



# FCC Maximum Permissible Exposure(MPE) Estimation Report

**Product Name:** Wireless Gateway

**Model:** B68L-54

**Report No.:** SYBH(Z-SAR)004122013-2

**FCC ID:** QISB68L-54

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DATE	2014-01-02	2014-01-02

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※ ※ **Modified History** ※ ※

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## 1 EUT Description

<b>Device Information:</b>			
DUT Name:	Wireless Gateway		
Type Identification:	B68L-54		
Device Type :	Mobile device		
FCC ID:	QISB68L-54		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment/general population		
Hardware Version :	WL1B680I		
Software Version :	V100R001		
Antenna Type :	Internal Antenna		
<b>Device Operating Configurations:</b>			
Supporting Mode(s)	GSM850/1900,UMTS Band II /V, WiFi 2.4G		
Test Modulation	GMSK/8PSK/QPSK/BPSK		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	UTMS Band II	1850-1910	1930-1990
	UTMS Band V	824-849	869-894
	WiFi 2.4G	2400-2483.5	2400-2483.5



## 1.1 General Description

The HUAWEI wireless gateway B68L-54 (hereinafter referred to as the B68L-54) is a wireless HSPA+3G gateway, which provides users with flexible and diversified 3G and 2G data access services, routing function, and network address translation (NAT) function. The WCDMA frequency is Band I/II/V. The GSM/GPRS/EDGE frequency band is Band II/V. The WLAN frequency is 2.4G. And the WLAN frequency range is 2400-2483.5MHz. B68L-54 implements such functions as RF signal receiving/transmitting, HSPA+ / WCDMA / GPRS/EDGE protocol processing, data service, etc. Externally it provides power supply interface, USIM card interface, two auto-sensing Ethernet interfaces and external antenna interface. And RJ11 interface (to connect to fixed telephone), provide voice service.



## 2 Test specification(s)

ANSI Std C95.1-1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010))
KDB 447498 D01	General RF Exposure Guidance v05r01

## 3 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Zone K3,Huawei Industrial Base, Bantian Industry Area, Longgang District, Shenzhen, Guangdong, China
Telephone	+86 755 28780808
Fax	+86 755 89652518
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01

## 4 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

## 5 Application details

Start Date of test	2014-01-02
End Date of test	2014-01-02

## 6 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%



## 7 RF Exposure Requirements

An estimation of MPE in this application for product is used to ensure if it complies to the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

We analysis if it comply with the limits for General population/uncontrolled exposure. The FCC's MPE limits for field strength and power density are given in 47CFR 1.1310(Table below).These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

**Table: Limits For Maximum Permissible Exposure (MPE)**

<b>(A) Limits for Occupational/controlled Exposure</b>				
Frequency Range(MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength(H)(A/m)	Power Density (S)(mW/cm <sup>2</sup> )	Averaging Time (minute) E  <sup>2</sup> , H  <sup>2</sup> or S
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f <sup>2</sup> )*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
<b>(B) Limits for General Population/uncontrolled Exposure</b>				
Frequency Range(MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength(H)(A/m)	Power Density (S)(mW/cm <sup>2</sup> )	Averaging Time (minute) E  <sup>2</sup> , H  <sup>2</sup> or S
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30
f=frequency in MHz			*Plane-wave equivalent power density	

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator



R= distance to the centre of radiation of the antenna

$$\text{EIRP} = P * G$$

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.



## 8 RF Exposure Evaluation

### 8.1 Operation in GSM850

(uplink: 824-849MHz, downlink: 869-894MHz)

Mode	Tune-up limit (dBm)	Gain (dBi)	EIRP* (dBm)	EIRP (mW)	R(cm)	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Conclusion
GSM CS	35.00	1.00	36.00	497.63	20	<b>0.099</b>	0.549	<b>PASS</b>
1TS*(1/8)	29.00	1.00	30.00	125.00	20	0.025	0.549	<b>PASS</b>
2TS*(2/8)	27.00	1.00	28.00	157.74	20	0.031	0.549	<b>PASS</b>
3TS*(3/8)	25.00	1.00	26.00	149.29	20	0.030	0.549	<b>PASS</b>
4TS*(4/8)	23.00	1.00	24.00	125.59	20	0.025	0.549	<b>PASS</b>

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer

According to the Table, we can conclude the max power density level at 20 cm is 0.099mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 0.549mW/cm<sup>2</sup> at 824MHz, so we can conclude it is into compliance.



## 8.2 Operation in GSM1900

(uplink: 1850-1910MHz, downlink: 1930-1990MHz)

Mode	Tune-up limit (dBm)	Gain (dBi)	EIRP* (dBm)	EIRP (mW)	R(cm)	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Conclusion
GSM CS	32.00	1.00	33.00	249.41	20	<b>0.050</b>	1.000	<b>PASS</b>
1TS*(1/8)	29.00	1.00	30.00	125.00	20	0.025	1.000	<b>PASS</b>
2TS*(2/8)	27.00	1.00	28.00	157.74	20	0.031	1.000	<b>PASS</b>
3TS*(3/8)	25.00	1.00	26.00	149.29	20	0.030	1.000	<b>PASS</b>
4TS*(4/8)	23.00	1.00	24.00	125.59	20	0.025	1.000	<b>PASS</b>

Note: \*- based on the maximum tune-up tolerance limit declared by manufacturer

According to the Table, we can conclude the max power density level at 20 cm is 0.050mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 1.0mW/cm<sup>2</sup> at 1850MHz, so we can conclude it is into compliance.



### 8.3 Operation in UMTS Band II

(uplink: 1850-1910MHz, downlink: 1930-1990MHz)

Tune-up limit (dBm)	Gain (dBi)	EIRP* (dBm)	EIRP (mW)	R(cm)	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Conclusion
25.00	1.00	26.00	398.11	20	0.079	1.000	<b>PASS</b>

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer

According to the Table, we can conclude the max power density level at 20 cm is 0.079mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 1.0mW/cm<sup>2</sup> at 1850MHz, so we can conclude it is into compliance.

### 8.4 Operation in UMTS Band V

(uplink: 824-849MHz, downlink: 869-894MHz)

Tune-up limit (dBm)	Gain (dBi)	EIRP* (dBm)	EIRP (mW)	R(cm)	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Conclusion
25.00	1.00	26.00	398.11	20	0.079	0.549	<b>PASS</b>

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer

According to the Table, we can conclude the max power density level at 20 cm is 0.079mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 0.549mW/cm<sup>2</sup> at 824MHz, so we can conclude it is into compliance.

### 8.5 Operation in WLAN 2.4G

(uplink: 2400-2483.5MHz, downlink: 2400-2483.5MHz)

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP* (dBm)	EIRP (mW)	R(cm)	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Conclusion
Antenna 1	18.00	1.50	19.50	89.13	20	0.018	1.000	<b>PASS</b>
Antenna 2	18.00	1.50	19.50	89.13	20	0.018	1.000	<b>PASS</b>

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer

According to the Table, we can conclude the max power density level at 20 cm is 0.018mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit of 1.000mW/cm<sup>2</sup> at 2400MHz, so we can conclude it is into compliance.



## 9 Exposure calculations for multiple sources

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table(A) and Table(B). To comply with the MPE, the fraction of the MPE in terms of  $E^2$ ,  $H^2$  (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

<b>Simultaneous Tx Combination</b>	<b>Configuration</b>
1	WLAN 2.4G MIMO
2	GSM/UMTS + WLAN 2.4G SISO
3	GSM/UMTS + WLAN 2.4G MIMO



**9.1 Estimation for WLAN2.4G MIMO**

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP* (dBm)	EIRP (mW)	R(cm)	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Calculation result	Conclusion
antenna 1	15.00	1.50	16.50	44.67	20	0.009	1.000	0.018	PASS
antenna 2	15.00	1.50	16.50	44.67	20	0.009	1.000		

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer

**9.2 Estimation for GSM850& WLAN2.4G**

No.	Mode	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Calculation result	Conclusion
1	GSM850	0.099	0.549	0.198	PASS
	WLAN 2.4G SISO	0.018	1.000		
2	GSM850	0.099	0.549	0.198	PASS
	WLAN MIMO with Antenna 1	0.009	1.000		
	WLAN MIMO with Antenna 2	0.009	1.000		

**9.3 Estimation for GSM1900& WLAN2.4G**

No.	Mode	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Calculation result	Conclusion
1	GSM1900	0.050	1.000	0.068	PASS
	WLAN SISO	0.018	1.000		
2	GSM1900	0.050	1.000	0.068	PASS
	WLAN MIMO with Antenna 1	0.009	1.000		
	WLAN MIMO with Antenna 2	0.009	1.000		

**9.4 Estimation for UMTS Band II & WLAN2.4G**

No.	Mode	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Calculation result	Conclusion
1	UMTS Band II	0.079	1.000	0.097	PASS
	WLAN SISO	0.018	1.000		
2	UMTS Band II	0.079	1.000	0.097	PASS
	WLAN MIMO with Antenna 1	0.009	1.000		
	WLAN MIMO with Antenna 2	0.009	1.000		

**9.5 Estimation for UMTS Band V & WLAN2.4G**

No.	Mode	S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Calculation result	Conclusion
1	UMTS Band V	0.079	0.549	0.162	PASS
	WLAN SISO	0.018	1.000		
2	UMTS Band V	0.079	0.549	0.162	PASS
	WLAN MIMO with Antenna 1	0.009	1.000		
	WLAN MIMO with Antenna 2	0.009	1.000		

According to the Table above, we can conclude that the calculation results of all simultaneous transmission possibilities are less than 1, so it is into compliance.

Therefore the product also meets the requirements under multiple sources condition.

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