

# **RADIO FREQUENCY RADIATION EXPOSURE REPORT**

## **Mobiles /Fixed Base Station Maximum Permissible Exposure (MPE)**

*OF*

**Product Name:** 3.5G/HSPA WLAN Router

**Brand Name:** BandLuxe

**Model Name:** R250

**Model Different:** N/A

**FCC ID:** UZI-R250

**Report No.:** EH/2009/60026

**Issue Date:** Jun. 30, 2009

**Prepared for:** BandRich Inc.  
7F., No. 188, Baociao Rd., Sindian City, Taipei  
County 23146, Taiwan (R.O.C.)

**Prepared by:** SGS Taiwan Ltd.  
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No. 134, Wu Kung Rd., Wuku Industrial Zone,  
Taipei County, Taiwan.

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## VERIFICATION OF COMPLIANCE

**Applicant:** BandRich Inc.  
7F., No. 188, Baociao Rd., Sindian City,  
Taipei County 23146, Taiwan (R.O.C.)

**Product Name:** 3.5G/HSPA WLAN Router

**Brand Name:** BandLuxe

**FCC ID:** UZI-R250

**Model No.:** R250

**Model Difference:** N/A

**File Number:** EH/2009/60026


**Date of test:** Jun, 11, 2009 ~Jun, 26, 2009

**Date of EUT Received:** Jun, 11, 2009

### We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd., Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091 and RSS102.

The test results of this report relate only to the tested sample identified in this report.

<b>Test By:</b>	 <hr/> <i>Sky Wang / Asst. Supervisor</i>	<b>Date</b>	<hr/> Jun. 30, 2009
<b>Prepared By:</b>	 <hr/> <i>Alex Hsieh / Sr. Engineer</i>	<b>Date</b>	<hr/> Jun. 30, 2009
<b>Approved By:</b>	 <hr/> <i>Jim Chang / Supervisor</i>	<b>Date</b>	<hr/> Jun. 30, 2009

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## Report Version

Version No.	Date	Description
00	Jun. 30, 2009	Initial creation of document
01	Jul. 31, 2009	Revise test data of GPRS/WCDMA EIRP

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## 1. GENERAL INFORMATION

### General:

Product Name:	3.5G/HSPA WLAN Router	
Brand Name:	BandLuxe	
Model Name:	R250	
Model Difference:	N/A	
Power Supply:	12Vdc by AC/DC power adapter	
	Adapter:	Model: DSA-12G-12 FUS 120120, Supplier: DVE

### GSM/WCDMA/HSUPA/HSDPA:

	Operating Frequency	Rated Power	
Cellular Phone Standards Frequency Range and Power:	E-GSM/GPRS, 850, Class 12	824.2 MHz– 848.8 MHz	33 dBm
	E-GSM/GPRS, 900, Class 12	880.2MHz – 914.8MHz	33 dBm
	E-GSM/GPRS, 1800, Class 12	1710.2MHz-1784.8MHz	30 dBm
	E-GSM/GPRS, 1900, Class 12	1850.2MHz -1909.8MHz	30 dBm
	WCDMA/HSUPA/HSDPA Band II	1850MHz – 1910MHz	24 dBm
	WCDMA/HSUPA/HSDPA Band V	880MHz – 915MHz	24 dBm
Type of Emission:	GPRS 850: 245KGXW GPRS 1900 :247KGXW EDGE 850: 248KG7W EDGE 1900:246KG7W WCDMA Band II: 4M17F9W WCDMA Band V:4M16F9W		
Hardware Version:	V00		
Software Version:	N/A		
IMEI:	357112020038248		

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WLAN: 802.11 b/g & 802.11n (20M)

Frequency Range:	2412 – 2462 MHz
Channel number:	11 channels
Transmit Power:	<input checked="" type="checkbox"/> 802.11 b: 15.28 dBm <input checked="" type="checkbox"/> 802.11 g: 14.38 dBm <input checked="" type="checkbox"/> 802.11n (20M): 14.28 dBm
Modulation Technology:	<input checked="" type="checkbox"/> DSSS, <input checked="" type="checkbox"/> OFDM
Modulation type:	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Transition Rate:	802.11 b: 1/2/5.5/11 Mbps; 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11n (20M): 6.5/13/19.5/26/39/52/58.5/65 Mbps
Antenna Designation:	PIFA Antenna, 2dBi.
Type of Emission:	802.11 b/g: 16M3D1D 802.11n (20M): 17M4D1D

802.11n (40M)

Frequency Range:	2422 – 2452 MHz
Channel number:	7 channels
Transmit Power:	<input checked="" type="checkbox"/> 802.11n (40M): 14.36 dBm
Modulation Technology:	<input type="checkbox"/> DSSS, <input checked="" type="checkbox"/> OFDM
Modulation type:	64QAM, 16QAM, QPSK, BPSK for OFDM
Transition Rate:	802.11n (40M): 6.5/13.5/27/40.5/54/81/108/121.5/135 Mbps
Antenna Designation:	PIFA Antenna, 2dBi.
Type of Emission:	35M7D1D

The EUT is compliance with IEEE 802.11 b/g/n Standard.

This report applies for WCDMA/HSDPA/HSUPA Band II / Band V and IEEE 802.11 b/g/n Standard

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### 1.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissible Exposure (MPE)

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

## 1.2 Maximum Permissible Exposure (MPE) Evaluation

### MPE Prediction (802.11b/g)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

Where: S = Power density

P = Power input to antenna

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

2412MHz

Maximum peak output power at antenna input terminal:	15.28	(dBm)
Maximum peak output power at antenna input terminal:	33.72873087	(mW)
Duty cycle:	100	(%)
Maximum Pav :	33.72873087	(mW)
Antenna gain (typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm) distance	0.0106402	(mW/cm <sup>2</sup> )
Measurement Result:		
The predicted power density level at 20 cm is	0.106402142	(W/m <sup>2</sup> )
This is below the uncontrolled exposure limit of 1 mW/cm <sup>2</sup> at	2412	MHz

### Measurement Result

The predicted power density level at 20 cm is 0.106402 W/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2412MHz.

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**MPE Prediction 802.11n (20M)**

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4 \pi R^2$$

Where: S = Power density

P = Power input to antenna

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

The worst case: 802.11n (20M)

Maximum peak output power at antenna input terminal:	14.28	(dBm)
Maximum peak output power at antenna input terminal:	26.79168325	(mW)
Duty cycle:	100	(%)
Maximum Pav :	26.79168325	(mW)
Antenna gain (typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm) distance	0.0084518	(mW/cm <sup>2</sup> )
Measurement Result:		
The predicted power density level at 20 cm is	0.084518225	(W/m <sup>2</sup> )
This is below the uncontrolled exposure limit of 1 mW/cm <sup>2</sup> at	2412	MHz

**Measurement Result**

The predicted power density level at 20 cm is 0.084518 W/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2412MHz.

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**MPE Prediction 802.11n (40M)**

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4 \pi R^2$$

Where: S = Power density

P = Power input to antenna

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

The worst case: 802.11a mode

Maximum peak output power at antenna input terminal:	14.36	(dBm)
Maximum peak output power at antenna input terminal:	27.28977783	(mW)
Duty cycle:	100	(%)
Maximum Pav :	27.28977783	(mW)
Antenna gain (typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2422	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm) distance	0.0086090	(mW/cm <sup>2</sup> )
Measurement Result:		
The predicted power density level at 20 cm is	0.086089536	(W/m <sup>2</sup> )
This is below the uncontrolled exposure limit of 1 mW/cm <sup>2</sup> at	2422	MHz

**Measurement Result**

The predicted power density level at 20 cm is 0.086089 W/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2422MHz.

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### Maximum Permissible Exposure (MPE) Evaluation

In this application we seek modular approval to the R250 GPRS/EDGE/WCDMA band II and band V class12 . Based on the FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, we have concluded that the R250 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 (824.2MHz – 848.8 MHz)

The ERP power of R250 is 32.10dBm at GPRS 850 band. Take the worst case of power density 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)	ERP (dBm)	Limit (dBm)
GPRS 850	824.20	128	H	V	122.74	36.35	-7.87	3.62	24.85	38.45
				H	129.87	43.60	-7.87	3.62	<b>32.10</b>	38.45
			E1	V	129.79	43.40	-7.87	3.62	31.90	38.45
				H	128.41	42.14	-7.87	3.62	30.64	38.45
			E2	V	125.95	39.56	-7.87	3.62	28.06	38.45
				H	128.51	42.24	-7.87	3.62	30.74	38.45
	836.60	190	H	V	121.58	35.33	-7.88	3.65	23.80	38.45
				H	128.18	41.95	-7.88	3.65	30.42	38.45
			E1	V	128.95	42.70	-7.88	3.65	31.17	38.45
				H	128.27	42.04	-7.88	3.65	30.51	38.45
			E2	V	125.15	38.90	-7.88	3.65	27.37	38.45
				H	127.27	41.04	-7.88	3.65	29.51	38.45
	848.80	251	H	V	120.96	34.84	-7.88	3.68	23.28	38.45
				H	127.42	41.23	-7.88	3.68	29.67	38.45
			E1	V	127.18	41.06	-7.88	3.68	29.50	38.45
				H	127.76	41.57	-7.88	3.68	30.01	38.45
			E2	V	124.89	38.77	-7.88	3.68	27.21	38.45
				H	126.45	40.26	-7.88	3.68	28.70	38.45

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$$\text{EIRP} = 32.10 + 2.14 \text{ dBm} = 34.24 \text{ dBm} = 2654.61 \text{ mW}$$

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

$$= 2654.61 * 0.5 / (4 * \pi * 20^2) = 0.264 \text{ mW/cm}^2$$

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:

$$\text{MPE limit} = 824 / 1500 = 0.55 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore R250 in cellular band is compliant with the FCC rules on RF exposure.

**Operation in PCS band (1850.2MHz – 1909.8MHz)**

The peak conducted output power of R250 in PCS band is 27.23 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	H	V	110.40	6.01	9.90	5.56	10.35	33.00
				H	124.64	20.46	9.90	5.56	24.80	33.00
			E1	V	115.40	11.01	9.90	5.56	15.35	33.00
				H	119.04	14.86	9.90	5.56	19.20	33.00
			E2	V	125.24	20.85	9.90	5.56	25.19	33.00
				H	119.16	14.98	9.90	5.84	19.04	33.00
	1880.00	661	H	V	111.31	6.95	9.99	5.61	11.33	33.00
				H	125.71	21.57	9.99	5.61	25.94	33.00
			E1	V	116.13	11.77	9.99	5.61	16.15	33.00
				H	121.89	17.75	9.99	5.61	22.12	33.00
			E2	V	124.95	20.59	9.99	5.61	24.97	33.00
				H	120.21	16.07	9.99	5.61	20.44	33.00
	1909.80	810	H	V	111.95	7.62	10.08	5.66	12.04	33.00
				H	126.92	22.81	10.08	5.66	<b>27.23</b>	33.00
			E1	V	117.14	12.81	10.08	5.66	17.23	33.00
				H	122.11	18.00	10.08	5.66	22.42	33.00
			E2	V	125.89	21.56	10.08	5.66	25.98	33.00
				H	121.28	17.17	10.08	5.66	21.59	33.00

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$$\text{EIRP} = 27.23 \text{ dBm} = 528.45 \text{ mW}$$

$$\begin{aligned} \text{Power Density} &= \text{EIRP} * \text{Duty Cycle} / (4 \pi R^2) \\ &= 528.45 * 0.5 / (4 * \pi * 20^2) = 0.0526 \text{ mW/cm}^2 \end{aligned}$$

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:

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

As we can see the resulted power density is below the MPE limit, therefore R250 in PCS band is compliant with the FCC rules on RF exposure.

**Operation in WCDMA /HSDPA/HSUPA band V (880MHz – 915 MHz)**

The EIRP power of R250 is 24.13dBm at WCDMA band V. Take the worst case of power density 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)	ERP (dBm)	Limit (dBm)
WCDMA Band V	826.40	4132	H	V	114.29	27.93	-7.88	3.63	16.42	38.45
				H	120.46	34.20	-7.88	3.63	22.70	38.45
			E1	V	120.08	33.72	-7.88	3.63	22.21	38.45
				H	119.43	33.17	-7.88	3.63	21.67	38.45
			E2	V	117.01	30.65	-7.88	3.63	19.14	38.45
				H	119.75	33.49	-7.88	3.63	21.99	38.45
	836.60	4183	H	V	115.43	29.17	-7.88	3.65	17.64	38.45
				H	121.83	35.60	-7.88	3.65	24.07	38.45
			E1	V	121.92	35.66	-7.88	3.65	<b>24.13</b>	38.45
				H	121.26	35.03	-7.88	3.65	23.50	38.45
			E2	V	118.96	32.70	-7.88	3.65	21.17	38.45
				H	120.84	34.61	-7.88	3.65	23.08	38.45
	846.60	4233	H	V	115.14	28.99	-7.88	3.67	17.44	38.45
				H	121.73	35.53	-7.88	3.67	23.98	38.45
			E1	V	121.22	35.06	-7.88	3.67	23.51	38.45
				H	121.02	34.82	-7.88	3.67	23.27	38.45
			E2	V	118.92	32.77	-7.88	3.67	21.22	38.45
				H	120.48	34.28	-7.88	3.67	22.73	38.45

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$$\text{EIRP} = 24.13 + 2.14 \text{ dBm} = 26.27 \text{ dBm} = 423.64 \text{ mW}$$

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

$$= 423.64 * 1 / (4 * \pi * 20^2) = 0.0843 \text{ mW/cm}^2$$

where Duty Cycle is 1 for WCDMA 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:

$$\text{MPE limit} = 824 / 1500 = 0.55 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore R250 in WCDMA band V is compliant with the FCC rules on RF exposure.



**Operation in WCDMA /HSDPA/HSUPA band II (1850MHz – 1910MHz)**

The peak conducted output power of module R250 module in WCDMA band II is 24.50 dBm. Take the worst case of power density 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	H	V	108.76	4.38	9.90	5.56	8.71	33.00
				H	123.68	19.50	9.90	5.56	23.84	33.00
			E1	V	118.13	13.75	9.90	5.56	18.08	33.00
				H	121.47	17.29	9.90	5.56	21.63	33.00
			E2	V	123.88	19.50	9.90	5.56	23.83	33.00
				H	118.25	14.07	9.90	5.84	18.13	33.00
	1880.00	9400	H	V	108.54	4.18	9.99	5.61	8.56	33.00
				H	122.77	18.63	9.99	5.61	23.00	33.00
			E1	V	116.95	12.56	9.90	5.56	16.90	33.00
				H	121.12	16.98	9.99	5.61	21.35	33.00
			E2	V	123.89	19.53	9.99	5.61	23.91	33.00
				H	118.72	14.58	9.99	5.61	18.95	33.00
	1907.60	9538	H	V	108.15	3.82	10.07	5.66	8.23	33.00
				H	122.68	18.57	10.07	5.66	22.98	33.00
			E1	V	116.77	12.44	10.07	5.66	16.85	33.00
				H	121.46	17.35	10.07	5.66	21.76	33.00
			E2	V	124.42	20.09	10.07	5.66	<b>24.50</b>	33.00
				H	119.99	15.88	10.07	5.66	20.29	33.00

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$$\text{EIRP} = 24.50\text{dBm} = 281.84\text{mW}$$

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

$$= 281.84 * 1 / (4 * \pi * 20^2) = 0.056 \text{ mW/cm}^2$$

where Duty Cycle is 1 for WCDMA 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:

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

As we can see the resulted power density is below the MPE limit, therefore R250 in WCDMA Band II is compliant with the FCC rules on RF exposure.