



RF Exposure Evaluation Report

APPLICANT : Sierra Wireless Inc.
EQUIPMENT : Embedded module
BRAND NAME : AirPrime
MODEL NAME : HL6528RD
MARKETING NAME : HL6528RD
FCC ID : N7NHL6528RD
IC : 2417C-HL6528RD
STANDARD : 47 CFR Part 2.1091
IC RSS-102 Issue 5 (2015)

We, SPORTON INTERNATIONAL (SHENZHEN) INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and IC RSS-102 Issue 5, and pass the limit. Without written approval of SPORTON INTERNATIONAL (SHENZHEN) INC., the test report shall not be reproduced except in full.

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**Revision History**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA591804	Rev. 01	Initial issue of report	Dec. 18, 2015

**1. Administration Data****1.1. Testing Laboratory**

Testing Laboratory	
Test Site	SPORTON International (SHENZHEN) Inc.
Test Site Location	1F & 2F, Building A, Morning Business Center, No. 4003 ShiGu Rd., Xili Town, Nanshan District, Shenzhen, Guangdong, P. R. China TEL: 86-755-8637-9589 FAX: 86-755-8637-9595
Applicant	
Company Name	Sierra Wireless Inc.
Address	13811 Wireless Way, Richmond, British Columbia V6V 3A4
Manufacturer	
Company Name	Sierra Wireless Inc.
Address	13811 Wireless Way, Richmond, British Columbia V6V 3A4

**2. Description of Equipment Under Test (EUT)**

Product Feature & Specification	
EUT Type	Embedded module
Brand Name	AirPrime
Model Name	HL6528RD
Marketing Name	HL6528RD
FCC ID	N7NHL6528RD
IC	2417C-HL6528RD
IMEI Code	014492000000326
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz
Mode	• GSM/GPRS
HW Version	1.0
SW Version	A.1.7
EUT Stage	Production Unit
Remark:	
1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.	
2. The device supports GPRS Class 10.	

3. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM (GMSK, 1 Tx slot)	33.26	33.22	33.14	35.00	24.26	24.22	24.14	26.00
GPRS (GMSK, 1 Tx slot)	33.22	33.18	33.10	35.00	24.22	24.18	24.10	26.00
GPRS (GMSK, 2 Tx slots)	32.46	32.46	32.41	34.00	26.46	26.46	26.41	28.00
Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM (GMSK, 1 Tx slot)	30.86	30.71	30.51	31.00	21.86	21.71	21.51	22.00
GPRS (GMSK, 1 Tx slot)	30.84	30.70	30.49	31.00	21.84	21.70	21.49	22.00
GPRS (GMSK, 2 Tx slots)	30.02	29.81	29.63	31.00	24.02	23.81	23.63	25.00

Remark: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.

The calculated method are shown as below:

Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB

Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB

4. RF Exposure Limit Introduction for FCC

FCC limit:

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

IC limit:

IC has adopted the RF field strength limits established in Health Canada's RF exposure guideline. The limits are shown in Table 4 below per RSS-102.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

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



5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

General Note:

1. For the host which integrates HL6528RD only and connects the antenna with antenna gain less or equal the figures in the table below, if the distance between the antenna and the user is equal or larger than 20cm, the power density calculation below shows compliance.

<Standalone Calculated for FCC>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum ERP (dBm)	Maximum ERP (W)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)
GSM 850 (1 Tx slot)	824-849	3.1	35.0	35.950	3.945	38.100	6.457	7.000	812.831	0.162	0.549
GPRS 850 (1 Tx slot)	824-849	3.1	35.0	35.950	3.945	38.100	6.457	7.000	812.831	0.162	0.549
GPRS 850 (2 Tx slots)	824-849	3.1	34.0	34.960	3.133	37.100	5.129	7.000	1282.153	0.255	0.549
GSM 1900 (1 Tx slot)	1850-1910	2.0	31.0	30.860	1.219	33.000	1.995	2.000	251.189	0.050	1.000
GPRS 1900 (1 Tx slot)	1850-1910	2.0	31.0	30.860	1.219	33.000	1.995	2.000	251.189	0.050	1.000
GPRS 1900 (2 Tx slots)	1850-1910	2.0	31.0	30.860	1.219	33.000	1.995	2.000	498.816	0.099	1.000

<Standalone Calculated for IC>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum ERP (dBm)	Maximum ERP (W)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (W/m ²)	Limit (W/m ²)
GSM 850 (1 Tx slot)	824-849	3.1	35.0	35.950	3.945	38.100	6.457	7.000	812.831	1.618	2.576
GPRS 850 (1 Tx slot)	824-849	3.1	35.0	35.950	3.945	38.100	6.457	7.000	812.831	1.618	2.576
GPRS 850 (2 Tx slots)	824-849	3.1	34.0	34.960	3.133	37.100	5.129	7.000	1282.153	2.552	2.576
GSM 1900 (1 Tx slot)	1850-1910	2.0	31.0	30.860	1.219	33.000	1.995	2.000	251.189	0.500	4.477
GPRS 1900 (1 Tx slot)	1850-1910	2.0	31.0	30.860	1.219	33.000	1.995	2.000	251.189	0.500	4.477
GPRS 1900 (2 Tx slots)	1850-1910	2.0	31.0	30.860	1.219	33.000	1.995	2.000	498.816	0.993	4.476

5.2. Collocated Power Density Calculations

General Note:

1. This MPE analysis is applicable to any collocated transmitters with EIRP for WLAN is less than or equal to 27dBm and EIRP for Bluetooth is less than or equal to 18dBm.
2. A maximum antenna gain of 3 dBi for WLAN/BT has been assumed for all collocated antennas.

<Collocated Calculation for FCC>

Band	Frequency (MHz)	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
GSM 850 (1 Tx slot)	824-849	2.0	35.0	37.0	5.01	630.96	0.126	0.549	0.229
GPRS 850 (1 Tx slot)	824-849	2.0	35.0	37.0	5.01	630.96	0.126	0.549	0.229
GPRS 850 (2 Tx slots)	824-849	2.0	34.0	36.0	3.98	995.27	0.198	0.549	0.361
GSM 1900 (1 Tx slot)	1850-1910	2.0	31.0	33.0	2.00	251.19	0.050	1.000	0.050
GPRS 1900 (1 Tx slot)	1850-1910	2.0	31.0	33.0	2.00	251.19	0.050	1.000	0.050
GPRS 1900 (2 Tx slots)	1850-1910	2.0	31.0	33.0	2.00	498.82	0.099	1.000	0.099
WLNA2.4GHz Band	2400 - 2500	3.0	24.0	27.0	0.50	501.19	0.100	1.000	0.100
WLNA5GHz Band	5150 – 5850	3.0	24.0	27.0	0.50	501.19	0.100	1.000	0.100
Bluetooth	2400 - 2500	3.0	15.0	18.0	0.06	63.10	0.013	1.000	0.013

<Collocated Calculation for IC>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (W/m ²)	Limit (W/m ²)	Power Density / Limit
GSM 850 (1 Tx slot)	824-849	2.0	35.0	37.0	5.01	630.96	1.256	2.576	0.488
GPRS 850 (1 Tx slot)	824-849	2.0	35.0	37.0	5.01	630.96	1.256	2.576	0.488
GPRS 850 (2 Tx slots)	824-849	2.0	34.0	36.0	3.98	995.27	1.981	2.576	0.769
GSM 1900 (1 Tx slot)	1850-1910	2.0	31.0	33.0	2.00	251.19	0.500	4.477	0.112
GPRS 1900 (1 Tx slot)	1850-1910	2.0	31.0	33.0	2.00	251.19	0.500	4.477	0.112
GPRS 1900 (2 Tx slots)	1850-1910	2.0	31.0	33.0	2.00	498.82	0.993	4.476	0.222
WLNA2.4GHz Band	2400 - 2500	3.0	24.0	27.0	0.50	501.19	0.998	5.366	0.186
WLNA5GHz Band	5150 – 5850	3.0	24.0	27.0	0.50	501.19	0.998	9.047	0.110
Bluetooth	2400 - 2500	3.0	15.0	18.0	0.06	63.10	0.126	5.351	0.023

<Collocated analysis>
General Note:

1. For collocation analysis, GPRS850 (2TX slot) is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + WLAN + Bluetooth
3. Considering the WWAN module collocation with the other transmitters of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant.

<Analysis for FCC>

Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	Σ (Power Density / Limit) of WWAN + WLAN + Bluetooth
0.100	0.013	0.361	0.473

<Analysis for IC>

Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	Σ (Power Density / Limit) of WWAN + WLAN + Bluetooth
0.186	0.023	0.769	0.979

Conclusion:

Based on 47 CFR§2.1091 and IC RSS-102 Issue 5, the analysis concludes that this product is compliant with the RF exposure requirements in mobile exposure condition, provided the peak gain of the connected WWAN antenna, the conducted power and the antenna gain of the collocated transmitter, do not exceed the limits for each frequency band listed below.

Device	Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Standalone Maximum Antenna Gain (dBi)	Collocated Maximum Antenna Gain (dBi)
HL6528RD	GSM	824 - 249	35.0	3.1	2.0
		1850 -1910	31.0	2.0	2.0
Collocated Transmitters	WLAN	2400 - 2500	24.0		3.0
	WLAN	5150 - 5850	24.0		3.0
	BT	2400 - 2500	15.0		3.0