RF Exposure Evaluation Report

APPLICANT	:	**Sierra Wireless Inc.**
EQUIPMENT	:	**Quad-Band GSM/GPRS/EDGE and Tri-Band WCDMA/HSDPA MODULE**
BRAND NAME	:	**Sierra Wireless**
MODEL NAME	:	**HiLo3G-850**
FCC ID	:	**VW3HILO3G850**
STANDARD	:	**47 CFR Part 2.1091**

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

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA541318	Rev. 01	Initial issue of report	May 12, 2015

1. Administration Data

1.1. Testing Laboratory

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	Sierra Wireless Inc.
Address	13811 Wireless Way, BC V6V 3A4 Richmond, Canada

Manufacturer	
Company Name	Sierra Wireless Inc.
Address	13811 Wireless Way, BC V6V 3A4 Richmond, Canada

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Quad-Band GSM/GPRS/EDGE and Tri-Band WCDMA/HSDPA MODULE
Brand Name	Sierra Wireless
Model Name	HiLo3G-850
FCC ID	VW3HILO3G850
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz
Mode	・GPRS/EGPRS ・RMC 12.2Kbps ・HSDPA
Antenna Type	Fixed External Antenna
EUT Stage	Production Unit

3. Maximum RF average output power among production units

Mode	Burst Average Power (dBm)	
	GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)	32.17	29.43
GPRS/EDGE (GMSK, 1 Tx slot)	32.28	29.44
GPRS/EDGE (GMSK, 2 Tx slots)	32.22	29.35
GPRS/EDGE (GMSK, 4 Tx slots)	31.21	28.23
EDGE (8PSK, 1 Tx slot)	26.57	25.48
EDGE (8PSK, 2 Tx slots)	26.50	25.38
EDGE (8PSK, 4 Tx slots)	25.90	24.84

Average Power (dBm)	
WCDMA Band V	WCDMA Band II
23.34	23.19

4. 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/f2)	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/f2)	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

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

General Note:

1. For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band

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	2.50	32.17	32.520	1.791	34.670	2.931	7.000	368.978	0.073	0.549
GPRS 850 (1 Tx slot)	824	2.50	32.28	32.630	1.837	34.780	3.006	7.000	378.443	0.075	0.549
GPRS 850 (2 Tx slots)	824	2.50	32.22	32.580	1.811	34.720	2.965	7.000	741.208	0.148	0.549
GPRS 850 (4 Tx slots)	824	2.50	31.21	31.560	1.435	33.710	1.432	7.000	1177.606	0.234	0.549
EGPRS 850 (1 Tx slot)	824	2.50	26.57	26.920	0.493	29.070	0.493	7.000	101.625	0.020	0.549
EGPRS 850 (2 Tx slots)	824	2.50	26.50	26.860	0.485	29.000	0.794	7.000	198.582	0.040	0.549
EGPRS 850 (4 Tx slots)	824	2.50	25.90	26.260	0.423	28.400	0.692	7.000	345.915	0.069	0.549
GSM 1900 (1 Tx slot)	1850	3.50	29.43	30.790	1.199	32.930	1.963	2.000	247.172	0.049	1.000
GPRS 1900 (1 Tx slot)	1850	3.50	29.44	30.800	1.202	32.940	1.968	2.000	247.742	0.049	1.000
GPRS 1900 (2 Tx slots)	1850	3.50	29.35	30.710	1.178	32.850	1.928	2.000	481.881	0.096	1.000
GPRS 1900 (4 Tx slots)	1850	3.50	28.23	29.590	0.910	31.730	1.489	2.000	746.449	0.149	1.000
EGPRS 1900 (1 Tx slot)	1850	3.50	25.48	26.840	0.483	28.980	0.791	2.000	99.541	0.020	1.000
EGPRS 1900 (2 Tx slots)	1850	3.50	25.38	26.740	0.472	28.880	0.773	2.000	193.170	0.038	1.000
EGPRS 1900 (4 Tx slots)	1850	3.50	24.84	26.200	0.417	28.340	0.682	2.000	341.169	0.068	1.000
WCDMA Band 5	826	2.50	23.34	23.700	0.234	25.840	0.384	7.000	383.707	0.076	0.551
WCDMA Band 2	1850	3.50	23.19	24.550	0.285	26.690	0.467	2.000	466.659	0.093	1.000

5.2. Collocated Power Density Calculation

General Note:

1. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN / WiMax / Bluetooth is less than or equal to 15dBm.
2. A maximum antenna gain of 5 dBi for WLAN/WiMAX/BT has been assumed for all collocated antennas.

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	2.50	32.17	34.67	2.93	368.98	0.073	0.549	0.134
GPRS 850 (1 Tx slot)	824	2.50	32.28	34.78	3.01	378.44	0.075	0.549	0.137
GPRS 850 (2 Tx slots)	824	2.50	32.22	34.72	2.96	741.21	0.148	0.549	0.269
GPRS 850 (4 Tx slots)	824	2.50	31.21	33.71	2.35	1177.61	0.234	0.549	0.427
EGPRS 850 (1 Tx slot)	824	2.50	26.57	29.07	0.81	101.62	0.020	0.549	0.037
EGPRS 850 (2 Tx slots)	824	2.50	26.50	29.00	0.79	198.58	0.040	0.549	0.072
EGPRS 850 (4 Tx slots)	824	2.50	25.90	28.40	0.69	345.92	0.069	0.549	0.125
GSM 1900 (1 Tx slot)	1850	3.50	29.43	32.93	1.96	247.17	0.049	1.000	0.049
GPRS 1900 (1 Tx slot)	1850	3.50	29.44	32.94	1.97	247.74	0.049	1.000	0.049
GPRS 1900 (2 Tx slots)	1850	3.50	29.35	32.85	1.93	481.88	0.096	1.000	0.096
GPRS 1900 (4 Tx slots)	1850	3.50	28.23	31.73	1.49	746.45	0.149	1.000	0.149
EGPRS 1900 (1 Tx slot)	1850	3.50	25.48	28.98	0.79	99.54	0.020	1.000	0.020
EGPRS 1900 (2 Tx slots)	1850	3.50	25.38	28.88	0.77	193.17	0.038	1.000	0.038
EGPRS 1900 (4 Tx slots)	1850	3.50	24.84	28.34	0.68	341.17	0.068	1.000	0.068
WCDMA Band 5	826	3.50	23.34	26.84	0.48	483.06	0.096	0.551	0.175
WCDMA Band 2	1850	3.50	23.19	26.69	0.47	466.66	0.093	1.000	0.093
WLNA2.4GHz Band	2412	5.00	15.00	20.00	0.10	100.00	0.020	1.000	0.020
WLNA5GHz Band	5180	5.00	15.00	20.00	0.10	100.00	0.020	1.000	0.020
WiMax2.6GHz	2500	5.00	15.00	20.00	0.10	100.00	0.020	1.000	0.020
WiMax3.5GHz	3400	5.00	15.00	20.00	0.10	100.00	0.020	1.000	0.020
WiMax3.7GHz	3600	5.00	15.00	20.00	0.10	100.00	0.020	1.000	0.020
Bluetooth	2402	5.00	15.00	20.00	0.10	100.00	0.020	1.000	0.020

<Collocated analysis>

Note:

1. For colocation analysis, GPRS 850 (4 Tx slots) is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. ∑(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 and WWAN + WiMax + Bluetooth.
3. Considering the WWAN module collocation with the WLAN and Bluetooth transmitter 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

Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	∑(Power Density / Limit) of WWAN + WLAN + Bluetooth
0.020	0.020	0.427	0.466

Max WiMax Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	∑(Power Density / Limit) of WWAN + WiMax + Bluetooth
0.020	0.020	0.427	0.466

Conclusion:

Based on CFR §2.1091 the analysis concludes that this product when transmitting in standalone within a host device, is complant with the FCC RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

Technology	Band	Frequency (MHz)	Maximum Conducted Power (dBm)	Stanalone Maximum Antenna Gain (dBi)	Collocated Maximum Antenna Gain (dBi)
GSM	GSM850	824 - 249	32.28	2.50	2.50
	GSM1900	1850 -1910	29.44	3.50	3.50
UMTS	Band 5	824 - 849	23.34	2.50	3.50
	Band 2	1850 -1910	23.19	3.50	3.50