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. And RSS-102 issue 4 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

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	$280/f$	$2.19/f$	-	6
10-30	28	$2.19/f$	-	6
30-300	28	0.073	2^*	6
300-1500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	$f/150$	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000/f^{1.2}$

Note: f is frequency in MHz.

* Power density limit is applicable at frequencies greater than 100 MHz.

Maximum Permissible Exposure (MPE) Evaluation

In this application we seek approval to the MO6092. Based on the FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, we have concluded that the MC55i 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 cellular band (824 – 849 MHz)

The ERP of MO6092 in cellular band is 31.81dBm max at GSM/GPRS 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 (dBi)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
GPRS 850 (Class 12)	824.20	128	E2	V	115.61	29.22	-7.87	3.62	17.72	38.45
				H	125.29	39.02	-7.87	3.62	27.52	38.45
	836.60	190	E2	V	107.33	21.08	-7.88	3.65	9.55	38.45
				H	125.83	39.60	-7.88	3.65	28.07	38.45
	848.80	251	E2	V	108.09	21.97	-7.88	3.68	10.41	38.45
				H	129.56	43.37	-7.88	3.68	**31.81**	38.45

ERP = 31.81 dBm = 1517.05 mW

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

=1517.05*0.5/(4* π *20^2) = 0.1509 mW/cm^2

where Duty Cycle is 0.5 for GPRS operation (class 12) 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 MO6092 in cellular band is compliant with the FCC rules on RF exposure.

Operation in PCS band (1850 – 1910 MHz)

The EIRP of MO6092 in PCS band is 28.79 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	112.12	7.73	9.90	5.56	12.07	33.00
				H	127.91	23.73	9.90	5.84	27.79	33.00
	1880.00	661	E2	V	115.06	10.70	9.99	5.61	15.08	33.00
				H	128.05	23.91	9.99	5.61	28.28	33.00
	1909.80	810	E2	V	114.81	10.48	10.08	5.66	14.90	33.00
				H	128.48	24.37	10.08	5.66	**28.79**	33.00

EIRP = 28.79 dBm = 756.83 mW

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

=756.83*0.5/(4*π*20^2) = 0.0753 mW/cm^2

where Duty Cycle is 0. 5 for GPRS operation (class 12) 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 MO6092 in PCS band is compliant with the FCC rules on RF exposure.

Operation in WCDMA band II (1850 – 1910 MHz)

The ERP of MO6092 in cellular band is 24.42dBm max at WCDMA II 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 (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
WCDMA II	1852.40	9262	E2	V	111.43	6.91	9.48	5.33	11.05	33.00
				H	124.51	20.18	9.90	5.84	24.24	33.00
	1880.00	600	E2	V	112.48	7.98	9.54	5.36	12.15	33.00
				H	124.56	20.25	9.54	5.36	**24.42**	33.00
	1908.75	1175	E2	V	112.92	8.44	9.61	5.40	12.64	33.00
				H	124.06	19.77	9.61	5.40	23.98	33.00

ERP = 24.42 dBm = 276.69 mW

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

=345.14*1/(4* π *20^2) = 0.0550 mW/cm^2

where Duty Cycle is 1 for HSUPA band II mode 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 MO6092 in cellular band is compliant with the FCC rules on RF exposure.

Operation in HSUPA band V (826 – 849 MHz)

The EIRP of MO6092 in PCS band is 24.14dBm. 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 V	826.40	4132	E2	V	106.90	20.54	-7.88	3.63	9.03	38.45
				H	121.16	34.90	-7.88	3.63	23.40	38.45
	1880.00	600	E2	V	105.73	19.47	-7.88	3.65	7.94	38.45
				H	121.90	35.67	-7.88	3.65	**24.14**	38.45
	1908.75	1175	E2	V	106.48	20.33	-7.88	3.67	8.78	38.45
				H	121.80	35.60	-7.88	3.67	24.05	38.45

EIRP = 24.14 dBm = 259.418 mW

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

=259.418*1/(4* π *20^2) = 0.0516 mW/cm^2

where Duty Cycle is 1 for HSUPA band V mode 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 = 826.4/1500 = 0.55 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore MO6092 in PCS band is compliant with the FCC rules on RF exposure.

Operation in cellular band (824 – 849 MHz)

The ERP of MO6092 in cellular band is 26.04dBm max at CDMA2000 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 (dBi)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
CDMA 2000 Cellular	824.70	1013	E2	V	113.39	27.03	-7.88	3.63	15.52	38.45
				H	123.44	37.18	-7.88	3.63	25.68	38.45
	836.52	384	E2	V	113.79	27.53	-7.88	3.65	16.00	38.45
				H	123.80	37.57	-7.88	3.65	**26.04**	38.45
	848.31	777	E2	V	111.95	25.80	-7.88	3.67	14.25	38.45
				H	122.67	36.47	-7.88	3.67	24.92	38.45

ERP = 26.04dBm = 401.791mW

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

=401.791*1/($4*\pi*20^2$) = 0.0799 mW/cm^2

where Duty Cycle is 1 for CDMA operation 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 MO6092 in cellular band is compliant with the FCC rules on RF exposure.

Operation in PCS band (1850 – 1910 MHz)

The EIRP of MO6092 in PCS band is27.58dBm. 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)
CDMA 2000 PCS	1851.25	25	E2	V	112.38	8.00	9.90	5.56	12.33	33.00
				H	119.33	15.15	9.90	5.84	19.21	33.00
	1880.00	600	E2	V	114.30	9.94	9.99	5.61	14.32	33.00
				H	127.35	23.21	9.99	5.61	**27.58**	33.00
	1908.75	1175	E2	V	112.05	7.72	10.07	5.66	12.13	33.00
				H	125.55	21.44	10.07	5.66	25.85	33.00

EIRP = 27.58 dBm = 572.796 mW

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

=572.796*1/($4*\pi*20^2$) = 0.1140 mW/cm^2

where Duty Cycle is 1 for CDMA2000 operation 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 MO6092 in PCS band is compliant with the FCC rules on RF exposure.