98	20.84	9.99	5.61	25.21	33.00
	1909.80	810	E2	V	118.50	14.17	10.08	5.66	18.59	33.00
				H	125.22	21.11	10.08	5.66	25.53	33.00

EIRP = 25.53 dBm = 357.3 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

=357.3*0.25/($4*\pi*20^2$) = 0.0711 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

Operation in EDGE 850 band (824~850 MHz)

The EIRP of 3G Data Module in EDGE 850 band is 29.68 dBm max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
EDGE 850	824.20	128	E2	V	116.77	30.38	-7.87	3.62	18.88	38.40
				H	127.45	41.18	-7.87	3.62	29.68	38.40
	836.60	190	E2	V	115.62	29.37	-7.88	3.65	17.84	38.40
				H	127.08	40.85	-7.88	3.65	29.32	38.40
	848.80	251	E2	V	116.02	29.90	-7.88	3.68	18.34	38.40
				H	126.94	40.75	-7.88	3.68	29.19	38.40

EIRP = 29.68 dBm = 929 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

=929*0.25/($4*\pi*20^2$) = 0.18491 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

Operation in EDGE 1900 band (1850 – 1910 MHz)

The EIRP of 3G Data Module in EDGE 1900 band is 23.26 dBm. max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
EDGE 1900	1850.20	512	E2	V	116.23	11.84	9.90	5.56	16.18	33.00
				H	123.10	18.92	9.90	5.56	23.26	33.00
	1880.00	661	E2	V	114.80	10.44	9.99	5.61	14.82	33.00
				H	121.86	17.72	9.99	5.61	22.09	33.00
	1909.80	810	E2	V	115.81	11.48	10.08	5.66	15.90	33.00
				H	122.56	18.45	10.08	5.66	22.87	33.00

EIRP = 23.26 dBm = 211.8 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

=211.8*0.25/($4*\pi*20^2$) = 0.04216 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

Operation in WCDMA band II (1850 – 1910 MHz)

The EIRP of 3G Data Module in WCDMA band II band is 18.70 dBm. max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
WCDMA BAND II	1852.40	9262	E2	V	111.66	7.28	9.90	5.56	11.61	33.00
				H	118.54	14.36	9.90	5.56	18.70	33.00
	1880.00	9400	E2	V	111.58	7.22	9.99	5.61	11.60	33.00
				H	118.23	14.09	9.99	5.61	18.46	33.00
	1907.60	9538	E2	V	111.64	7.31	10.07	5.66	11.72	33.00
				H	118.15	14.04	10.07	5.66	18.45	33.00

EIRP = 18.70 dBm = 74.1 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

$=74.1*0.25/(4*\pi*20^2) = 0.01476$ mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

Operation in HSUPA band II (1850 – 1910 MHz)

The EIRP of 3G Data Module in HSUPA band II is 19.98 dBm. max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
HSUPA BAND II	1852.40	9262	E2	V	112.12	7.74	9.90	5.56	12.07	33.00
				H	119.17	14.99	9.90	5.56	19.33	33.00
	1880.00	9400	E2	V	112.79	8.43	9.99	5.61	12.81	33.00
				H	119.25	15.11	9.99	5.61	19.48	33.00
	1907.60	9538	E2	V	112.98	8.65	10.07	5.66	13.06	33.00
				H	119.68	15.57	10.07	5.66	19.98	33.00

EIRP = 19.98 dBm = 99.5 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

=99.5*0.25/(4* π *20^2) = 0.01936 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

Operation in WCDMA band V(824 – 850 MHz)

The EIRP of 3G Data Module in WCDMA band V is 22.48 dBm. max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
WCDMA BAND V	826.40	4132	E2	V	111.22	24.86	-10.02	3.63	11.21	38.40
				H	121.46	35.20	-10.02	3.63	21.56	38.40
	836.60	4183	E2	V	111.34	25.08	-10.02	3.65	11.41	38.40
				H	122.38	36.15	-10.02	3.65	22.48	38.40
	846.60	4233	E2	V	110.75	24.60	-10.02	3.67	10.91	38.40
				H	121.78	35.58	-10.02	3.67	21.89	38.40

EIRP = 22.48dBm = 177.01 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

= 177.01*0.25/($4*\pi*20^2$) = 0.03523 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

Operation in HSUPA band V (824 – 850 MHz)

The EIRP of 3G Data Module in HSUPA band V is 23.48 dBm. max. The resulted EIRP can be expressed as follows:

EUT Mode	Frequency (MHz)	CH	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
HSUPA BAND V	826.40	4132	E2	V	112.15	25.79	-10.02	3.63	12.14	38.40
				H	122.37	36.11	-10.02	3.63	22.47	38.40
	836.60	4183	E2	V	112.35	26.09	-10.02	3.65	12.42	38.40
				H	123.38	37.15	-10.02	3.65	23.48	38.40
	846.60	4233	E2	V	111.70	25.55	-10.02	3.67	11.86	38.40
				H	122.65	36.45	-10.02	3.67	22.76	38.40

EIRP = 23.48 dBm = 222.84 mW

Power Density = EIRP*Duty Cycle/($4\pi R^2$)

=222.84*0.25/(4* π *20^2) = 0.04436 mW/cm^2

where Duty Cycle is 0.25 for GSM/GPRS operation (class 10) and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore 3G Data Module in PCS band is compliant with the FCC rules on RF exposure.

End of Report ~