Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	2AYRA-08451
Equipment	:	Linksys Velop Pro 7 10G
Brand Name	:	Linksys
Model Name	:	LN1400, LN14, LN14EC, LN14WH, LN14MS, SPNLN14, MBE7100, MBE71, SPNMBE71
Applicant	:	Linksys USA, Inc. 121 Theory, Irvine, CA. 92617, USA
Standard	:	47 CFR Part 2.1091

The product was received on Dec. 01, 2022, and testing was started from Dec. 14, 2022 and completed on Feb. 20, 2024. 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
No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FA291415-02	01	Initial issue of report	Jun. 04, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-
Note: Reference to Sporton Project No.: 291415				

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: Lavender Zeng

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 5500-5720 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) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)
6GHz WLAN	5925-7125	5955-7095	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)
Bluetooth	2400-2483.5	2402-2480	LE: GFSK
IEEE802.15.4	2400-2483.5	2405-2480	O-QPSK

1.2 Antenna Information

Ant.	Port				Brand	Model Name	Antenna Type	Connector	Gain (dBi)
	2.4GHz	5GHz	6GHz	Bluetooth Zigbee					
1	1	1	-	-	Galtronics	02102140-07691-1	PCB Antenna	I-PEX	Note1
2	2	2	-	-	Galtronics	02102140-07691-2	PCB Antenna	I-PEX	
3	-	-	2	-	Galtronics	02102475-07691-2	PCB Antenna	I-PEX	
4	-	-	1	-	Galtronics	02102475-07691-1	PCB Antenna	I-PEX	
5	-	-	-	1	Galtronics	02102073-07691-2	PCB Antenna	I-PEX	

Note1:

Ant.	Antenna Gain (dBi)									
	WLAN 2.4GHz	WLAN 5GHz UNII 1	WLAN 5GHz UNII 2A	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3	WLAN 6GHz UNII 5	WLAN 6GHz UNII 6	WLAN 6GHz UNII 7	WLAN 6GHz UNII 8	Bluetooth Zigbee
1	2.626	3.600	3.535	3.323	3.333	-	-	-	-	-
2	2.626	3.600	3.535	3.323	3.333	-	-	-	-	-
3	-	-	-	-	-	3.076	3.246	3.429	3.429	-
4	-	-	-	-	-	3.076	3.246	3.429	3.429	-
5	-	-	-	-	-	-	-	-	-	1.095

Note2: The above information was declared by manufacturer.

<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/be (2TX/2RX):
Port 1 and Port 2 can be used as transmitting/receiving antenna.
Port 1 and Port 2 could transmit/receive simultaneously.
<For 6GHz function>
For IEEE 802.11ax/be (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/Zigbee function> (1TX/1RX):
Only Port 1 can be used as transmitting/receiving antenna.
Port 1 could transmit/receive simultaneously.

Note 3: 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	$Directional Gain = 10 \cdot \log\left[\frac{\sum_{i=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{i,k}\right\}^2}{N_{ANT}}\right]$
BF	$Directional Gain = 10 \cdot \log\left[\frac{\sum_{i=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{i,k}\right\}^2}{N_{ANT}}\right]$	$Directional Gain = 10 \cdot \log\left[\frac{\sum_{i=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{i,k}\right\}^2}{N_{ANT}}\right]$

Ex.

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

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

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

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

Where ;

2.4G G1= 2.626 dBi ;2.4G G2= 2.626 dBi ;DG= 5.636dBi

5G UNII-1 G1= 3.6 dBi ;5G UNII-1 G2= 3.6 dBi ;DG= 6.610dBi

5G UNII-2A G1= 3.535 dBi ;5G UNII-2A G2= 3.535 dBi ;DG= 6.545dBi

5G UNII-2C G1= 3.323 dBi ;5G UNII-2C G2= 3.323 dBi ;DG= 6.333dBi

5G UNII-3 G1= 3.33 dBi ;5G UNII-3 G2= 3.33 dBi ;DG= 6.343dBi

6G UNII-5 G1= 3.076 dBi ;6G UNII-5 G2= 3.076 dBi ;DG= 6.086dBi

6G UNII-6 G1= 3.246 dBi ;6G UNII-6 G2= 3.246 dBi ;DG= 6.256dBi

6G UNII-7 G1= 3.429 dBi ;6G UNII-7 G2= 3.429 dBi ;DG= 6.439dBi

6G UNII-8 G1= 3.429 dBi ;6G UNII-7 G2= 3.429 dBi ;DG= 6.439dBi

1.3 Table for Multiple Listing

The model names in the following table are all refer to the identical product.
The differences in models are listed in the table below:

Model Name	Description
LN1400	For retail store
LN14	For online store
LN14EC	For e-commerce
LN14WH	For Warehouse
LN14MS	For Supermarket
SPNLN14	For Service provider A
MBE7100	Sell on Linksys.com (multipack)
MBE71	Sell on Linksys.com (multipack)
SPNMBE71	For Service provider B

Note 1: From the above models, model: LN1400 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 Accessories

Accessories			
Equipment Name	**Brand Name**	**Model Name**	**Rating**
Adapter 1 (Removable plug)	Ktec	KSA-36W-120300D5	Input: 100-240V ~ 50/60Hz, 1.0A Output: 12.0V, 3.0A, 36.0W
Adapter 2	Ktec	KSA-36W-120300HU	Input: 100-240V ~ 50/60Hz, 1.0A Output: 12V, 3.0A
Adapter 3	MOSO	V30-V3000R120-036T0-US	Input: 100-240V ~ 50/60Hz, 1.0A max. Output: 12.0V, 3.0A
Others			
RJ-45 cable*1, non-shielded, 0.9m			
Plug*1 (Equip with Adapter 1 use only)			

1.5 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

1.6 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 48 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/cm^2)	S Limit (mW/cm^2)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	5.636	27.56	33.20	0.50	33.70	48	0.08097	1.00000	C	38.606	0.3231
5.2G;D1D	6.610	28.13	34.74	0.50	35.24	48	0.11543	1.00000	C	38.606	0.4607
5.3G;D1D	6.545	23.03	29.58	0.41	29.99	48	0.03446	1.00000	C	38.606	0.1375
5.6G;D1D	6.333	23.62	29.95	0.04	29.99	48	0.03446	1.00000	C	38.606	0.1375
5.8G;D1D	6.343	28.99	35.33	0.50	35.83	48	0.13222	1.00000	C	38.606	0.5277
2.4G;BT-LE	1.095	9.34	10.44	0.50	10.94	48	0.00043	1.00000	C	38.606	0.0017
2.4G;G1D (Zigbee)	1.095	9.37	10.46	0.50	10.96	48	0.00043	1.00000	C	38.606	0.0017
6.2G;D1D	6.086	-	29.21	0.50	29.71	48	0.03231	1.00000	C	38.606	0.1289
6.4G;D1D	6.256	-	27.06	0.50	27.56	48	0.01969	1.00000	C	38.606	0.0786
6.7G;D1D	6.439	-	28.21	0.50	28.71	48	0.02566	1.00000	C	38.606	0.1024
7.0G;D1D	6.439	-	25.62	0.50	26.12	48	0.01414	1.00000	C	38.606	0.0564

Note: The above antenna gain was declared by manufacturer.

Simultaneous Transmission Analysis Mode:

For WLAN 2.4GHz + WLAN 5GHz + WLAN 6GHz + 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	5.636	27.56	33.20	0.50	33.70	48	0.08097	1.00000	C	38.606	0.3231
5.8G;D1D	6.343	28.99	35.33	0.50	35.83	48	0.13222	1.00000	C	38.606	0.5277
6.2G;D1D	6.086	-	29.21	0.50	29.71	48	0.03231	1.00000	C	38.606	0.1289
2.4G;BT-LE	1.095	9.34	10.44	0.50	10.94	48	0.00043	1.00000	C	38.606	0.0017
Sum TL Ratio_C	0.9814										
Ratio Limit	1										

For WLAN 2.4GHz + WLAN 5GHz + WLAN 6GHz + Zigbee

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	5.636	27.56	33.20	0.50	33.70	48	0.08097	1.00000	C	38.606	0.3231
5.8G;D1D	6.343	28.99	35.33	0.50	35.83	48	0.13222	1.00000	C	38.606	0.5277
6.2G;D1D	6.086	-	29.21	0.50	29.71	48	0.03231	1.00000	C	38.606	0.1289
2.4G;G1D (Zigbee)	1.095	9.37	10.46	0.50	10.96	48	0.00043	1.00000	C	38.606	0.0017
Sum TL Ratio_C	0.9814										
Ratio Limit	1										

Note: The above antenna gain was declared by manufacturer.

———THE END———