



RADIO EXPOSURE TEST REPORT

FCC ID : RSL-TQM6403GEN2

Equipment : IEEE802.11ax tri-radio 5G/5G/2.4GHz 2x2+2x2+2x2 wireless AP

Brand Name : Allied Telesis

Model Name : AT-TQm6403 GEN2

Applicant : Allied Telesis K.K.
2nd. TOC Bldg.7-21-11 Nishi-Gotanda, Shinagawa-ku Tokyo
1410031 Japan

Manufacturer : Allied Telesis K.K.
2nd. TOC Bldg.7-21-11 Nishi-Gotanda, Shinagawa-ku Tokyo
1410031 Japan

Standard : 47 CFR Part 2.1091

The product was received on Aug. 01, 2022, and testing was started from Aug. 04, 2022 and completed on Aug. 09, 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 variant 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

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Photographs of EUT v01



History of this test report

TEL : 886-3-656-9065
FAX : 886-3-656-9085
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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.: 272619-01.

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:

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: 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) 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) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)

1.2 Antenna Information

Ant.	Port			Brand	P/N	Antenna Type	Connector	Gain (dBi)
	2.4GHz	5GHz UNII 1 UNII 2A	5GHz UNII 3 UNII 2C					
1	1	1	-	WNC	ATKK RANQ-AK610	PIFA	I-PEX	Note 1
2	2	2	-	WNC	ATKK RANQ-AK610	PIFA	I-PEX	
3	-	-	1	WNC	ATKK RANQ-AK610	PIFA	I-PEX	
4	-	-	2	WNC	ATKK RANQ-AK610	PIFA	I-PEX	

Note 1

Ant.	Gain (dBi)				
	2.4GHz	5GHz UNII 1	5GHz UNII 2A	5GHz UNII 2C	5GHz UNII 3
1	2.93	5.39	5.52	5.66	5.95
2	2.69	5.99	5.99	5.54	5.88
3	-	5.54	5.55	5.92	5.92
4	-	5.84	5.93	5.79	5.91

Note 2: The above information was declared by manufacturer.

For 2.4GHz function:

For IEEE 802.11 b/g/n/VHT/ax 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 5GHz function:

For IEEE 802.11a/n/ac/ax mode (2TX/2RX)

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

Port 1 and Port 2 could transmit/receive simultaneously.

Note 3: The directional gain is measured which follows the procedure of KDB 662911 D01.

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

Ex.

Directional Gain (NSS1) formula :

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

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

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

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2))^2 / N_{ANT}] \Rightarrow 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$$

Where ;

$$G1 = 10 ; G2 = 10 ;$$

$$2.4G \ G1 = 2.93 \text{ dBi}; G2 = 2.69 \text{ dBi}; DG = 5.82 \text{ dBi}$$

$$5G \text{ UNII1} \ G1 = 5.39 \text{ dBi}; G2 = 5.99 \text{ dBi}; DG = 8.71 \text{ dBi}$$

$$5G \text{ UNII2A} \ G1 = 5.52 \text{ dBi}; G2 = 5.99 \text{ dBi}; DG = 8.77 \text{ dBi}$$

$$5G \text{ UNII2C} \ G1 = 5.92 \text{ dBi}; G2 = 5.79 \text{ dBi}; DG = 8.87 \text{ dBi}$$

$$5G \text{ UNII3} \ G1 = 5.92 \text{ dBi}; G2 = 5.91 \text{ dBi}; DG = 8.93 \text{ dBi}$$



1.3 Table for Radio function

Radio	WLAN 2.4GHz	5GHz UNII 1 + UNII 2A	5GHz UNII 2C + UNII 3
1	V	-	-
2	-	V	-
3	-	-	V

Note: The above information was declared by manufacturer.

1.4 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA272620.

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1.Adding 5GHz band 2 and band 3 (5250~5350 MHz, 5470~5725 MHz) for this device. 2.Adding 160MHz to U-NII-2C for this device.	MPE

Note: WLAN 2.4GHz, WLAN 5GHz UNII 1&3 MPE results were based on original report.

1.5 Accessories

Wall-mounted rack*1

1.6 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

1.7 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 51 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, <= P_{th}.

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

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)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)
2.4G;D1D	5.82	25.91	31.73	0.50	32.23	1.67109	51	0.05113	1.00000
5.2G;D1D	8.71	24.94	33.65	0.50	34.15	2.60016	51	0.07955	1.00000
5.3G;D1D	8.77	21.01	29.78	0.21	29.99	0.99770	51	0.02746	1.00000
5.6G;D1D	5.92	23.96	29.88	0.11	29.99	0.99770	51	0.03052	1.00000
5.8G;D1D	8.93	26.14	35.07	0.50	35.57	3.60579	51	0.11032	1.00000

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
2437	0.0196	0.51	32.23	30.08	1.019	4.994	Complies
5200	0.0092		34.15	32.00	1.585	4.994	Complies
5300	0.0090		29.99	27.84	0.608	4.994	Complies
5710	0.0084		29.99	27.84	0.608	4.994	Complies
5795	0.0082		35.57	33.42	2.198	4.994	Complies

Simultaneous Transmission Analysis

EUT + WLAN 2.4GHz + WLAN 5GHz_UNII1/UNII2A + WLAN 5GHz_UNII2C/UNII3

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
2437	0.51	32.23	30.08	1.019	4.994	0.96	<= 1
5200		34.15	32.00	1.585	4.994		
5795		35.57	33.42	2.198	4.994		

————THE END————