

## 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 and Part 27 subpart C & subpart L 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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>0.5</sup>	0.0042 f <sup>0.5</sup>	f/150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f <sup>1.2</sup>
150000-300000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000/f <sup>1.2</sup>

Note: f is frequency in MHz.

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

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### Maximum Permissible Exposure (MPE) Evaluation

In this application we seek approval to the 1KU2. Based on the FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, we have concluded that the 1KU2 module will comply with the FCC rules on RF exposure for mobile devices in WCDMA band and HSUPA band. The following analysis will demonstrate such compliance. The analysis will be done in two US bands.

#### Operation in HSUPA Band II (1852.40 – 1907.60 MHz)

The EIRP of 1KU2 is 28.12dBm max in HSUPA Band II mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	EIRP	Limit
	MHz		V/H	dBm	dBi	dB	dBm	dBm
HSUPA Band II	1852.40	9262	V	22.83	4.17	-5.49	21.52	33.00
			H	23.34	4.51	-5.49	22.36	33.00
	1880.00	9400	V	28.16	4.14	-5.56	26.74	33.00
			H	21.70	4.44	-5.56	20.58	33.00
	1907.60	9538	V	29.65	4.10	-5.62	<b>28.12</b>	33.00
			H	24.42	4.37	-5.62	23.17	33.00

$$EIRP = 28.12dBm = 648.634mW$$

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

$$= 648.634 * 1 / (4 * \pi * 20^2) = 0.1291\ mW/cm^2$$

where Duty Cycle is 1 for HSUPA Band II 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 1KU2 in HSUPA Band II mode is compliant with the FCC rules on RF exposure.

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Operation in WCDMA Band IV (1712.40 – 1752.60 MHz)

The EIRP of 1KU2 is 25.26dBm max in WCDMA Band IV mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	EIRP	Limit
	MHz		V/H	dBm	dBi	dB	dBm	dBm
WCDMA Band IV	1712.40	1312	V	24.69	4.40	-5.40	23.69	33.00
			H	21.96	4.79	-5.40	21.35	33.00
	1732.60	1413	V	23.57	4.78	-5.42	22.92	33.00
			H	26.34	4.35	-5.42	<b>25.26</b>	33.00
	1752.60	1513	V	23.10	4.31	-5.44	21.97	33.00
			H	22.01	4.77	-5.44	21.34	33.00

$$\text{EIRP} = 25.26 \text{ dBm} = 335.737 \text{ mW}$$

$$\text{Power Density} = \text{EIRP} \cdot \text{Duty Cycle} / (4 \pi R^2)$$

$$= 335.737 \cdot 1 / (4 \cdot \pi \cdot 20^2) = 0.0668 \text{ mW/cm}^2$$

where Duty Cycle is 1 for WCDMA Band IV 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:

$$\text{MPE limit} = 1.0 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore 1KU2 in WCDMA Band IV mode is compliant with the FCC rules on RF exposure.

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Operation in WCDMA Band V (826.40 – 846.60 MHz)

The ERP of 1KU2 is 22.07dBm max in WCDMA Band V mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	ERP	Limit
	MHz		V/H	dBm	dBi	dB	dBm	dBm
WCDMA Band V	826.40	4132	V	21.18	4.00	-4.24	20.94	38.45
			H	21.78	3.99	-4.24	21.54	38.45
	836.60	4183	V	22.32	3.97	-4.22	<b>22.07</b>	38.45
			H	22.28	3.97	-4.22	22.03	38.45
	846.60	4233	V	21.35	4.02	-4.24	21.13	38.45
			H	20.39	4.02	-4.24	20.18	38.45

$$ERP = 22.07 \text{ dBm} = 161.065 \text{ mW}$$

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

$$= 161.065 * 1 / (4 * \pi * 20^2) = 0.0321 \text{ mW/cm}^2$$

where Duty Cycle is 1 for WCDMA Band V 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:

$$\text{MPE limit} = 826.4 / 1500 = 0.55 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore 1KU2 in WCDMA Band V mode is compliant with the FCC rules on RF exposure.

**- End of Report -**

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