

Maximum Permissible Exposure Report

Product	: IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.2 M.2 LGA Type 1216 Module
Model Name	: AP6275SDSR
FCC ID	: RYK-AP6275SDSR
Test Regulation	: 47 CFR FCC Part 2.1091
Received Date	: 2022/8/31
Test Date	: 2022/9/14 ~ 2022/9/19
Issued Date	: 2022/12/23
Applicant	: SparkLAN Communications, Inc. 5F, No. 199, Ruihu St., Neihu Dist., Taipei City 114067, Taiwan
Issued By	: Underwriters Laboratories Taiwan Co., Ltd. Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan



The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

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1. Attestation of Test Results

APPLICANT: SparkLAN Communications, Inc.
5F, No. 199, Ruihu St., Neihu Dist., Taipei City 114067, Taiwan

MANUFACTURER: SparkLAN Communications, Inc.
5F, No. 199, Ruihu St., Neihu Dist., Taipei City 114067, Taiwan

EUT DESCRIPTION: IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.2 M.2 LGA
Type 1216 Module

BRAND: SparkLAN, Ampak

MODEL: AP6275SDSR

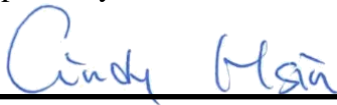
SAMPLE STAGE: Engineering Verification Test sample

APPLICABLE STANDARDS	
STANDARD	Test Results
47 CFR FCC PART 2.1091	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Cindy Hsin
Project Handler

Date : 2022/12/23

Approved and Authorized By:



Eric Lee
Senior Laboratory Engineer

Date : 2022/12/23

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Doc No: Form-ULID-004725 (DCS:17-EM-F0864) / 5.1

2. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with KDB 447498 D04 Interim General RF Exposure Guidance v01.

3. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

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4. Equipment Under Test

4.1. Description of EUT

Product	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.2 M.2 LGA Type 1216 Module	
Brand Name	SparkLAN, Ampak	
Model Name	AP6275SDSR	
Operating Frequency	Bluetooth EDR	2402MHz ~ 2480MHz
	Bluetooth LE	2402MHz ~ 2480MHz
	WLAN	2.4GHz: 2412MHz ~ 2462MHz 5GHz: 5180MHz ~ 5240MHz 5260MHz ~ 5320MHz 5500MHz ~ 5720MHz 5745MHz ~ 5825MHz
Modulation	Bluetooth EDR	GFSK, $\pi/4$ -DQPSK, 8DPSK
	Bluetooth LE	GFSK
	WLAN	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA
Number of Channel	Bluetooth EDR	79
	Bluetooth LE	40

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Number of Channel	2.4G WLAN 2412 ~ 2462 MHz	11 for 802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20)
	5G WLAN 5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5G WLAN 5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5G WLAN 5500 ~ 5720 MHz	12 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		6 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40)
		3 for 802.11ac (VHT80), 802.11ax (HE80)
	5G WLAN 5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11 ac (VHT40), 802.11ax (HE40)
1 for 802.11ac (VHT80), 802.11ax (HE80)		
Normal Voltage	3.3Vdc	
Sample ID	5297201	

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Note:

1. The model has two brand names as follows:

Brand	Product name	Model
SparkLAN	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.2 M.2 LGA Type 1216 Module	AP6275SDSR
Ampak		

2. The EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
GFSK (BT- BLE)	1TX,1RX
GFSK, $\pi/4$ -DQPSK and 8DPSK (BT-EDR)	1TX,1RX
802.11a	2TX,2RX
802.11b	1Tx Diversity, 2RX
802.11g	2TX,2RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX
802.11ac (VHT20)	2TX,2RX
802.11ac (VHT40)	2TX,2RX
802.11ac (VHT80)	2TX,2RX
802.11ax (HE20)	2TX,2RX
802.11ax (HE40)	2TX,2RX
802.11ax (HE80)	2TX,2RX

3. The EUT contains following accessory devices:

Product	Brand	Model	Description
Antenna 1	SparkLAN	AD-103AG	-
Antenna 2	SparkLAN	AD-301N	-
Antenna 3	SparkLAN	AD-302N	-
Antenna 4	SparkLAN	AD-303N	-
Antenna 5	SparkLAN	AD-305N	-
Antenna 6	SparkLAN	AD-308N	-
Antenna 7	SparkLAN	AD-309N	-
Antenna 8	SparkLAN	AD-310N	-
Antenna 9	SparkLAN	AD-311N	-
Antenna 10	GRAND-TEK Technology	103DG00000140	-
Antenna 11	GRAND-TEK Technology	103DG00000150	-

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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4.2. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Frequency Band (MHz)	Maximum Gain (dBi)	Remark
1	Chain (0)+(1)	SparkLAN	AD-103AG	Dipole	2400~2500	2.02	RP-SMA
					5150~5875	2.03	
2	Chain (0)+(1)	SparkLAN	AD-301N	Dipole	2400~2500	4.4	RP-SMA
					5150~5850	5.8	
3	Chain (0)+(1)	SparkLAN	AD-302N	Dipole	2400~2500	3.14	RP-SMA
					5150~5850	2.87	
4	Chain (0)+(1)	SparkLAN	AD-303N	Dipole	2400~2500	3.14	RP-SMA
					5150~5850	3.45	
5	Chain (0)+(1)	SparkLAN	AD-305N	Dipole	2400~2500	5	RP-SMA
					5150~5825	5.53	
6	Chain (0)+(1)	SparkLAN	AD-308N	Dipole	2400~2500	3	I-PEX
					5150~5825	5	
7	Chain (0)+(1)	SparkLAN	AD-309N	Dipole	2400~2500	1.68	I-PEX
					5150~5875	4.72	
8	Chain (0)+(1)	SparkLAN	AD-310N	Dipole	2400~2500	2.65	I-PEX
					5150~5875	4.86	
9	Chain (0)+(1)	SparkLAN	AD-311N	Dipole	2400~2500	2.67	I-PEX
					5150~5875	4.91	
10	Chain (0)+(1)	GRAND-TEK Technology	103DG00000140	Dipole	2400~2500	4.8	I-PEX
					5150~5875	5	
11	Chain (0)+(1)	GRAND-TEK Technology	103DG00000150	Dipole	2400~2500	2.5	I-PEX
					5150~5875	5.3	

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

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5. Requirement

Limits for General Population/Uncontrolled Exposure

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 ²	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

Note 1: f = frequency in MHz, * means Plane-wave equivalent power density

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Power Density (S) is calculated by the following formula:

$$S = (P \cdot G) / 4\pi R^2$$

where: S = power density (in appropriate units, e.g. mW/ cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

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6. General RF Exposure Test Exemption

The corresponding Exclusion Threshold condition, listed below:

- 1) Blanket Exempt: Following 47 CFR 1.1307(b)(3)(i)(A), the available maximum time-averaged power is no more than 1 mW.
- 2) SAR Exempt: Following 47 CFR 1.1307(b)(3)(i)(B), the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

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- 3) MPE Exempt: Following 47 CFR 1.1307(b)(3)(i)(C), using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2f$.
1,500-100,000	$19.2R^2$.

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7. Radio Frequency Radiation Exposure Evaluation

(1) General RF Exposure Test Exemption

Option	Evaluation Method	Clause
<input type="checkbox"/>	Blanket Exempt	47 CFR 1.1307(b)(3)(i)(A)
<input type="checkbox"/>	SAR Exempt	47 CFR 1.1307(b)(3)(i)(B)
<input checked="" type="checkbox"/>	MPE Exempt	47 CFR 1.1307(b)(3)(i)(C)

Note: Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) - 2.15 (dB)

Non-Beamforming mode

Bluetooth EDR

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2402 ~ 2480	0.0199	0.2	13.70	0.023	0.768

Bluetooth LE

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2402 ~ 2480	0.0199	0.2	12.78	0.019	0.768

WLAN 2.4GHz

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2412 ~ 2462	0.0198	0.2	26.02	0.4	0.768

WLAN 5GHz

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
5180 ~ 5240	0.0092	0.2	26.63	0.46	0.768
5260 ~ 5320	0.0091	0.2	26.71	0.469	0.768
5500 ~ 5700	0.0087	0.2	26.69	0.467	0.768
5745 ~ 5825	0.0083	0.2	28.71	0.743	0.768

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Beamforming mode**WLAN 2.4GHz**

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2412 ~ 2462	0.0198	0.2	25.79	0.379	0.768

WLAN 5GHz

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
5180 ~ 5240	0.0092	0.2	26.36	0.433	0.768
5260 ~ 5320	0.0091	0.2	26.35	0.432	0.768
5500 ~ 5700	0.0087	0.2	26.39	0.436	0.768
5745 ~ 5825	0.0084	0.2	28.30	0.676	0.768

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(2) Simultaneously transmission condition:

Condition	Technology	
1	BT-GFSK	WLAN (2.4GHz)
2	BT-GFSK	WLAN (5GHz)

Condition 1	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
802.11ax(HE20)	0.2	0.4	0.768	0.551	≤ 1
BT-GFSK	0.2	0.023	0.768		

Condition 2	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
802.11a	0.2	0.743	0.768	0.997	≤ 1
BT-GFSK	0.2	0.023	0.768		

Conclusion:

The Bluetooth EDR and WLAN 2.4GHz and Bluetooth EDR and WLAN 5GHz can transmit simultaneously, the formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

Bluetooth + WLAN 2.4GHz

$$\text{Situation is } (0.00765 / 1) + (0.13054 / 1) = 0.13819$$

Bluetooth + WLAN 5GHz

$$\text{Situation is } (0.00765 / 1) + (0.24251 / 1) = 0.25016$$

Therefore the maximum calculations of above situations are less than the “1” limit.

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

END OF REPORT

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