Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	RAXXCI55AX
Equipment	:	TITAN II
Brand Name	:	Verizon
Model Name	:	ARC-XCI55AX
Applicant	:	Arcadyan Technology Corporation No.8, Sec.2, Guangfu Rd.,Hsinchu, 30071 Taiwan
Manufacturer	:	Arcadyan Technology Corporation No.8, Sec.2, Guangfu Rd.,Hsinchu, 30071 Taiwan
Standard	:	47 CFR Part 2.1091

The product was received on Oct. 22, 2021, and testing was started from Oct. 28, 2021 and completed on Jan. 12, 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
FA1O1524	01	Initial issue of report	Feb. 23, 2022
FA1O1524	02	1.Adding WWAN spec. to section 1.1. 2.Revising the Calculated Result and Limit on section 2.3.	Mar. 10, 2022
FA1O1524	03	1. Revising the Calculated Result and Limit on section 2.3.	Mar. 17, 2022
FA1O1524	04	1. Revising the Calculated Result and Limit on section 2.3.	Mar. 30, 2022

Summary of Test Result

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

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:
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: Viola Huang

1 General Description

1.1 EUT General Information

For WLAN

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)

For WWAN

RF General Information			
Evaluation Mode	**Uplink Frequency (MHz)**	**Downlink Frequency (MHz)**	**Modulation Type**
LTE Band 2	1850 ~ 1910	1930 ~ 1990	QPSK / 16QAM / 64QAM / 256QAM
LTE Band 5	824 ~ 849	869 ~ 894	
LTE Band 13	777 ~ 787	746 ~ 756	
LTE Band 48	3550 ~ 3700	3550 ~ 3700	
LTE Band 66	1710 ~ 1780	2110 ~ 2200	
5G NR n2	1850 ~ 1910	1930 ~ 1990	PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM
5G NR n5	824 ~ 849	869 ~ 894	
5G NR n66	1710 ~ 1780	2110 ~ 2200	
5G NR n77	3300 ~ 4200	3300 ~ 4200	

1.2 Antenna Information

For WLAN

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	PSA	120800109200J	Dipole	I-Pex	Note 1
2	PSA	120800109300J	Dipole	I-Pex	
3	PSA	120800109400J	Dipole	I-Pex	
4	PSA	120800109500J	Dipole	I-Pex	
5	PSA	120800109600J	Dipole	I-Pex	

Note 1:

Ant.	Port		Antenna Gain (dBi)				
	WLAN 2.4GHz	WLAN 5GHz	WLAN 2.4GHz	WLAN 5GHz			
				UNII 1	UNII 2A	UNII 2C	UNII 3
1	1	1	3.01	2.79	2.88	2.91	2.83
2	2	2	2.87	3.00	3.00	2.91	2.92
3	3	3	2.93	3.05	3.09	3.02	2.97
4	4	4	2.81	3.07	3.12	2.93	3.10
5	-	5	-	3.09	2.98	3.10	3.10

Note 2: The above information was declared by manufacturer.

For WWAN

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	walsin	120800109700J	Monopole	I-Pex	Note 3
2	walsin	120800112900J	Dipole	I-Pex	
3	walsin	120800115000J	Dipole	I-Pex	
4	walsin	120800105100J	Monopole	I-Pex	
5	walsin	120800109900J	Monopole	I-Pex	
6	walsin	120800110300J	Dipole	I-Pex	
7	walsin	120800110400J	Dipole	I-Pex	

Note 3:

Ant.	Antenna Gain (dBi)								
	LTE Band 2	LTE Band 5	LTE Band 13	LTE Band 48	LTE Band 66	5G NR n2	5G NR n5	5G NR n66	5G NR n77
1	-	0.6	2.5	-	-	-	0.6	4.1	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	3.3	-	-	-
4	-	-	-	-	-	-	-	-	-
5	2.3	-	-	-	-	2.3	-	2.7	-
6	-	-	-	1	2.7	-	-	-	1.0
7	-	-	-	-	-	-	-	-	3.9

Note 4: The above information was declared by manufacturer.

Note 5: 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	$Directiona\ lGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$
BF	$Directiona\ lGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$	$Directiona\ lGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

Ex.

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

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

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

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

Where ;

G1 = Ant 1 Gain ; G2 = Ant 2 Gain ; G3 = Ant 3 Gain ; G4 = Ant 4 Gain ;

2.4GHz DG = 8.93 dBi

5 GHz U-NII-1 DG =9.00 dBi

5 GHz U-NII-2A DG =9.04 dBi

5 GHz U-NII-2C DG =8.96 dBi

5 GHz U-NII-3 DG =8.98 dBi

The EUT has five antennas for WLAN.

For 2.4GHz function:

For IEEE 802.11 b/g/n/VHT/ax 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.

For 5GHz function:

For IEEE 802.11a/n/ac/ax 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.

Port 5 which has the receiving function only is used for zero wait.

1.3 Accessories

Accessories				
No.	**Equipment Name**	**Brand Name**	**Model Name**	**Rating**
1	Adapter	DELTA	ADH-42BW B	INPUT: 105-125V~60Hz, 1.2A OUTPUT: 12.0V, 3.5A, 42.0W
Other				
RJ-45 cable*1: Non-shielded, 1.5m				

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 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/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/ 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/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 28 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 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For WLAN

Mode	DG (dBi)	Tune-up Power (dBm)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)
2.4G;D1D	8.93	26.90	35.83	3.82825	28	0.38857	1.00000
5.2G;D1D	9.00	26.70	35.70	3.71535	28	0.37711	1.00000
5.3G;D1D	9.04	20.90	29.94	0.98628	28	0.10011	1.00000
5.6G;D1D	8.96	21.00	29.96	0.99083	28	0.10057	1.00000
5.8G;D1D	8.98	26.80	35.78	3.78443	28	0.38412	1.00000

For WWAN

Mode	DG (dBi)	Tune-up Power (dBm)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)
4G-LTE B2	2.30	23.00	25.30	0.33884	28	0.03439	1.00000
4G-LTE B5	0.60	23.00	23.60	0.22909	28	0.02325	0.54933
4G-LTE B13	2.50	23.00	25.50	0.35481	28	0.03601	0.51800
4G-LTE B48	1.00	23.00	24.00	0.25119	28	0.02550	1.00000
4G-LTE B66	2.70	23.00	25.70	0.37154	28	0.03771	1.00000
5G-NR N2	3.30	23.50	26.80	0.47863	28	0.04858	1.00000
5G-NR N5	0.60	24.00	24.60	0.28840	28	0.02927	0.54933
5G-NR N66	4.10	23.50	27.60	0.57544	28	0.05841	1.00000
5G-NR N77	3.90	25.50	29.40	0.87096	28	0.08840	1.00000

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz + WLAN 5GHz + WWAN LTE + WWAN 5G NR

Mode	DG (dBi)	Tune-up Power (dBm)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
2.4G;D1D	8.93	26.90	35.83	3.82825	28	0.38857	1.00000	0.38857
5.8G;D1D	8.98	26.80	35.78	3.78443	28	0.38412	1.00000	0.38412
4G-LTE B13	2.50	23.00	25.50	0.35481	28	0.03601	0.51800	0.06952
5G-NR N77	3.90	25.50	29.40	0.87096	28	0.08840	1.00000	0.08840
							Sum Ratio	0.93061
							Ratio Limit	1

Note: The above antenna gain was declared by manufacturer.

———THE END———