Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	2AYRA-03791
Equipment	:	Linksys Velop Micro-Router 6
Brand Name	:	LINKSYS
Model Name	:	LN1100, LN1110, LN1115
Applicant	:	Linksys USA, Inc. 121 Theory, Irvine, CA. 92617, USA
Standard	:	47 CFR Part 2.1091

The product was received on Aug. 10, 2023, and testing was started from Aug. 14, 2023 and completed on Sep. 26, 2023. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
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History of this test report

Report No.	Version	Description	Issued Date
FA380925	01	Initial issue of report	Nov. 29, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Conformity Assessment Condition:
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account. 2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".
Disclaimer:
The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Cathy Chiu

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) VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5250 5250-5320 5500-5700 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	BR / EDR: FHSS (GFSK / π/4-DQPSK / 8DPSK) LE: GFSK

1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	Galtronics	02102140-07935E1(DB1)	PCB Antenna	I-PEX	Note1
2	Galtronics	02102140-07935E2(DB2)	PCB Antenna	I-PEX	
3	Gemtek	WRTQ-388AX	Printed Antenna	N/A	

Note1:

Ant.	Port			Antenna Gain (dBi)					
				WLAN 2.4GHz	WLAN 5GHz				Bluetooth
	2.4GHz	5GHz	Bluetooth		UNII 1	UNII 2A	UNII 2C	UNII 3	
1	2	1	-	4.69	3.86	3.86	4.05	4.05	-
2	1	2	-	4.69	4.88	5.01	4.88	4.89	-
3	-	-	1	-	-	-	-	-	2.86

Note2: The above information was declared by manufacturer.
Note3: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left[\sum_{k=1}^{N_{ANT}} g_{j,k}\right]^2}{N_{ANT}}\right]$
BF	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left[\sum_{k=1}^{N_{ANT}} g_{j,k}\right]^2}{N_{ANT}}\right]$	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left[\sum_{k=1}^{N_{ANT}} g_{j,k}\right]^2}{N_{ANT}}\right]$

Ex.

Directional Gain (NSS1) formula : $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left[\sum_{k=1}^{N_{ANT}} g_{j,k}\right]^2}{N_{ANT}}\right]$

$NSS1(g1,1) = 10^{G1/20}$; $NSS1(g1,2) = 10^{G2/20}$; $NSS1(g1,2) = 10^{G3/20}$; $NSS1(g1,2) = 10^{G4/20}$

$gj,k = (Nss1(g1,1) + Nss1(g1,2) + Nss1(g1,3) + Nss1(g1,4))^2$

$DG = 10 \log[(Nss1(g1,1) + Nss1(g1,2) + Nss1(g1,3) + Nss1(g1,4))^2 / N_{ANT}] => 10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / N_{ANT}]$

Where ;

2.4G G1= 4.69 dBi ;G2= 4.69 dBi ;
5G UNII-1 G1 = 3.86 dBi; G2 = 4.88 dBi;
5G UNII-2A G1 = 3.86 dBi; G2 = 5.01 dBi;
5G UNII-2C G1 = 4.05 dBi; G2 = 4.88 dBi;
5G UNII-3 G1 = 4.05 dBi; G2 = 4.89 dBi;

2.4G DG = 7.70 dBi
5G UNII-1 DG = 7.40 dBi
5G UNII-2A DG = 7.46 dBi
5G UNII-2C DG = 7.49 dB
5G UNII-3 DG = 7.49 dBi

For 2.4GHz function:
For IEEE 802**.11b/g/n/VHT/ax (2TX/2RX):**
Port 1 and Port 2 can be used as transmitting/receiving antenna.
Port 1 and Port 2 could transmit/receive simultaneously.

For 5GHz function:
For IEEE 802.11a/n/ac/ax (2TX/2RX):
Port 1 and Port 2 can be used as transmitting/receiving antenna.
Port 1 and Port 2 could transmit/receive simultaneously.

For Bluetooth function (1TX/1RX):
Only Port 1 can be used as transmitting/receiving antenna.

1.3 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description
LN1100	All the models are identical, the difference model served as marketing strategy.
LN1110	
LN1115	

Note 1: From the above models, model: LN110 was selected as representative model for the test and its data was recorded in this report.
Note 2: The above information was declared by manufacturer.

1.4 Table for EUT support function

Function
AP Router
Mesh

Note: The above information was declared by manufacturer.

1.5 Accessories

Accessories			
Equipment Name	**Brand Name**	**Model Name**	**Rating**
Adapter 1	Ktec	KSA-18W-120150VU	INPUT: 100-240V ~ 50/60Hz, 0.5A OUTPUT: 12V, 1.5A
Adapter 2	MOSO	MS-V1500R120-018H0-US	INPUT: 100-240V ~ 50/60Hz, 0.6A, max. OUTPUT: 12.0V, 1.5A
Adapter 3	Ktec	KSA-18W-120150D5	INPUT: 100-240V ~ 50/60Hz, 0.5A OUTPUT: 12.0V, 1.5A, 18.0W
Others			
RJ-45 cable 1*1, non-shielded, 1m (Black)			
RJ-45 cable 2*1, non-shielded, 1m (White)			
Plug*1 (Only for adapter 3 use)			

1.6 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- 47 CFR Part 1.1307
- 47 CFR Part 1.1310

1.7 Testing Location

Testing Location Information	
Test Lab.：Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

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/ cm²)	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/f²)	<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/ cm²)	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/f²)	<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 35 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = 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 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

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

Where

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

and

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

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance R between the person and the antenna / radiating structure, where R > λ / 2 π.

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.
Note: R is in meters, f is in MHz.	

2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm²)	S Limit (mW/cm²)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	4.69	24.05	28.74	0.50	29.24	35	0.05453	1.00000	B	37.006	0.1673
5.2G;D1D	7.40	28.58	35.98	0.01	35.99	35	0.25802	1.00000	B	37.006	0.7915
5.3G;D1D	7.46	22.01	29.47	0.50	29.97	35	0.06451	1.00000	B	37.006	0.1979
5.6G;D1D	7.49	22.43	29.92	0.07	29.99	35	0.06481	1.00000	B	37.006	0.1988
5.8G;D1D	7.49	28.31	35.80	0.19	35.99	35	0.25802	1.00000	B	37.006	0.7915
2.4G;BT-BR	2.86	14.12	16.98	0.50	17.48	35	0.00364	1.00000	B	37.006	0.0112
2.4G;BT-LE	2.86	3.35	6.21	0.50	6.71	35	0.00030	1.00000	B	37.006	0.0009

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz + WLAN 5GHz + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm²)	Limit (mW/cm²)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	4.69	24.05	28.74	0.50	29.24	35	0.05453	1.00000	B	37.006	0.1673
5.2G;D1D	7.40	28.58	35.98	0.01	35.99	35	0.25802	1.00000	B	37.006	0.7915
2.4G;BT-BR	2.86	14.12	16.98	0.50	17.48	35	0.00364	1.00000	B	37.006	0.0112
Sum TL Ratio_B	0.97										
Ratio Limit	1										

Note: The above antenna gain was declared by manufacturer.

———THE END———