



RADIO EXPOSURE TEST REPORT

FCC ID : UIDG54
Equipment : Cable Modem
Brand Name : ARRIS
Model Name : G54
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 Feb. 27, 2023, and testing was started from Feb. 27, 2023 and completed on Mar. 24, 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

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

TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A1_1 Ver1.1

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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/manufacture 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: Sandy Chuang



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 5725-5850	5180-5240 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) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)


1.1.1 Antenna Information

Ant.	Port				Brand	Model Name	Ant. Type	Connector	Support Band
	2.4GHz	5GHz		6GHz					
		UNII1 UNII2A	UNII2C UNII3						
1	-	2	-	-	Wanshih	WPB866	DIPOLE	I-PEX	5GHz UNII 1, 2A
2	1	-	1	-	Wanshih	WPB867	DIPOLE	I-PEX	2.4GHz/5GHz UNII 2C, 3
3	-	1	-	-	Wanshih	WPB868	DIPOLE	I-PEX	5GHz UNII 1, 2A
4	2	-	2	-	Wanshih	WPB869	DIPOLE	I-PEX	2.4GHz/5GHz UNII 2C, 3
5	-	-	-	2	Wanshih	WPB870	DIPOLE	I-PEX	6GHz
6	-	-	-	1	Wanshih	WPB871	DIPOLE	I-PEX	6GHz
7	-	-	-	4	Wanshih	WPB872	DIPOLE	I-PEX	6GHz
8	-	-	-	3	Wanshih	WPB873	DIPOLE	I-PEX	6GHz

Ant.	Antenna Gain (dBi)			Ant.	Antenna Gain (dBi)	
	2.4GHz	5GHz UNII1 / UNII2A	5GHz UNII2C / UNII3		6GHz	
1	-	4.92	-	5	4.94	
2	4.14	-	4.75	6	5.68	
3	-	4.78	-	7	4.77	
4	2.64	-	4.60	8	5.83	

Note 1: The above information was declared by manufacturer.

Note 2: The DFS band and 6GHz doesn't enable at this time.

<For WLAN 2.4GHz>
For IEEE 802.11b/g/n/VHT mode (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For WLAN 5GHz>
For IEEE 802.11a/n/ac/ax/be mode (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For WLAN 6GHz>
For IEEE 802.11ax/be mode (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.

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 $N_{ANT} \leq 4$	$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_m} \left[\sum_{k=1}^{N_{ant}} \mathbf{g}_{j,k} \right]^2}{N_{ANT}} \right]$
BF	$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_m} \left[\sum_{k=1}^{N_{ant}} \mathbf{g}_{j,k} \right]^2}{N_{ANT}} \right]$	$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_m} \left[\sum_{k=1}^{N_{ant}} \mathbf{g}_{j,k} \right]^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_m} \left[\sum_{k=1}^{N_{ant}} \mathbf{g}_{j,k} \right]^2}{N_{ANT}} \right]$$

$$NSS1(g1,1) = 10^{G1/20} ; NSS1(g1,2) = 10^{G2/20} ; NSS1(g1,3) = 10^{G3/20} ; NSS1(g1,4) = 10^{G4/20}$$

$$g_{j,k} = (NSS1(g1,1) + NSS1(g1,2) + NSS1(g1,3) + NSS1(g1,4))^2$$

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2) + NSS1(g1,3) + NSS1(g1,4))^2 / N_{ANT}] \Rightarrow 10$$

$$\log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / N_{ANT}]$$

Where ;

$$2.4G\ G1 = 4.14\ dB_i ; G2 = 2.64\ dB_i ; DG = 6.43\ dB_i$$

$$5G\ UNII-1\ G1 = 4.92\ dB_i ; G2 = 4.78\ dB_i ; DG = 7.86\ dB_i$$

$$5G\ UNII-2A\ G1 = 4.92\ dB_i ; G2 = 4.78\ dB_i ; DG = 7.86\ dB_i$$

$$5G\ UNII-2C\ G1 = 4.75\ dB_i ; G2 = 4.60\ dB_i ; DG = 7.69\ dB_i$$

$$5G\ UNII-3\ G1 = 4.75\ dB_i ; G2 = 4.60\ dB_i ; DG = 7.69\ dB_i$$

$$6G\ UNII-4\ G1 = 4.94\ dB_i ; G2 = 5.68\ dB_i ; G3 = 4.77\ dB_i ; G4 = 5.83\ dB_i ; DG = 11.34\ dB_i$$

$$6G\ UNII-5\ G1 = 4.94\ dB_i ; G2 = 5.68\ dB_i ; G3 = 4.77\ dB_i ; G4 = 5.83\ dB_i ; DG = 11.34\ dB_i$$

$$6G\ UNII-6\ G1 = 4.94\ dB_i ; G2 = 5.68\ dB_i ; G3 = 4.77\ dB_i ; G4 = 5.83\ dB_i ; DG = 11.34\ dB_i$$

$$6G\ UNII-7\ G1 = 4.94\ dB_i ; G2 = 5.68\ dB_i ; G3 = 4.77\ dB_i ; G4 = 5.83\ dB_i ; DG = 11.34\ dB_i$$



1.2 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter 1	MOSO	MS-V4000R120-050A0-US	INPUT: 100-240V ~ 50/60Hz, 1.3A max. OUTPUT: 12.0V, 4.0A
Adapter 2	Frecom	F48L1-120400SPAU	INPUT: 100-240V ~ 50/60Hz, 1.4A OUTPUT: 12.0V, 4.0A, 48.0W

1.3 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

1.4 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 ISCED.



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 52 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 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	$19.2 R^2$.
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	6.43	29.32	35.75	0.24	35.99	52	0.11689	1.00000	C	39.302	0.4665
5.2G;D1D	7.86	27.26	35.12	0.50	35.62	52	0.10735	1.00000	C	39.302	0.4284
5.8G;D1D	7.69	28.14	35.83	0.16	35.99	52	0.11689	1.00000	C	39.302	0.4665

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

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm ²)	Limit (mW/cm ²)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	6.43	29.32	35.75	0.24	35.99	52	0.11689	1.00000	C	39.302	0.4665
5.8G;D1D	7.69	28.14	35.83	0.16	35.99	52	0.11689	1.00000	C	39.302	0.4665
Sum TL Ratio_C	0.9330										
Ratio Limit	1										

Note: The above antenna gain was declared by manufacturer.

————THE END————