



# RF EXPOSURE REPORT

**REPORT NO.:** SA130927E08E

**MODEL NO.:** FiOS-G1100

**FCC ID:** 2ABTEG1100

**RECEIVED:** Sep. 27, 2013

**TESTED:** Dec. 03 to 04, 2013

**ISSUED:** Mar. 21, 2014

**APPLICANT:** Verizon Online LLC

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**ISSUED BY:** Bureau Veritas Consumer Products Services  
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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
SA130927E08E	Original release	Mar. 21, 2014



## 1. CERTIFICATION

**PRODUCT:** FiOS Quantum Gateway  
**BRAND NAME:** Verizon  
**MODEL NO.:** FiOS-G1100  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**APPLICANT:** Verizon Online LLC  
**TESTED DATE:** Dec. 03 to 04, 2013  
**STANDARDS:** FCC Part 2 (Section 2.1091)  
FCC OET Bulletin 65, Supplement C (01-01)  
IEEE C95.1

The above equipment (Model: FiOS-G1100) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY** :  , **DATE:** Mar. 21, 2014  
( Elsie Hsu, Specialist )

**APPROVED BY** :  , **DATE:** Mar. 21, 2014  
( May Chen, Manager )

## 2. RF EXPOSURE LIMIT

### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

FREQUENCY RANGE (MHz)	ELECTRIC FIELD STRENGTH (V/m)	MAGNETIC FIELD STRENGTH (A/m)	POWER DENSITY (mW/cm <sup>2</sup> )	AVERAGE TIME (minutes)
<b>LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE</b>				
300-1500	...	...	F/1500	30
1500-100,000	...	...	1.0	30

F = Frequency in MHz

### 3. MPE CALCULATION FORMULA

$$P_d = (P_{out} * G) / (4 * \pi * r^2)$$

where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

$\pi$  = 3.1416

r = distance between observation point and center of the radiator in cm

### 4. CLASSIFICATION

The antenna of this product, under normal use condition, is at least 28cm away from the body of the user. So, this device is classified as **Mobile Device**.

## 5. CALCULATION RESULT OF MAXIMUM CONDUCTED POWER

The EUT inside has one Zigbee technology module (option) which FCC ID: Z3M-ZBMOD1.

### For 15.247 (2.4GHz):

FREQUENCY BAND (MHz)	CONDUCTED POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11b</b>					
2412 - 2462	76.033	3.97	28	0.01925	1.00
<b>802.11g</b>					
2412 - 2462	287.078	3.97	28	0.07269	1.00
<b>802.11n (HT20)</b>					
2412 - 2462	490.908	3.97	28	0.12430	1.00
<b>802.11n (HT40)</b>					
2422 - 2452	84.723	3.97	28	0.02145	1.00
<b>CDD_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11b</b>					
2412 - 2462	120.238	7.05	28	0.06187	1.00
<b>NOTE:</b> Directional gain = $10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20})^2 / 2] = 7.05\text{dBi}$					
<b>SDM_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11n (HT20)</b>					
2412 - 2462	379.835	4.1	28	0.09910	1.00
<b>802.11n (HT40)</b>					
2422 - 2452	105.681	4.1	28	0.02757	1.00

<b>CDD_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11b</b>					
2412 - 2462	116.819	8.59	28	0.08570	1.00
<b>802.11n (HT20)</b>					
2412 - 2462	535.959	8.59	28	0.39319	1.00
<b>802.11n (HT40)</b>					
2422 - 2452	189.726	8.59	28	0.13919	1.00
<b>NOTE:</b> Directional gain = $10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20} + 10^{\text{Chain2}/20})^2 / 3] = 8.59\text{dBi}$					
<b>STBC_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11n (HT20)</b>					
2412 - 2462	919.616	4.1	28	0.23993	1.00
<b>802.11n (HT40)</b>					
2422 - 2452	196.924	4.1	28	0.05138	1.00

**For 15.247 (5GHz):**

FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11a</b>					
5745 - 5825	225.944	4.05	28	0.05827	1.00
<b>CDD_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5745 - 5825	446.548	7.93	28	0.28141	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	597.854	7.93	28	0.37676	1.00
<b>802.11ac (VHT80)</b>					
5775	224.328	7.93	28	0.14137	1.00
<b>NOTE: Directional gain = <math>10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20})^2 / 2] = 7.93\text{dBi}</math></b>					
<b>STBC_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5745 - 5825	569.758	5.71	28	0.21536	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	597.854	5.71	28	0.22598	1.00
<b>802.11ac (VHT80)</b>					
5775	224.328	5.71	28	0.08479	1.00
<b>Beam forming (MCS0 N=1)_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5745 - 5825	446.548	7.93	28	0.28141	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	597.854	7.93	28	0.37676	1.00
<b>802.11ac (VHT80)</b>					
5775	224.328	7.93	28	0.14137	1.00
<b>NOTE: Directional gain = <math>10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20})^2 / 2] = 7.93\text{dBi}</math></b>					



<b>Beam forming (MCS0 N=2)_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5745 - 5825	446.548	5.71	28	0.38965	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	597.854	5.71	28	0.22598	1.00
<b>802.11ac (VHT80)</b>					
5775	224.328	5.71	28	0.08479	1.00
<b>NOTE: Directional gain = 10 log[(10<sup>Chain0/20</sup> + 10<sup>Chain1/20</sup>)<sup>2</sup> / 2] = 5.71dBi</b>					
<b>CDD_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5745 - 5825	585.942	9.46	28	0.52520	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	625.599	9.46	28	0.56075	1.00
<b>802.11ac (VHT80)</b>					
5775	347.638	9.46	28	0.31160	1.00
<b>NOTE: Directional gain = 10 log[(10<sup>Chain0/20</sup> + 10<sup>Chain1/20</sup> + 10<sup>Chain2/20</sup>)<sup>2</sup> / 3] = 9.46</b>					
<b>STBC_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5745 - 5825	848.370	5.71	28	0.32067	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	904.050	5.71	28	0.34172	1.00
<b>802.11ac (VHT80)</b>					
5775	347.638	5.71	28	0.13140	1.00



**Beam forming (MCS0 N=1)\_MODE**

FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5745 - 5825	435.183	9.46	28	0.39007	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	443.598	9.46	28	0.39761	1.00
<b>802.11ac (VHT80)</b>					
5775	347.638	9.46	28	0.31160	1.00

**NOTE:** Directional gain =  $10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20} + 10^{\text{Chain2}/20})^2 / 3] = 9.46$

**Beam forming (MCS0 N=2)\_MODE**

FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5745 - 5825	585.942	7.47	28	0.33214	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	625.599	7.47	28	0.35462	1.00
<b>802.11ac (VHT80)</b>					
5775	347.638	7.47	28	0.19706	1.00

**NOTE:** Directional gain =  $10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20} + 10^{\text{Chain2}/20})^2 / 3] = 7.47\text{dBi}$

**Beam forming (MCS0 N=3)\_MODE**

FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5745 - 5825	585.942	5.71	28	0.22148	1.00
<b>802.11ac (VHT40)</b>					
5755 - 5795	625.599	5.71	28	0.23647	1.00
<b>802.11ac (VHT80)</b>					
5775	347.638	5.71	28	0.13140	1.00

**NOTE:** Directional gain =  $10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2 / 3] = 5.71\text{dBi}$

**For 15.407(5GHz):**

FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11a</b>					
5180 - 5240	29.174	3.56	28	0.00672	1.00
<b>CDD_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5180 - 5240	33.656	7.48	28	0.01912	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	49.493	7.48	28	0.02812	1.00
<b>802.11ac (VHT80)</b>					
5210	49.268	7.48	28	0.02799	1.00
Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 7.48\text{dBi}$					
<b>3STBC_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5180 - 5240	33.656	5.30	28	0.01158	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	49.493	5.30	28	0.01702	1.00
<b>802.11ac (VHT80)</b>					
5210	49.268	5.30	28	0.01694	1.00
<b>Beam forming (MCS0 N=1)_MODE</b>					
FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
<b>802.11ac (VHT20)</b>					
5180 - 5240	33.656	7.48	28	0.01912	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	34.358	7.48	28	0.01952	1.00
<b>802.11ac (VHT80)</b>					
5210	35.082	7.48	28	0.01993	1.00
<b>NOTE:</b> Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 7.48\text{dBi}$					



<b>Beam forming (MCS0 N=2)_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5180 - 5240	33.656	5.3	28	0.01158	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	49.493	5.3	28	0.01702	1.00
<b>802.11ac (VHT80)</b>					
5210	49.268	5.3	28	0.01694	1.00
<b>NOTE: Directional gain = <math>10 \log[(10^{\text{Chain0}/20} + 10^{\text{Chain1}/20})^2 / 2] = 5.3\text{dBi}</math></b>					
<b>CDD_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5180 - 5240	26.041	9.29	28	0.02245	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	49.247	9.29	28	0.04245	1.00
<b>802.11ac (VHT80)</b>					
5210	49.372	9.29	28	0.04256	1.00
<b>NOTE: Directional gain = <math>10 \log[(10^{\text{G1}/20} + 10^{\text{G2}/20} + 10^{\text{G3}/20})^2 / 3] = 9.29\text{dBi}</math></b>					
<b>STBC_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5180 - 5240	39.110	5.3	28	0.01345	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	49.247	5.3	28	0.01694	1.00
<b>802.11ac (VHT80)</b>					
5210	49.372	5.3	28	0.01698	1.00

<b>Beam forming (MCS0 N=1)_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5180 - 5240	23.349	9.29	28	0.02013	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	23.103	9.29	28	0.01991	1.00
<b>802.11ac (VHT80)</b>					
5210	22.688	9.29	28	0.01956	1.00
<b>NOTE: Directional gain = <math>10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2 / 3] = 9.29\text{dBi}</math></b>					
<b>Beam forming (MCS0 N=2)_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5180 - 5240	34.760	7.06	28	0.01793	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	38.974	7.06	28	0.02010	1.00
<b>802.11ac (VHT80)</b>					
5210	39.183	7.06	28	0.02021	1.00
<b>NOTE: Directional gain = maximum gain of antennas + <math>10 \log(3/2) = 7.06\text{dBi}</math></b>					
<b>Beam forming (MCS0 N=3)_MODE</b>					
<b>FREQUENCY BAND (MHz)</b>	<b>MAX POWER (mW)</b>	<b>ANTENNA GAIN (dBi)</b>	<b>DISTANCE (cm)</b>	<b>POWER DENSITY (mW/ cm<sup>2</sup>)</b>	<b>LIMIT (mW/cm<sup>2</sup>)</b>
<b>802.11ac (VHT20)</b>					
5180 - 5240	41.871	5.3	28	0.01440	1.00
<b>802.11ac (VHT40)</b>					
5190 - 5230	49.247	5.3	28	0.01694	1.00
<b>802.11ac (VHT80)</b>					
5210	49.372	5.3	28	0.01698	1.00

**For Zigbee:**

FREQUENCY BAND (MHz)	MAX POWER (mW)	ANTENNA GAIN (dBi)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
2405 - 2480	106.17	3.5	28	0.02413	1.00

**For Zwave:**

FREQUENCY BAND (MHz)	FIELD STRENGTH OF FUNDAMENTAL @3m (dBuV/m)	POUT EIRP (dBm)	POUT EIRP (mW)	DISTANCE (cm)	POWER DENSITY (mW/ cm <sup>2</sup> )	LIMIT (mW/cm <sup>2</sup> )
908.4-916.0	100.9	5.67	3.691	28	0.00037	0.61

**CONCLUSION:**

All of the Z-Wave technology, Zigbee technology and WLAN (2.4GHz & 5GHz) can transmit simultaneously, the formula of calculated the MPE is:

$$CPD_1 / LPD_1 + CPD_2 / LPD_2 + \dots \text{etc.} < 1$$

**CPD = Calculation power density**

**LPD = Limit of power density**

Therefore, the worst-case situation is  $0.39319 / 1 + 0.56075 / 1 + 0.02413 / 1 + 0.00037 / 0.61 = 0.979$ , which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

**--- END ---**