

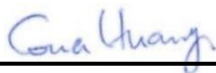
RF Exposure Evaluation

(Mobile Condition)

FCC ID : A4RGTU8P
Equipment : Wireless Device
Applicant : Google LLC
1600 Amphitheatre Parkway,
Mountain View, California, 94043 USA
Standard : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC has been evaluated in accordance with 47 CFR Part 2.1091 for the device and pass the limit.

The results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Cona Huang / Deputy Manager



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1. Description of Equipment Under Test (EUT)

Product Feature & Specification	
Equipment Name	Wireless Device
FCC ID	A4RGTU8P
Wireless Technology and Frequency Range	WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2 GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3 GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6 GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8 GHz Band: 5725 MHz ~ 5850 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz UWB: 6489.6 MHz, 7987.2 MHz
Mode	WLAN: 802.11a/b/g/n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/HE20/HE40/HE80 Bluetooth BR/EDR/LE UWB: BPM-BPSK

Reviewed by: Jason Wang

Report Producer: Carlie Tsai



2. Maximum Tune-up Limit (unit: dBm)

<WLAN Maximum Power Table>

2.4GHz WLAN				Ant 0
Mode	Channel	Frequency (MHz)	Tune-Up Limit	
2.4GHz WLAN	802.11b 1Mbps	1	2412	20.50
		6	2437	20.50
		11	2462	20.50
802.11g 6Mbps	1	2412	19.00	
	6	2437	20.50	
	11	2462	18.00	

2.4GHz WLAN				Ant 2
Mode	Channel	Frequency (MHz)	Tune-Up Limit	
2.4GHz WLAN	802.11b 1Mbps	1	2412	20.50
		6	2437	20.50
		11	2462	20.50
802.11g 6Mbps	1	2412	16.50	
	6	2437	20.50	
	11	2462	17.50	

2.4GHz WLAN				Ant 0+2(0)	Ant 0+2(2)	Ant 0+2
Mode	Channel	Frequency (MHz)	Tune-Up Limit	Tune-Up Limit	Tune-Up Limit	
2.4GHz WLAN	802.11g 6Mbps	1	2412	16.00	16.00	19.00
		6	2437	20.50	20.50	23.50
		11	2462	16.00	16.00	19.00
802.11n-HT20 MCS0	1	2412	16.00	16.00	19.00	
	6	2437	19.50	19.50	22.50	
	11	2462	16.00	16.00	19.00	
802.11ac-VHT20 MCS0	1	2412	16.00	16.00	19.00	
	6	2437	19.50	19.50	22.50	
	11	2462	16.00	16.00	19.00	
802.11ax-HE20 MCS0	1	2412	16.00	16.00	19.00	
	6	2437	19.50	19.50	22.50	
	11	2462	16.00	16.00	19.00	



5.2GHz WLAN				Ant 0
5.2GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	36	5180	17.50
		40	5200	17.50
		44	5220	17.50
		48	5240	17.50

5.2GHz WLAN				Ant 2
5.2GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	36	5180	17.50
		40	5200	17.50
		44	5220	17.50
		48	5240	17.50

5.2GHz WLAN				Ant 0+2(0)	Ant 0+2(2)	Ant 0+2
5.2GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit	Tune-Up Limit	Tune-Up Limit
	802.11a 6Mbps	36	5180	16.00	16.00	19.00
		40	5200	16.00	16.00	19.00
		44	5220	17.50	17.50	20.50
		48	5240	17.50	17.50	20.50
	802.11n-HT20 MCS0	36	5180	15.00	15.00	18.00
		40	5200	16.00	16.00	19.00
		44	5220	17.50	17.50	20.50
	802.11n-HT40 MCS0	38	5190	12.00	12.00	15.00
		46	5230	15.50	15.50	18.50
	802.11ac-VHT20 MCS0	36	5180	15.00	15.00	18.00
		40	5200	16.50	16.50	19.50
		44	5220	16.50	16.50	19.50
	802.11ac-VHT40 MCS0	48	5240	16.50	16.50	19.50
		38	5190	12.00	12.00	15.00
	802.11ac-VHT80 MCS0	46	5230	15.50	15.50	18.50
		42	5210	12.00	12.00	15.00
	802.11ax-HE20 MCS0	36	5180	15.00	15.00	18.00
		40	5200	16.50	16.50	19.50
		44	5220	16.50	16.50	19.50
802.11ax-HE40 MCS0	48	5240	16.50	16.50	19.50	
	38	5190	12.00	12.00	15.00	
802.11ax-HE80 MCS0	46	5230	14.50	14.50	17.50	
	42	5210	12.00	12.00	15.00	



5.3GHz WLAN				Ant 0
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	52	5260	17.50
		56	5280	17.50
		60	5300	17.50
		64	5320	17.50

5.3GHz WLAN				Ant 2
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	52	5260	17.50
		56	5280	17.50
		60	5300	17.50
		64	5320	17.50

5.3GHz WLAN				Ant 0+2(0)	Ant 0+2(2)	Ant 0+2
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit	Tune-Up Limit	Tune-Up Limit
	802.11a 6Mbps	52	5260	16.00	16.00	19.00
		56	5280	17.00	17.00	20.00
		60	5300	17.50	17.50	20.50
		64	5320	16.50	16.50	19.50
	802.11n-HT20 MCS0	52	5260	16.50	16.50	19.50
		56	5280	17.50	17.50	20.50
		60	5300	17.50	17.50	20.50
	802.11n-HT40 MCS0	64	5320	16.00	16.00	19.00
		54	5270	15.50	15.50	18.50
		62	5310	15.50	15.50	18.50
	802.11ac-VHT20 MCS0	52	5260	16.50	16.50	19.50
		56	5280	16.50	16.50	19.50
		60	5300	16.50	16.50	19.50
	802.11ac-VHT40 MCS0	64	5320	16.50	16.50	19.50
		54	5270	15.50	15.50	18.50
	802.11ac-VHT80 MCS0	62	5310	15.50	15.50	18.50
		58	5290	12.50	12.50	15.50
	802.11ax-HE20 MCS0	52	5260	16.50	16.50	19.50
		56	5280	16.50	16.50	19.50
60		5300	16.50	16.50	19.50	
802.11ax-HE40 MCS0	64	5320	16.50	16.50	19.50	
	54	5270	14.50	14.50	17.50	
802.11ax-HE80 MCS0	62	5310	14.50	14.50	17.50	
	58	5290	12.50	12.50	15.50	



5.5GHz WLAN				Ant 0
5.5GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	100	5500	17.50
		116	5580	17.50
		124	5620	17.50
		132	5660	17.50
		144	5720	17.50

5.5GHz WLAN				Ant 2
5.5GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	100	5500	17.50
		116	5580	17.50
		124	5620	17.50
		132	5660	17.50
		144	5720	17.50



5.5GHz WLAN				Ant 0+2(0)	Ant 0+2(2)	Ant 0+2
Mode	Channel	Frequency (MHz)	Tune-Up Limit	Tune-Up Limit	Tune-Up Limit	
5.5GHz WLAN	802.11a 6Mbps	100	5500	16.00	16.00	19.00
		116	5580	17.00	17.00	20.00
		124	5620	17.50	17.50	20.50
		132	5660	17.50	17.50	20.50
		144	5720	17.50	17.50	20.50
	802.11n-HT20 MCS0	100	5500	17.50	17.50	20.50
		116	5580	17.50	17.50	20.50
		124	5620	17.00	17.00	20.00
		132	5660	17.50	17.50	20.50
	802.11n-HT40 MCS0	102	5510	15.50	15.50	18.50
		110	5550	15.50	15.50	18.50
		126	5630	15.50	15.50	18.50
		134	5670	15.50	15.50	18.50
	802.11ac-VHT20 MCS0	142	5710	15.50	15.50	18.50
		100	5500	16.50	16.50	19.50
		116	5580	16.50	16.50	19.50
		124	5620	16.00	16.00	19.00
	802.11ac-VHT40 MCS0	132	5660	16.50	16.50	19.50
		144	5720	16.50	16.50	19.50
		102	5510	15.50	15.50	18.50
110		5550	15.50	15.50	18.50	
802.11ac-VHT80 MCS0	126	5630	15.50	15.50	18.50	
	134	5670	15.50	15.50	18.50	
	142	5710	15.50	15.50	18.50	
	106	5530	13.00	13.00	16.00	
802.11ax-HE20 MCS0	122	5610	15.50	15.50	18.50	
	138	5690	15.50	15.50	18.50	
	100	5500	16.50	16.50	19.50	
	116	5580	16.50	16.50	19.50	
	124	5620	16.00	16.00	19.00	
802.11ax-HE40 MCS0	132	5660	16.50	16.50	19.50	
	144	5720	16.50	16.50	19.50	
	102	5510	14.50	14.50	17.50	
	110	5550	14.50	14.50	17.50	
	126	5630	14.50	14.50	17.50	
802.11ax-HE80 MCS0	134	5670	14.50	14.50	17.50	
	142	5710	14.50	14.50	17.50	
	106	5530	13.00	13.00	16.00	
	122	5610	14.50	14.50	17.50	
	138	5690	14.50	14.50	17.50	



5.8GHz WLAN				Ant 0
5.8GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	149	5745	17.50
		157	5785	17.50
		165	5825	17.50

5.8GHz WLAN				Ant 2
5.8GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11a 6Mbps	149	5745	17.50
		157	5785	17.50
		165	5825	17.50

5.8GHz WLAN	5.8GHz WLAN			Ant 0+2(0)	Ant 0+2(2)	Ant 0+2
	Mode	Channel	Frequency (MHz)	Tune-Up Limit	Tune-Up Limit	Tune-Up Limit
	802.11a 6Mbps	149	5745	17.50	17.50	20.50
		157	5785	17.50	17.50	20.50
		165	5825	17.50	17.50	20.50
	802.11n-HT20 MCS0	149	5745	17.50	17.50	20.50
		157	5785	17.50	17.50	20.50
		165	5825	17.50	17.50	20.50
	802.11n-HT40 MCS0	151	5755	15.50	15.50	18.50
		159	5795	15.50	15.50	18.50
	802.11ac-VHT20 MCS0	149	5745	16.50	16.50	19.50
		157	5785	16.50	16.50	19.50
		165	5825	16.50	16.50	19.50
802.11ac-VHT40 MCS0	151	5755	15.50	15.50	18.50	
	159	5795	15.50	15.50	18.50	
802.11ac-VHT80 MCS0	155	5775	15.50	15.50	18.50	
802.11ax-HE20 MCS0	149	5745	16.50	16.50	19.50	
	157	5785	16.50	16.50	19.50	
	165	5825	16.50	16.50	19.50	
802.11ax-HE40 MCS0	151	5755	14.50	14.50	17.50	
	159	5795	14.50	14.50	17.50	
802.11ax-HE80 MCS0	155	5775	14.50	14.50	17.50	

<Bluetooth Maximum Power Table>

Mode	Ant 0				
	Burst Average Power (dBm)				
	BR / EDR			LE	
	1Mbps	2Mbps	3Mbps	1Mbps	2Mbps
Tune-up Limit	17.50	12.50	12.50	17.50	17.50



<UWB Maximum Power Table>

UWB	Maximum EIRP Power (dBm)
	-14.3

3. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) 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 ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

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



4. Radio Frequency Radiation Exposure Evaluation

4.1. Power Density Calculation

Ant 0

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
WLAN2.4GHz Band	2.5	20.5	23.0	0.20	199.53	0.040	1.000	0.040
WLAN5GHz Band	3.5	17.5	21.0	0.13	125.89	0.025	1.000	0.025
Bluetooth	2.5	17.5	20.0	0.10	100.00	0.020	1.000	0.020

Ant 2

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
WLAN2.4GHz Band	2.5	20.5	23.0	0.20	199.53	0.040	1.000	0.040
WLAN5GHz Band	4.0	17.5	21.5	0.14	141.25	0.028	1.000	0.028

UWB

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
UWB			-14.3	0.00004	0.0372	0.00001	1.000	0.00001

Ant 0 Power Density / Limit	Ant 2 Power Density / Limit	Bluetooth Power Density / Limit	UWB	Σ (Power Density / Limit) of Ant 0 + Ant 2 + Bluetooth + UWB
0.040	0.040	0.020	0.00001	0.10001

Note:

- Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for Ant 0 + Ant 2 + Bluetooth + UWB.
- Considering the transmitters of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 4 collocated transmitters is compliant

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.