Maximum Permissible Exposure Report

Product	:	11ax/ac/a/n 4T4R WiFi Mini PCIe Module
Model Name	:	WPEQ-405AX
FCC ID	:	RYK-WPEQ405AX
Test Regulation	:	47 CFR FCC Part 2.1091
Received Date	:	2021/7/22
Test Date	:	2021/7/26 ~ 2021/8/29
Issued Date	:	2021/10/5
Applicant	:	SparkLAN Communications, Inc. 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Testing Laboratory
3398

REVISION HISTORY

Original Test Report No.: 4790058688-US-R2-V0

Rev.	Test report No.	Date	Page revised	Contents
Original	4790058688-US-R2-V0	2021/10/5	-	Initial issue

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1. Attestation of Test Results

APPLICANT:	SparkLAN Communications, Inc. 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)
MANUFACTURER:	SparkLAN Communications, Inc. 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)
EUT DESCRIPTION:	11ax/ac/a/n 4T4R WiFi Mini PCIe Module
BRAND:	SparkLAN
MODEL:	WPEQ-405AX
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:

Sally Lu Date : 2021/10/5
Project Handler

Approved and Authorized By:

Mike Cai Date : 2021/10/5
Engineer Project Associate

2. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with KDB 447498 D01 General RF Exposure Guidance v06.

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.

4. Equipment Under Test

4.1. Description of EUT

Product Name	11ax/ac/a/n 4T4R WiFi Mini PCIe Module	
Brand Name	SparkLAN	
Model Name	WPEQ-405AX	
Operating Frequency	WLAN	**5GHz:** 5180MHz ~ 5240MHz 5260MHz ~ 5320MHz 5500MHz ~ 5700MHz 5745MHz ~ 5825MHz
Modulation	WLAN	1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA
Number of Channel	5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
		1 for 802.11ac (VHT160), 802.11ax (HE160)
	5500 ~ 5700 MHz	11 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		5 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		2 for 802.11ac (VHT80), 802.11ax (HE80)
		1 for 802.11ac (VHT160), 802.11ax (HE160)
	5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)

Normal Voltage	3.3Vdc from Host
Sample ID	4091428
Software Version	N/A

Note:

1. The EUT provides four completed transmitters and four receivers.

Modulation Mode	Tx,Rx Function
802.11a	4TX,4RX
802.11b	4TX,4RX
802.11g	4TX,4RX
802.11n (HT20)	4TX,4RX
802.11n (HT40)	4TX,4RX
802.11ac (VHT20)	4TX,4RX
802.11ac (VHT40)	4TX,4RX
802.11ac (VHT80)	4TX,4RX
802.11ac (VHT160)	4TX,4RX
802.11ax (HE20)	4TX,4RX
802.11ax (HE40)	4TX,4RX
802.11ax (HE80)	4TX,4RX
802.11ax (HE160)	4TX,4RX

2. The EUT contains following accessory devices:

Product	Brand	Model	Description
Dipole Antenna 1	SparkLAN	AD-103AG	2.4 GHz: 2.02 dBi 5 GHz: 2.03 dBi RP-SMA
Dipole Antenna 2	SparkLAN	AD-302N	2.4 GHz: 3.14 dBi 5 GHz: 2.74 dBi RP-SMA
Dipole Antenna 3	SparkLAN	AD-303N	2.4 GHz: 3.14 dBi 5 GHz: 3.24dBi RP-SMA

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

4.2. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)	Remark
1	Chain (0)+(1)+(2)+(3)	SparkLAN	AD-103AG	Dipole	2.03	Length of Antenna cable:150mm Connector type of Antenna cable: I-PEX/MHF4 to RP-SMA(F)
2	Chain (0)+(1)+(2)+(3)	SparkLAN	AD-302N	Dipole	2.73	
3	Chain (0)+(1)+(2)+(3)	SparkLAN	AD-303N	Dipole	3.24	

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.

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:

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

where: S = power density (in appropriate units, e.g. mW/cm^2)
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)

6. Radio Frequency Radiation Exposure Evaluation

WLAN 5GHz

Evaluation Frequency (MHz)	Max. Average power (dBm)	Directional Gain (dBi)	Max. EIRP (dBm)	Max. EIRP (mW)	Power density @ 26 cm (mW/cm^2)	Limit (mW/cm^2)
5180 ~ 5240	22.22	9.26	31.48	1406.048	0.16552	1
5260 ~ 5320	22.39	9.26	31.65	1462.177	0.17212	1
5500 ~ 5700	23.39	9.26	32.65	1840.772	0.21669	1
5745 ~ 5825	29.58	9.26	38.84	7655.966	0.90124	1

Note:
1. Max. EIRP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi)
2. Max. EIRP (mW) = $10^{(\text{Max. EIRP (dBm)} / 10)}$
3. Power density (mW/cm^2) = Max. EIRP (mW) / [$4 \times \pi \times$ (calculated distance)^2], the calculated distance is 26 cm.

Conclusion:

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

END OF REPORT