



RADIO EXPOSURE TEST REPORT

FCC ID : UIDNVG653UX

Equipment : 5G NR Fixed Wireless Router

Brand Name : ARRIS

Model Name : NVG653UX


Applicant : ARRIS
3871 Lakefield Drive Suite 300 SUWANEE Georgia United States 30024

Manufacturer : ARRIS
3871 Lakefield Drive Suite 300 SUWANEE Georgia United States 30024

Standard : 47 CFR Part 2.1091

The product was received on Sep. 12, 2022, and testing was started from Sep. 21, 2022 and completed on Oct. 31, 2022. 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
FA282902-02	01	Initial issue of report	Feb. 06, 2023



Summary of Test Result

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

Note: Reference to Sporton Project No.: 282902 and 282902-01.

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

- 1.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.
- 2.The presented declaration output power of WWAN for EUT in the report is provided by the manufacturer, and We, Sporton International Inc. Hsinchu Laboratory does not guarantee its accuracy.

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, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5720 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)

RF General Information			
Evaluation Mode	TX Frequency (MHz)	RX Frequency (MHz)	Modulation Type
LTE Band 5	824~849	869~894	QPSK,16QAM,64QAM, 256QAM
LTE Band 41	2496~2690	2496~2690	
5G NR n2	1850~1910	1930~1990	QPSK,16QAM,64QAM, 256QAM
5G NR n25	1850~1915	1930~1995	
5G NR n41	2496 ~2690	2496 ~2690	
5G NR n66	1710~1780	2110~2200	
5G NR n71	663~698	617~652	

Note1: The above information was declared by manufacturer.

Note2: This device contains WWAN module FCC ID: ZMOFG360NA. The WWAN function supports LTE Band 5, 41 and 5G NR n2, NR n25, NR n41, NR n66, NR n71.



1.2 Antenna Information

Ant.	Port	Brand Name	Model Name	Antenna Type	Connector	Support	Gain (dBi)
1	-	Lynwave	ALX22P-011AA1-00	Dipole	I-Pex	WWAN (617-960)(1710-2690)MHz	4.9
2	-	Lynwave	ALX22P-011AA6-00	Dipole	I-Pex	WWAN (617-960)(1710-2690)MHz	5.6
3	-	Lynwave	ALX21P-122AA0-00	Dipole	I-Pex	WWAN (1452-2690)(3000-4200) (5150-5925)MHz	5.6
4	-	Lynwave	ALX21P-122AA1-00	Dipole	I-Pex	WWAN (1452-2690)(3000-4200) (5150-5925)MHz	5.4
5	-	Lynwave	ALX21P-091AA4-00	Dipole	I-Pex	Zero wait	4.5
6	-	Lynwave	ALX21P-101AA2-00	Dipole	I-Pex	GPS	4.3
7	-	Lynwave	ALX21P-151AA0-A	Dipole	I-Pex	WWAN (3300-5000)MHz	4.3
8	-	Lynwave		Dipole	I-Pex	WWAN (3300-5000)MHz	5.2
9	2	Lynwave	ALX21P-221AA1-A	Dipole	I-Pex	WLAN 2.4GHz+ WLAN 5GHz	Note1
10	1	Lynwave		Dipole	I-Pex	WLAN 2.4GHz+ WLAN 5GHz	Note1
11	3	Lynwave	ALX21P-221AA2-A	Dipole	I-Pex	WLAN 2.4GHz+ WLAN 5GHz	Note1
12	4	Lynwave		Dipole	I-Pex	WLAN 2.4GHz+ WLAN 5GHz	Note1

Note1:

Ant.	Antenna Gain (dBi)				
	WLAN 2.4GHz	WLAN 5GHz			
		UNII 1	UNII 2A	UNII 2C	UNII 3
9	3.78	3.44	2.93	3.89	4.93
10	3.54	4.09	4.35	4.99	5.82
11	2.96	4.48	3.51	2.81	3.46
12	3.55	5.29	4.52	4.63	5.75

Ant.	Directional Gain (dBi)														
	WLAN 2.4GHz			WLAN 5GHz											
	2.45GHz			UNII 1			UNII 2A			UNII 2C			UNII 3		
	4T1S	4T2S	4T4S	4T1S	4T2S	4T4S	4T1S	4T2S	4T4S	4T1S	4T2S	4T4S	4T1S	4T2S	4T4S
9															
10	6.8	3.79	3.78	5.65	5.29	5.29	5.45	4.52	4.52	6.45	4.99	4.99	6.22	5.82	5.82
11															
12															

Note 2: The above information(excepting antenna 9~12 gain) was declared by manufacturer.

Note 3. The antenna 5 which has the receiving function only is used for zero wait.

Note 4: The antenna 9~12 gain and directional gain are measured which follow the procedure of KDB 662911 D03

Note 5: The EUT has twelve antennas.

For 2.4GHz function:

For IEEE 802.11b/g/n/VHT/ax (4TX/4RX):

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.
Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11a/n/ac/ax (4TX/4RX):

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.
Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.



1.3 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter	Frecom	F30L7-120250SPAU	INPUT: 100-240V ~ 50/60Hz, 0.8A OUTPUT: 12.0V, 2.5A, 30.0W

1.4 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

1.5 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.

1.6 Table for EUT supports functions

Function
AP Router
Mesh

Note: The above information was declared by manufacturer.



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 65 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

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 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.

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

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);

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 $R > \lambda / 2 \pi$.

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	19.2R 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)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)
2.4G;D1D	6.80	29.16	35.96	0.03	35.99	3.97192	65	0.07481	1.00000
5.2G;D1D	5.65	29.29	34.94	0.50	35.44	3.49945	65	0.06591	1.00000
5.3G;D1D	5.45	23.76	29.21	0.50	29.71	0.93541	65	0.01762	1.00000
5.6G;D1D	6.45	23.49	29.94	0.05	29.99	0.99770	65	0.02084	1.00000
5.8G;D1D	6.22	29.71	35.93	0.06	35.99	3.97192	65	0.07481	1.00000
LTE Band 5	5.60	24.17	29.77	0.50	30.27	1.06414	65	0.02004	0.54980
LTE Band 41	5.60	29.02	34.62	0.50	35.12	3.25087	65	0.06123	1.00000
5G NR n2	5.60	23.00	28.60	0.50	29.10	0.81283	65	0.01531	1.00000
5G NR n25	5.60	25.00	30.60	0.50	31.10	1.28825	65	0.02426	1.00000
5G NR n41	5.60	29.95	35.55	0.50	36.05	4.02717	65	0.07585	1.00000
5G NR n66	5.60	28.76	34.36	0.50	34.86	3.06196	65	0.05767	1.00000
5G NR n71	5.60	27.52	33.12	0.50	33.62	2.30144	65	0.04335	0.44367

MPE Exemption Option C							
Frequency (MHz)	$\lambda/2\pi$ (m)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	MPE Exemption
665.5	0.0717	0.65	33.62	31.47	1.403	3.599	Complies
2437	0.0196		35.99	33.84	2.421	8.112	Complies
5825	0.0082		35.99	33.84	2.421	8.112	Complies

Simultaneous Transmission Analysis:

WLAN 2.4GHz+WLAN 5GHz+WWAN LTE/5GHz

Simultaneous Transmissions Option C							
Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
665.5	0.65	33.62	31.47	1.403	3.599	0.99	<= 1
2437		35.99	33.84	2.421	8.112		
5825		35.99	33.84	2.421	8.112		

————THE END————