

RF Exposure Report

Report No.: SA170417C09C

FCC ID: 2AKCZ-0C1

Test Model: APL42-0C1

Received Date: Sep. 29, 2017

Test Date: Oct. 11 ~ Nov. 17, 2017

Issued Date: Dec. 01, 2017

Applicant: SonicWall Inc.

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Release Control Record

Issue No.	Description	Date Issued
SA170417C09C	Original release.	Dec. 01, 2017

1 Certificate of Conformity

Product: Wireless Access Point

Brand: SONICWALL

Test Model: APL42-0C1

Sample Status: Engineering sample

Applicant: SonicWall Inc.

Test Date: Oct. 11 ~ Nov. 17, 2017

Standards: FCC Part 2 (Section 2.1091)

KDB 447498 D01 General RF Exposure Guidance v06

IEEE C95.1

The above equipment 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:

Dec. 01, 2017

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Approved by :



Date:

Dec. 01, 2017

Ken Liu / Senior Manager

2 RF Exposure

2.1 Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
300-1500	...	...	F/1500	30
1500-100,000	...	...	1.0	30

F = Frequency in MHz

2.2 MPE Calculation Formula

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

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

2.3 Classification

The antenna of this product, under normal use condition, is at least 58cm away from the body of the user. So, this device is classified as Mobile Device.

3 Calculation Result of Maximum Conducted Power

Ant. Type	Frequency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
Radio 1						
Dipole	WLAN 2412~2462 (CDD mode)	28.14	10.52	58	0.174	1
	WLAN 2412~2462 (Beamforming mode)	21.16	10.52	58	0.035	1
Sector	WLAN 2412~2462 (CDD mode)	23.31	18.27	58	0.340	1
	WLAN 2412~2462 (Beamforming mode)	17.29	18.27	58	0.085	1
Panel (Model: P254-07)	WLAN 2412~2462 (CDD mode)	27.16	13.87	58	0.300	1
	WLAN 2412~2462 (Beamforming mode)	20.77	13.87	58	0.069	1
Panel (Model: P254-13)	WLAN 2412~2462 (CDD mode)	22.85	18.37	58	0.313	1
	WLAN 2412~2462 (Beamforming mode)	16.83	18.37	58	0.078	1
Panel (Model: P254-09)	WLAN 2412~2462 (CDD mode)	26.28	15.17	58	0.330	1
	WLAN 2412~2462 (Beamforming mode)	19.21	15.17	58	0.065	1
Panel (Model: P124-10)	WLAN 2412~2462 (CDD mode)	26.28	15.67	58	0.371	1
	WLAN 2412~2462 (Beamforming mode)	19.74	15.67	58	0.082	1

Ant. Type	Frequency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
Radio 2						
Dipole	WLAN 5180~5240 (CDD mode)	24.79	12.32	58	0.122	1
	WLAN 5260~5320 (CDD mode)	18.71	12.32	58	0.030	1
	WLAN 5500~5700 (CDD mode)	18.65	12.32	58	0.030	1
	WLAN 5745~5825 (CDD mode)	27.75	12.32	58	0.240	1
	WLAN 5180~5240 (Beamforming mode)	18.52	12.32	58	0.029	1
	WLAN 5260~5320 (Beamforming mode)	12.69	12.32	58	0.007	1
	WLAN 5500~5700 (Beamforming mode)	12.63	12.32	58	0.007	1
	WLAN 5745~5825 (Beamforming mode)	21.69	12.32	58	0.060	1
Sector	WLAN 5180~5240 (CDD mode)	13.90	19.97	58	0.058	1
	WLAN 5260~5320 (CDD mode)	14.45	19.97	58	0.065	1
	WLAN 5500~5700 (CDD mode)	15.34	19.97	58	0.080	1
	WLAN 5745~5825 (CDD mode)	21.37	19.97	58	0.322	1
	WLAN 5180~5240 (Beamforming mode)	7.87	19.97	58	0.014	1
	WLAN 5260~5320 (Beamforming mode)	8.43	19.97	58	0.016	1
	WLAN 5500~5700 (Beamforming mode)	9.32	19.97	58	0.020	1
	WLAN 5745~5825 (Beamforming mode)	15.35	19.97	58	0.081	1
Panel (Model: P254-07)	WLAN 5180~5240 (CDD mode)	11.37	16.17	58	0.013	1
	WLAN 5260~5320 (CDD mode)	19.06	16.17	58	0.079	1
	WLAN 5500~5700 (CDD mode)	17.05	16.17	58	0.050	1
	WLAN 5745~5825 (CDD mode)	25.30	16.17	58	0.332	1
	WLAN 5180~5240 (Beamforming mode)	5.29	16.17	58	0.003	1
	WLAN 5260~5320 (Beamforming mode)	13.04	16.17	58	0.020	1
	WLAN 5500~5700 (Beamforming mode)	11.03	16.17	58	0.012	1
	WLAN 5745~5825 (Beamforming mode)	19.28	16.17	58	0.083	1

Ant. Type	Frequency Band (MHz)	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
Panel (Model: P254-13)	WLAN 5180~5240 (CDD mode)	8.44	19.97	58	0.016	1
	WLAN 5260~5320 (CDD mode)	15.25	19.97	58	0.079	1
	WLAN 5500~5700 (CDD mode)	15.08	19.97	58	0.076	1
	WLAN 5745~5825 (CDD mode)	21.37	19.97	58	0.322	1
	WLAN 5180~5240 (Beamforming mode)	2.42	19.97	58	0.004	1
	WLAN 5260~5320 (Beamforming mode)	9.23	19.97	58	0.020	1
	WLAN 5500~5700 (Beamforming mode)	9.06	19.97	58	0.019	1
	WLAN 5745~5825 (Beamforming mode)	15.35	19.97	58	0.081	1
Panel (Model: P254-09)	WLAN 5180~5240 (CDD mode)	15.11	16.08	58	0.031	1
	WLAN 5260~5320 (CDD mode)	18.91	16.08	58	0.075	1
	WLAN 5500~5700 (CDD mode)	17.53	16.08	58	0.054	1
	WLAN 5745~5825 (CDD mode)	25.59	16.08	58	0.347	1
	WLAN 5180~5240 (Beamforming mode)	9.00	16.08	58	0.008	1
	WLAN 5260~5320 (Beamforming mode)	12.89	16.08	58	0.019	1
	WLAN 5500~5700 (Beamforming mode)	11.51	16.08	58	0.014	1
	WLAN 5745~5825 (Beamforming mode)	19.37	16.08	58	0.083	1
Panel (Model: P154-12)	WLAN 5180~5240 (CDD mode)	18.63	18.80	58	0.131	1
	WLAN 5260~5320 (CDD mode)	15.32	18.80	58	0.061	1
	WLAN 5500~5700 (CDD mode)	15.34	18.80	58	0.061	1
	WLAN 5745~5825 (CDD mode)	23.18	18.80	58	0.373	1
	WLAN 5180~5240 (Beamforming mode)	12.61	18.80	58	0.033	1
	WLAN 5260~5320 (Beamforming mode)	9.30	18.80	58	0.015	1
	WLAN 5500~5700 (Beamforming mode)	9.32	18.80	58	0.015	1
	WLAN 5745~5825 (Beamforming mode)	16.99	18.80	58	0.090	1
Radio 3						
Scanning Antenna	WLAN 2412~2462	21.12	3.15	58	0.006	1
Radio 4						
BLE Antenna	BT LE 2402~2480	4.81	3.37	58	0.0002	1

Note:

2.4GHz:

Dipole antenna, Directional gain = $4.5\text{dBi} + 10\log(4) = 10.52\text{dBi}$

Sector antenna, Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 18.27\text{dBi}$

Panel antenna (Model: P254-07), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 13.87\text{dBi}$

Panel antenna (Model: P254-13), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 18.37\text{dBi}$

Panel antenna (Model: P254-09), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 15.17\text{dBi}$

Panel antenna (Model: P124-10), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 15.67\text{dBi}$

5.0GHz:

Dipole antenna, Directional gain = $6.3\text{dBi} + 10\log(4) = 12.32\text{dBi}$

Sector antenna, Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 19.97\text{dBi}$

Panel antenna (Model: P254-07), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 16.17\text{dBi}$

Panel antenna (Model: P254-13), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 19.97\text{dBi}$

Panel antenna (Model: P254-09), Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/4] = 16.08\text{dBi}$

Panel antenna (Model: P124-10), Directional gain = $12.78\text{dBi} + 10\log(4) = 18.80\text{dBi}$

Dipole					
Frequency Band	Max. Power (dBm)			Total Power (dBm)	Power Limit (dBm)
	Radio 1	Radio 3	Radio 4		
2.4GHz	28.14	21.12	4.81	28.94	30

Sector					
Frequency Band	Max. Power (dBm)			Total Power (dBm)	Power Limit (dBm)
	Radio 1	Radio 3	Radio 4		
2.4GHz	23.31	21.12	4.81	25.40	30

Panel (Model: P254-07)					
Frequency Band	Max. Power (dBm)			Total Power (dBm)	Power Limit (dBm)
	Radio 1	Radio 3	Radio 4		
2.4GHz	27.16	21.12	4.81	28.15	30

Panel (Model: P254-13)					
Frequency Band	Max. Power (dBm)			Total Power (dBm)	Power Limit (dBm)
	Radio 1	Radio 3	Radio 4		
2.4GHz	22.85	21.12	4.81	25.12	30

Panel (Model: P254-09)					
Frequency Band	Max. Power (dBm)			Total Power (dBm)	Power Limit (dBm)
	Radio 1	Radio 3	Radio 4		
2.4GHz	26.28	21.12	4.81	27.46	30

Panel (Model: P124-10)					
Frequency Band	Max. Power (dBm)			Total Power (dBm)	Power Limit (dBm)
	Radio 1	Radio 3	Radio 4		
2.4GHz	26.28	21.12	4.81	27.46	30

Conclusion:

The formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

Radio 1 (Dipole) + Radio 2 (Dipole) + Radio 3 + Radio 4
 $= 0.174 + 0.240 + 0.006 + 0.0002 = 0.420 < 1$

Radio 1 (Sector) + Radio 2 (Sector) + Radio 3 + Radio 4
 $= 0.340 + 0.322 + 0.006 + 0.0002 = 0.668 < 1$

Radio 1 (Panel (Model: P254-07)) + Radio 2 (Panel (Model: P254-07)) + Radio 3 + Radio 4
 $= 0.300 + 0.332 + 0.006 + 0.0002 = 0.638 < 1$

Radio 1 (Panel (Model: P254-13)) + Radio 2 (Panel (Model: P254-13)) + Radio 3 + Radio 4
 $= 0.313 + 0.322 + 0.006 + 0.0002 = 0.641 < 1$

Radio 1 (Panel (Model: P254-09)) + Radio 2 (Panel (Model: P254-09)) + Radio 3 + Radio 4
 $= 0.330 + 0.347 + 0.006 + 0.0002 = 0.683 < 1$

Radio 1 (Panel (Model: P124-10)) + Radio 2 (Panel (Model: P154-12)) + Radio 3 + Radio 4
 $= 0.371 + 0.373 + 0.006 + 0.0002 = 0.750 < 1$

---END---