



RF Exposure Evaluation Report

APPLICANT : Hewlett-Packard Company
EQUIPMENT : 802.11 a/b/g/n Wi-Fi + BT combo adapter
BRAND NAME : HP
MODEL NAME : HSTNN-AR01
MARKETING NAME : Broadcom BCM4334 802.11abgn 2x2 Wi-Fi + BT 4.0 Combo Adapter
FCC ID : B94HNAR01
FILING TYPE : Certification
STANDARD : OET Bulletin 65 Supplement C (Edition 01-01)

We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with FCC OET Bulletin 65 Supplement C (Edition 01-01), and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

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FCC ID : B94HNAR01

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA320849	Rev. 01	Initial issue of report	Apr. 25, 2013



1. Administration Data

1.1. Testing Laboratory

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

1.2. Applicant

Company Name	Hewlett-Packard COMPANY
Address	3000 Hanover Street, Palo Alto, California 94304, USA

1.3. Manufacturer

Company Name	AzureWave Technologies (Shanghai) Inc.
Address	No.8 Lane 66, Chenbao Road, Malu Town, Jiading District, Shanghai, 201801, China

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	802.11 a/b/g/n Wi-Fi + BT combo adapter
Brand Name	HP
Model Name	HSTNN-AR01
Marketing Name	Broadcom BCM4334 802.11abgn 2x2 Wi-Fi + BT 4.0 Combo Adapter
FCC ID	B94HNAR01
Tx Frequency	WLAN2.4G: 2412 MHz ~ 2462 MHz WLAN5G: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5700 MHz; 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Antenna Type	WLAN: PIFA Antenna Bluetooth: PIFA Antenna
Uplink Modulation	802.11b: DSSS (BPSK / QPSK / CCK) 802.11a/g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth: GFSK Bluetooth +EDR: $\pi/4$ -DQPSK / 8-DPSK Bluetooth 4.0 LE: GFSK
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



3. RF Exposure Limit Introduction

The FCC categorizes the RF exposure limit based on the intended usage of the device and the user’s awareness and ability to exercise control over his or her exposure. This is a consumer product to be used in the home, hence this device was evaluated by mobile device with general population/uncontrolled exposure condition. The definition of these category are shown as follows:

▪ **Mobile Devices:**

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitters' radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR 2.1091.

▪ **General Population/Uncontrolled Exposure:**

The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category and the general population/uncontrolled exposure limits apply to these devices.

Per OET Bulletin 65, the power density limit for General Population/Uncontrolled Exposure summary here:

Table: Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Power Density (S) (mW/cm2)
0.3–1.34	*(100)
1.34–30	*(180/f ²)
30–300	0.2
300–1500	f/1500
1500–100,000	1.0

f = frequency in MHz

* = Plane-wave equivalent power density



4. Maximum RF average output power among production units

Mode / Band	IEEE 802.11 Average power (dBm)				
	a	b	g	N20	N40
WLAN 2.4GHz		16	14	13	11
WLAN 5GHz	14			13	11

Mode / Band	Bluetooth Average power (dBm)			
	1Mbps	2Mbps	3Mbps	BT4.0-LE
	(GFSK)	($\pi/4$ -DQPSK)	(8-DPSK)	(GFSK)
2.4 GHz Bluetooth	3.5	1	1	8.5



5. Conducted RF Output Power (Unit: dBm)

<WLAN 2.4GHz Conducted Power>

WLAN 2.4GHz 802.11b Average Power (dBm)						
Power vs. Channel			Power vs. Data Rate			
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)		
		1M		2M	5.5M	11M
CH 1	2412	14.92	CH 1	15.11	15.52	15.71
CH 6	2437	14.88				
CH 11	2462	14.71				

WLAN 2.4GHz 802.11g Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)						
		6M		9M	12M	18M	24M	36M	48M	54M
CH 1	2412	13.79	CH 1	13.51	13.43	13.40	13.35	13.45	13.46	13.50
CH 6	2437	13.64								
CH 11	2462	13.53								

WLAN 2.4GHz 802.11n-HT20 Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS0		MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 1	2412	12.80	CH 1	12.55	12.47	12.50	12.51	12.56	12.54	12.53
CH 6	2437	12.63								
CH 11	2462	12.48								



WLAN 2.4GHz 802.11n-HT40 Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS0		MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 3	2422	10.70	CH 1	10.68	10.63	10.53	10.65	10.59	10.63	10.65
CH 6	2437	10.62								
CH 9	2452	10.45								

<Bluetooth Conducted Power>

Channel	Frequency (MHz)	Average power (dBm)		
		Mode		
		GFSK	$\pi/4$ -DQPSK	8-DPSK
CH 0	2402	1.97	-1.9	-1.62
CH 39	2441	3.12	-0.64	-0.68
CH 78	2480	3.17	-0.52	-0.58

Channel	Frequency (MHz)	Average power (dBm)
		Mode
		BT v4.0 LE, GFSK
CH 0	2402	8.02
CH 19	2440	7.97
CH 39	2480	7.11



<WLAN 5GHz Conducted Power>

WLAN 5GHz 802.11a Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)						54M
		6M		9M	12M	18M	24M	36M	48M	
CH 36	5180	13.70	CH 48	13.85	13.84	13.89	13.89	13.88	13.88	13.86
CH 40	5200	13.73								
CH 44	5220	13.64								
CH 48	5240	13.90								
CH 52	5260	13.81	CH 64	13.88	13.82	13.85	13.82	13.86	13.83	13.90
CH 56	5280	13.89								
CH 60	5300	13.84								
CH 64	5320	13.91								
CH 100	5500	13.98	CH 100	13.94	13.88	13.95	13.96	13.94	13.95	13.97
CH 104	5520	13.96								
CH 108	5540	13.89								
CH 112	5560	13.92								
CH 116	5580	13.92								
CH 120	5600	13.88								
CH 124	5620	13.65								
CH 128	5640	13.49								
CH 132	5660	13.37								
CH 136	5680	13.33								
CH 140	5700	13.48								
CH 149	5745	13.93								
CH 153	5765	13.31								
CH 157	5785	13.43								
CH 161	5805	13.28								
CH 165	5825	13.08								



WLAN 5GHz 802.11n (BW 20M) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS0		MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 36	5180	12.67	CH 48	12.87	12.86	12.88	12.89	12.84	12.88	12.90
CH 40	5200	12.60								
CH 44	5220	12.68								
CH 48	5240	12.92								
CH 52	5260	12.93	CH 64	12.84	12.81	12.80	12.86	12.88	12.87	12.88
CH 56	5280	12.89								
CH 60	5300	12.90								
CH 64	5320	12.95								
CH 100	5500	12.98	CH 100	12.94	12.95	12.96	12.95	12.94	12.91	12.94
CH 104	5520	12.96								
CH 108	5540	12.97								
CH 112	5560	12.95								
CH 116	5580	12.92								
CH 120	5600	12.91								
CH 124	5620	12.80								
CH 128	5640	12.59								
CH 132	5660	12.52								
CH 136	5680	12.59								
CH 140	5700	12.42								
CH 149	5745	12.90								
CH 153	5765	12.18								
CH 157	5785	12.35								
CH 161	5805	12.42								
CH 165	5825	12.28								



WLAN 5GHz 802.11n (BW 40M) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS0		MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 38	5190	10.98	CH 46	10.92	10.90	10.94	10.98	10.95	10.96	10.98
CH 46	5230	10.99								
CH 54	5270	10.51	CH 62	10.46	10.45	10.51	10.48	10.44	10.32	10.38
CH 62	5310	10.53								
CH 102	5510	10.74	CH 102	10.69	10.69	10.71	10.72	10.72	10.73	10.70
CH 110	5550	10.51								
CH 118	5590	10.45								
CH 134	5670	10.15								
CH 151	5755	10.57	CH 159	10.89	10.87	10.89	10.88	10.89	10.92	10.94
CH 159	5795	10.97								



6. Radio Frequency Radiation Exposure Evaluation

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

For this device, the calculation is as follows:

WLAN (Chain 1) Operating Frequency > 1.5GHz

Function	Freq. (MHz)	Antenna Gain (dBi)	Burst-Based Time-Average Power (dBm)	Source-Based Time-Average Power (dBm)	Source-Based Time-Average EIRP (mW)	Calculated RF Exposure (mW/cm ²)	Limit (mW/cm ²)
WiFi 2.4G 802.11b	2412.00	3.00	16.00	16.00	79.43	0.02	1.00
WiFi 2.4G 802.11g	2412.00	3.00	14.00	14.00	50.12	0.01	1.00
WiFi 2.4G 802.11n-HT20	2412.00	3.00	13.00	13.00	39.81	0.01	1.00
WiFi 2.4G 802.11n-HT40	2422.00	3.00	11.00	11.00	25.12	0.00	1.00
WiFi 5G 802.11a	5500.00	4.00	14.00	14.00	63.10	0.01	1.00
WiFi 5G 802.11n-HT20	5500.00	4.00	13.00	13.00	50.12	0.01	1.00
WiFi 5G 802.11n-HT40	5230.00	4.00	11.00	11.00	31.62	0.01	1.00

Bluetooth Operating Frequency > 1.5GHz

Function	Freq. (MHz)	Antenna Gain (dBi)	Burst-Based Time-Average Power (dBm)	Source-Based Time-Average Power (dBm)	Source-Based Time-Average EIRP (mW)	Calculated RF Exposure (mW/cm ²)	Limit (mW/cm ²)
Bluetooth 2.4G	2440.00	2.98	8.5	8.5	14.06	0.00	1.00

Note:

According to "Maximum RF average output power among production units" to evaluate radiation exposure.



For Simultaneous Transmission Consideration

No.	Applicable Simultaneous Transmission Combination
1.	None

Note: WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously

Conclusion:

Per part 2.1091(c), EUT source-based time-averaged ERP < 1.5W for RF operating frequency \leq 1.5GHz, EUT source-based time-averaged EIRP < 3W for RF operating frequency > 1.5GHz, routine evaluation of MPE is not required; MPE calculation is sufficient to show compliance. The MPE calculation results indicate that the EUT complies with the RF exposure limit of FCC OET Bulletin 65 Supplement C (Edition 01-01).