



RADIO EXPOSURE TEST REPORT

FCC ID : 2AYRA-08330
Equipment : Velop AX3000 WiFi 6 System
Brand Name : LINKSYS
Model Name : MX2000, MX20EC, MX20MS, MX20WH
Applicant : Linksys USA, Inc.
12045 East Waterfront Drive
Playa Vista, CA 90094, United States.
Standard : 47 CFR Part 2.1091

The product was received on Jul. 13, 2021, and testing was started from Jul. 13, 2021 and completed on Oct. 05, 2021. 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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TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A1_1 Ver1.1



Summary of Test Result

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

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Wendy Pan



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 5850-5895	5180-5250 5250-5320 5500-5700 5745-5825 5815-5885	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 / $\pi/4$ -DQPSK / 8DPSK) LE: GFSK

1.2 Antenna Information

Ant.	Port			Brand	Model Name	Antenna Type	Connector	Gain (dBi)
	2.4GHz	5GHz	Bluetooth					
1	1	1	-	Galtronics	02102140-07575-1	PCB	I-PEX	Note1
2	2	2	-	Galtronics	02102140-07575-2	PCB	I-PEX	
3	-	-	1	Galtronics	02036073-07315	Metal	N/A	

Note1:

Ant.	Port			Antenna Gain (dBi)						
	2.4GHz	5GHz	Bluetooth	2.4GHz	5GHz UNII-1	5GHz UNII-2A	5GHz UNII-2C	5GHz UNII-3	5GHz UNII-4	Bluetooth
1	1	1	-	2.12	2.51	2.64	3.58	3.67	3.81	-
2	2	2	-	2.67	3.26	3.20	2.95	3.01	3.17	-
3	-	-	1	-	-	-	-	-	-	5.3

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 (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:

For Bluetooth mode (1TX/1RX)

Only Port 1 can be use as transmit and receive antenna.

Note3: Directional gain information

	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 $N_{ANT} \leq 4$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$
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 :

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

$$Nss1(g1,1) = 10^{G1/20} ; Nss1(g1,2) = 10^{G2/20} ; g_{j,k} = (Nss1(g1,1) + Nss1(g1,2))^2$$

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

$$2.4GHz DG = 10 \log[(10^{2.12/20} + 10^{2.67/20})^2 / N_{ANT}] = 5.41 \text{ dBi}$$

$$5 \text{ GHz Band1 DG} = 10 \log[(10^{2.51/20} + 10^{3.26/20})^2 / N_{ANT}] = 5.9 \text{ dBi}$$

$$5 \text{ GHz Band2 DG} = 10 \log[(10^{2.64/20} + 10^{3.2/20})^2 / N_{ANT}] = 5.93 \text{ dBi}$$

$$5 \text{ GHz Band3 DG} = 10 \log[(10^{3.58/20} + 10^{2.95/20})^2 / N_{ANT}] = 6.28 \text{ dBi}$$

$$5 \text{ GHz Band4 DG} = 10 \log[(10^{3.67/20} + 10^{3.01/20})^2 / N_{ANT}] = 6.36 \text{ dBi}$$

$$5.9 \text{ GHz DG} = 10 \log[(10^{3.81/20} + 10^{3.17/20})^2 / N_{ANT}] = 6.51 \text{ dBi}$$



1.3 Table for Multiple Listing

Brand	Model Name	Description
LINKSYS	MX2000	All the models are identical, the difference model served as marketing strategy.
	MX20EC	
	MX20MS	
	MX20WH	

Note 1: From the above models, model: MX2000 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-18W-120150D5	INPUT: 100-240V~50/60Hz, 0.5A OUTPUT: 12.0V, 1.5A, 18.0W
Adapter 2 (Fixed plug)	Ktec	KSA-18W-120150VU	INPUT: 100-240V~50/60Hz, 0.5A OUTPUT: 12V, 1.5A
Adapter 3 (Fixed plug)	APD	WB-18Q12FU	INPUT: 100-240V~, 50-60Hz, 0.6A Max. OUTPUT: 12V, 1.5A
Adapter 4 (Removable plug)	APD	WB-18Q12R	INPUT: 100-240V~, 50-60Hz, 0.6A, Max. OUTPUT: 12.0V, 1.5A, 18.0W
Others			
US plug*2 (for adapter 1 and adapter 4 use) RJ-45 cable*1: Non-shielded, 0.9m			

1.5 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/ cm ²)	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/f ²)	<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/ 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: 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:

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

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 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)
2.4G;D1D	5.41	23.34	28.75	0.50	29.25	0.84140	35	0.05466	1.00000
5.2G;D1D	5.90	29.01	34.91	0.50	35.41	3.47536	35	0.22576	1.00000
5.3G;D1D	5.93	23.45	29.38	0.50	29.88	0.97275	35	0.06319	1.00000
5.6G;D1D	6.28	23.16	29.44	0.50	29.94	0.98628	35	0.06407	1.00000
5.8G;D1D	6.36	29.47	35.83	0.16	35.99	3.97192	35	0.25802	1.00000
5.87G;D1D	6.51	27.69	34.20	0.50	34.70	2.95121	35	0.19171	1.00000
2.4G;BT-BR	5.30	5.46	10.76	0.50	11.26	0.01337	35	0.00087	1.00000
2.4G;BT-LE	5.30	5.36	10.66	0.50	11.16	0.01306	35	0.00085	1.00000

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

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)	Ratio (S/Limit)
2.4G;BT-BR	5.30	5.46	10.76	0.50	11.26	0.01337	35	0.00087	1.00000	0.00087
2.4G;D1D	5.41	23.34	28.75	0.50	29.25	0.84140	35	0.05466	1.00000	0.05466
5.8G;D1D	6.36	29.47	35.83	0.16	35.99	3.97192	35	0.25802	1.00000	0.25802
									Sum Ratio	0.31355
									Ratio Limit	1

Note: The above antenna gain was declared by manufacturer.

————THE END————