



APPENDIX I

RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

EUT Specification

EUT	HSPA+ 3G VPN Router																																									
Model	DWR-755																																									
Frequency band (Operating)	☒ GSM 850MHz: 824.2MHz ~ 848.8MHz ☒ GSM 1900MHz: 1850.2MHz ~ 1909.8MHz ☒ WCDMA Band II: 1852.4MHz ~ 1907.6MHz ☒ WCDMA Band IV: 1712.4MHz ~ 1752.6MHz ☒ WCDMA Band V: 826.4MHz ~ 846.6MHz ☒ Bluetooth 2.1 + EDR / 4.0: 2402 ~ 2480 MHz 802.11b/g/n HT20: 2.412GHz ~ 2.462GHz 802.11n HT40: 2.422GHz ~ 2.452GHz ☐ Others																																									
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others																																									
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)																																									
Antenna Specification	GSM: Antenna Gain : 3.97 dBi (Numeric gain 2.49) WCDMA: Antenna Gain : 4.66 dBi (Numeric gain 2.92) 2.4GHz: Antenna1 Gain : 4.74 dBi (Numeric gain 2.98) 2.4GHz: Antenna2 Gain : 2.97 dBi (Numeric gain 1.98)																																									
Measurement Average output power	<table><tr><th>System</th><th>Power</th><th></th></tr><tr><td>GSM850</td><td>31.70 dBm</td><td>(1479.11 mW)</td></tr><tr><td>GPRS850 (1 slot)</td><td>31.70 dBm</td><td>(1479.11 mW)</td></tr><tr><td>EDGE850 (1 slot)</td><td>26.80 dBm</td><td>(478.63 mW)</td></tr><tr><td>GSM1900</td><td>28.10 dBm</td><td>(645.65 mW)</td></tr><tr><td>GPRS1900 (1 slot)</td><td>28.10 dBm</td><td>(645.65 mW)</td></tr><tr><td>EDGE1900 (1 slot)</td><td>25.30 dBm</td><td>(338.84 mW)</td></tr><tr><td>WCDMA Band II</td><td>25.20 dBm</td><td>(331.13 mW)</td></tr><tr><td>WCDMA Band V</td><td>25.30 dBm</td><td>(338.84 mW)</td></tr><tr><td>IEEE 802.11b Mode</td><td>16.58 dBm</td><td>(45.50 mW)</td></tr><tr><td>IEEE 802.11g Mode</td><td>13.62 dBm</td><td>(23.01 mW)</td></tr><tr><td>IEEE 802.11n HT 20 Mode</td><td>13.95 dBm</td><td>(24.83 mW)</td></tr><tr><td>IEEE 802.11n HT 40 Mode</td><td>11.87 dBm</td><td>(15.38 mW)</td></tr></table>			System	Power		GSM850	31.70 dBm	(1479.11 mW)	GPRS850 (1 slot)	31.70 dBm	(1479.11 mW)	EDGE850 (1 slot)	26.80 dBm	(478.63 mW)	GSM1900	28.10 dBm	(645.65 mW)	GPRS1900 (1 slot)	28.10 dBm	(645.65 mW)	EDGE1900 (1 slot)	25.30 dBm	(338.84 mW)	WCDMA Band II	25.20 dBm	(331.13 mW)	WCDMA Band V	25.30 dBm	(338.84 mW)	IEEE 802.11b Mode	16.58 dBm	(45.50 mW)	IEEE 802.11g Mode	13.62 dBm	(23.01 mW)	IEEE 802.11n HT 20 Mode	13.95 dBm	(24.83 mW)	IEEE 802.11n HT 40 Mode	11.87 dBm	(15.38 mW)
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Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A																																							



Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2014/03/21	Initial Issue	ALL	Scott Hsu



TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P / 1000) \times G}{377 \times (d / 100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \textbf{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

**Maximum Permissible Exposure**

Substituting the MPE safe distance using $d = 20$ cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

GSM850 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
128	824.2	251.189	2.49	20	0.1245	0.549

GPRS850 mode (1 Slot):

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
128	824.2	251.189	2.49	20	0.1245	0.549

EGPRS850 mode (1 Slot):

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
128	824.2	63.096	2.49	20	0.0313	0.549

GSM1900 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
512	1850.2	100.000	2.49	20	0.0496	1.000

GPRS1900 mode (1 Slot):

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
512	1850.2	100.000	2.49	20	0.0496	1.000

EGPRS1900 mode (1 Slot):

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
512	1850.2	50.119	2.49	20	0.0248	1.000

WCDMA Band II mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
9262	1852.4	354.813	2.92	20	0.2062	1.000

WCDMA Band V mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
4132	826.4	354.813	2.92	20	0.2062	0.551

**IEEE 802.11b mode:**

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
1	2412	50.119	2.98	20	0.0297	1

IEEE 802.11g mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
6	2437	25.119	2.98	20	0.0149	1

IEEE 802.11n HT20 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
11	2462	26.915	2.98	20	0.0160	1

IEEE 802.11n HT40 mode:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
6	2437	20.417	2.98	20	0.0121	1



Simultaneously MPE

Simultaneously MPE = MPE1/Limit1 + MPE2/Limit2

2G + WiFi

$$\text{Simultaneously MPE} = (0.1245 \text{ mW/cm}^2 / 1) + (0.0297 \text{ mW/cm}^2 / 1) = 0.1542$$

3G + WiFi

$$\text{Simultaneously MPE} = (0.2062 \text{ mW/cm}^2 / 1) + (0.0297 \text{ mW/cm}^2 / 1) = 0.2359$$