

Maximum Permissible Exposure Report

Product : 802.11ax/ac/a/b/g/n 2T2R Wi-Fi USB Module

Model Name : WUBT-281AX [PU]

Series Model : WUBT-281AX [MU], WUBT-281AX [M9W],
WUBT-281AX [P9W]

FCC ID : RYK-WUBT281AX

Test Regulation : 47 CFR FCC Part 2.1091

Received Date : 2026/1/12

Test Date : 2026/01/19 ~ 2026/08/07

Issued Date : 2026/8/11

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

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building A, B and 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.

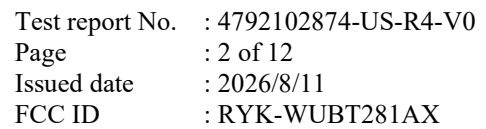
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1. Attestation of Test Results

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: 802.11ax/ac/a/b/g/n 2T2R Wi-Fi USB Module

BRAND: SparkLAN

MODEL: WUBT-281AX [PU]

SERIES MODEL: WUBT-281AX [MU], WUBT-281AX [M9W],
WUBT-281AX [P9W]

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:



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Project Handler

Date : 2026/8/11

Approved and Authorized By:



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Date : 2026/8/11

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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 A, B and 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	802.11ax/ac/a/b/g/n 2T2R Wi-Fi USB Module
Brand Name	SparkLAN
Model Name	WUBT-281AX [PU]
Series Model	WUBT-281AX [MU], WUBT-281AX [M9W], WUBT-281AX [P9W]
Normal Voltage	5Vdc from Host

Operating Frequency	2.4G WiFi: 2412MHz ~ 2462MHz 5G WiFi: 5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5720MHz, 5745 ~ 5825MHz
Sample ID	Conducted Test:9323067
	Radiated Test:9323067

Note:

1. For this report measurement uncertainty, statement of conformity, determining compliance, it is necessary to refer to the original measurement report of EUT.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.

4.2. Description of Available Antennas

Ant. No.	Transmitter Circuit	Frequency Range	Brand Name	Model Name	Maximum Gain (dBi)	Ant. Type	Connector Type
1	Chain0+1	2.4GHz 5GHz	SparkLAN	AD-103AG	2.02 2.03	Dipole	RP-SMA
2	Chain0+1	2.4GHz 5GHz	SparkLAN	AD-305N	5 5.53	Dipole	RP-SMA
3	Chain0+1	2.4GHz 5GHz	SparkLAN	AD-303N	3.14 3.45	Dipole	RP-SMA
4	Chain0+1	2.4GHz 5GHz	SparkLAN	AD-302N	3.14 2.87	Dipole	RP-SMA
5	Chain0+1	2.4GHz 5GHz	SparkLAN	AD-315N	3 5	Dipole	i-pex(MHF)
6	Chain0	2.4GHz 5GHz	SparkLAN	ANTENNA-L	-13.74 4.86	PCB	N/A
7	Chain1	2.4GHz 5GHz	SparkLAN	ANTENNA-R	-13.33 6.05	PCB	N/A

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, the laboratory shall not be held responsible.

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)

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);

- 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	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

7. Radio Frequency Radiation Exposure Evaluation

(1) General RF Exposure Test Exemption

Option	Evaluation Method	Clause
☐	Blanket Exempt	47 CFR 1.1307(b)(3)(i)(A)
☐	SAR Exempt	47 CFR 1.1307(b)(3)(i)(B)
☒	MPE Exempt	47 CFR 1.1307(b)(3)(i)(C)

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	0.36	30.18	1.042	2.4883

Note:

- $\lambda(m) = 3 \times 10^8 \text{ (m/s)} / \text{frequency (Hz)}$
- Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
- Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)} / 1000$
- Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = $19.2 R^2$
- Antenna Gain (dBi) = $5 + 10 \times \text{Log}(2) = 8.01 \text{ dBi}$

WLAN 5GHz

Evaluation Frequency	$\lambda/2\pi$	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
5180 ~ 5240	0.0092	0.36	23.08	0.203	2.4883
5260 ~ 5320	0.0091	0.36	23.20	0.209	2.4883
5500 ~ 5720	0.0086	0.36	27.23	0.528	2.4883
5745 ~ 5825	0.0083	0.36	31.56	1.432	2.4883

Note:

- $\lambda(m) = 3 \times 10^8 \text{ (m/s)} / \text{frequency (Hz)}$
- Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
- Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)} / 1000$
- Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = $19.2 R^2$
- Antenna Gain (dBi) = $5.53 + 10 \times \text{Log}(2) = 8.54 \text{ dBi}$

(2) Simultaneously transmission condition:

Condition	Technology	
1	WLAN (2.4GHz)	WLAN (5GHz)

Condition 1	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
WLAN (2.4GHz)	0.36	1.042	2.4883	0.994	≤ 1
WLAN (5GHz)	0.36	1.432	2.4883		

The formula for calculated simultaneous transmission MPE is:

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Where,

a is number of RF sources using the § 1.1307(b)(3)(i)(B) formula for Pth.

b is number of RF sources using the § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP.

c is number of RF sources with known evaluation for the specified minimum distance.

P_i is the available maximum time-averaged power or the ERP, i at a distance between 0.5 cm and 40 cm.

P_{th,i} is the exemption threshold power (Pth) according to the § 1.1307(b)(3)(i)(B) formula RF source i.

ERP_j is the available maximum time-averaged power or the ERP RF source j.

ERP_{th,j} is exemption threshold ERP RF source j, at a distance of at least $\lambda/2\pi$.

Evaluated_k is the maximum reported SAR or MPE RF source k.

Exposure Limit_k is SAR or MPE limit as applicable.

Conclusion:

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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