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.
Address:	5455 Great America Parkway, Santa Clara, CA 95054 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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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

Pettie Chen / Senior Specialist

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

$Pd = (Pout*G) / (4*pi*r^2)$

where

Pd = power density in mW/cm^2

Pout = 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

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 = 4.5dBi + 10log(4) = 10.52dBi
Sector antenna, Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 18.27dBi
Panel antenna (Model: P254-07), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 13.87dBi
Panel antenna (Model: P254-13), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 18.37dBi
Panel antenna (Model: P254-09), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 15.17dBi
Panel antenna (Model: P124-10), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 15.67dBi

5.0GHz:
Dipole antenna, Directional gain = 6.3dBi + 10log(4) = 12.32dBi
Sector antenna, Directional gain = Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 19.97dBi
Panel antenna (Model: P254-07), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 16.17dBi
Panel antenna (Model: P254-13), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 19.97dBi
Panel antenna (Model: P254-09), Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2/4$]= 16.08dBi
Panel antenna (Model: P124-10), Directional gain = 12.78dBi + 10log(4)= 18.80dBi

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 + ……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

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