



SPORTON International Inc.

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

Maximum Permissible Exposure Report

Applicant's company	Allied Telesis K.K
Applicant Address	2nd. TOC Bldg. 7-21-11 Nishi-Gotanda, Shinagawa-ku, Tokyo Japan, 141-0031
FCC ID	RSL-MWS2533AP
Manufacturer's company	Senao Networks, Inc.
Manufacturer Address	3F, No. 529, Chung Cheng Rd., Hsintien, Taipei, Taiwan

Product Name	IEEE 802.a/b/g/n/ac Managed Wireless Access Point
Brand Name	
Model Name	AT-MWS2533AP
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Oct. 15, 2015
Final Test Date	Nov. 30, 2015
Submission Type	Original Equipment


Kevin Liang
SPORTON INTERNATIONAL INC.



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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA720735-01AB	Rev. 01	Initial issue of report	Sep. 15, 2017

1. GENERAL DESCRIPTION

1.1. EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)

1.2. Table for Multiple List

The model names are identical to each other in all aspects except for the following table:

Equipment	EUT	Product Name	Model Name	Internal Antenna	External Antenna	Equipped Antenna
Wireless 802.11a/AC+ b/g/n Access Point	1	WS-AP3935e-FCC	31014	X	V	Set 1~9
	2	WS-AP3935i-FCC	31012	V	X	Set 10

1.3. Testing Location

Testing Location		
☐	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-327-0973
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085

2. MAXIMUM PERMISSIBLE EXPOSURE

2.1. Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	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

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2. MPE Calculation Method

The MPE was calculated at 25 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

2.3. Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For EUT 1

For Non-Beamforming Mode

For 5GHz Band:

Antenna Type : Sector Antenna

Conducted Power for IEEE 802.11a: 28.07dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	5785	7.50	5.6234	28.0654	640.5312	0.458850	1	Complies

For 2.4GHz Band:

Antenna Type : Sector Antenna

Conducted Power for IEEE 802.11g: 25.19 dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	2437	10.50	11.2202	25.1882	330.2313	0.472007	1	Complies

For Beamforming Mode

For 5GHz Band:

Antenna Type : Dipole Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 24.74dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	5230	10.69	11.7236	24.7364	297.6043	0.444457	1	Complies

Note:
$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

For 2.4GHz Band:

Antenna Type : Sector Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 22.36dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	2437	13.51	22.4404	22.3571	172.0738	0.491898	1	Complies

Note:
$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

Conclusion:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.491898 / 1 + 0.458850 / 1 = 0.950748, which is less than "1". This confirmed that the device complies.

For EUT 2

For Non-Beamforming Mode

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 28.82dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	5785	5.84	3.8371	28.8206	762.1921	0.372559	1	Complies

For 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11g: 28.34 dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	2437	3.98	2.5003	28.3352	681.5782	0.217093	1	Complies

For Beamforming Mode

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 24.26dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	5795	11.73	14.8911	24.2560	266.4387	0.505423	1	Complies

Note:
$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

For 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1(VHT20): 25.41 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
25	2437	9.78	9.4952	25.4070	347.2968	0.420083	1	Complies

Note:
$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

Conclusion:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.420083 / 1 + 0.505423 / 1 = 0.925506$, which is less than "1". This confirmed that the device complies.