



# RADIO EXPOSURE TEST REPORT

**FCC ID** : RSL-TQ6403GEN2

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

**Brand Name** : Allied Telesis

**Model Name** : AT-TQ6403 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 Sep. 14, 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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## History of this test report

TEL : 886-3-656-9065  
FAX : 886-3-656-9085  
Report Template No.: CB-A1\_1 Ver1.1

Page Number : 3 of 13  
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Report Version : 01



## 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: 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)<br>802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)<br>VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)<br>802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) |
| 5GHz WLAN              | 5150-5250<br>5250-5350<br>5470-5725<br>5725-5850 | 5180-5240<br>5260-5320<br>5500-5720<br>5745-5825 | 802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)<br>802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)<br>802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)                                 |
| Bluetooth              | 2400-2483.5                                      | 2402-2480                                        | LE: GFSK                                                                                                                                                                                       |
| Zigbee (IEEE802.15.4)  | 2400-2483.5                                      | 2405-2480                                        | O-QPSK                                                                                                                                                                                         |

**1.1.1 Antenna Information**

| Ant. | Port   |                     |                     |                                   | Brand | P/N             | Antenna Type | Connector | Gain (dBi) |
|------|--------|---------------------|---------------------|-----------------------------------|-------|-----------------|--------------|-----------|------------|
|      | 2.4GHz | 5GHz UNII 1 UNII 2A | 5GHz UNII 3 UNII 2C | Bluetooth / Zigbee (IEEE802.15.4) |       |                 |              |           |            |
| 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                   | 1                                 | 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 | Bluetooth / Zigbee (IEEE802.15.4) |
| 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        | 3.49                              |

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.

**For Bluetooth (1TX/1RX):**

Only Port 1 can be used as transmitting/receiving antenna.

Port 1 could transmit/receive simultaneously.

**For Zigbee (IEEE802.15.4) (1TX/1RX):**

Only Port 1 can be used as transmitting/receiving antenna.

Port 1 could not 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.<br>For power measurements on IEEE 802.11 devices<br>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 ;

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

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

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

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

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

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

### 1.1.2 Table for Radio function

| Radio | WLAN 2.4GHz | 5GHz UNII 1 + UNII 2A | 5GHz UNII 2C + UNII 3 | Bluetooth / Zigbee (IEEE802.15.4) |
|-------|-------------|-----------------------|-----------------------|-----------------------------------|
| 1     | V           | -                     | -                     | -                                 |
| 2     | -           | V                     | -                     | -                                 |
| 3     | -           | -                     | V                     | -                                 |
| 4     | -           | -                     | -                     | V                                 |

Note: The above information was declared by manufacturer.



### 1.1.3 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA272619.

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.<br>2.Adding 160MHz to U-NII-2C for this device. | MPE                  |

Note: WLAN 2.4GHz, WLAN 5GHz UNII 1&3, Bluetooth and Zigbee (IEEE802.15.4) MPE results were based on original report.



## 1.2 Accessories

Wall-mounted rack\*1

## 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 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 <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | *(100)                                   | <6                                                               |
| 3.0-30                | 1842/f                            | 4.89/f                            | *(900/f <sup>2</sup> )                   | <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 <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | *(100)                                   | <30                                                              |
| 1.34-30               | 824/f                             | 2.19/f                            | *(180/f <sup>2</sup> )                   | <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, <= 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) | Tune-up EIRP (W) | Distance (cm) | S (mW/cm <sup>2</sup> ) | S Limit (mW/cm <sup>2</sup> ) |
|-----------------------------|----------|-------------|------------|----------------|--------------------|------------------|---------------|-------------------------|-------------------------------|
| 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                       |
| 2.4G;BT-LE                  | 3.49     | 18.49       | 21.98      | 0.50           | 22.48              | 0.17701          | 51            | 0.00542                 | 1.00000                       |
| 2.4G; Zigbee (IEEE802.15.4) | 3.49     | 19.38       | 22.87      | 0.50           | 23.37              | 0.21727          | 51            | 0.00665                 | 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      |
| 2405                   | 0.0198             |       | 23.37              | 21.22             | 0.132           | 4.994             | Complies      |
| 2402                   | 0.0199             |       | 22.48              | 20.33             | 0.108           | 4.994             | Complies      |

**Simultaneous Transmission Analysis****Test Mode 1:****EUT + WLAN 2.4GHz + WLAN 5GHz\_UNII1 + WLAN 5GHz\_UNII3 + Zigbee (IEEE802.15.4)**

| 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             | 0.99                       | <= 1                             |
| 5200                                |       | 34.15              | 32.00             | 1.585           | 4.994             |                            |                                  |
| 5795                                |       | 35.57              | 33.42             | 2.198           | 4.994             |                            |                                  |
| 2405                                |       | 23.37              | 21.22             | 0.132           | 4.994             |                            |                                  |

**Test Mode 2:****EUT + WLAN 2.4GHz + WLAN 5GHz\_UNII1 + WLAN 5GHz\_UNII3 + Bluetooth**

| 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             | 0.98                       | <= 1                             |
| 5200                                |       | 34.15              | 32.00             | 1.585           | 4.994             |                            |                                  |
| 5795                                |       | 35.57              | 33.42             | 2.198           | 4.994             |                            |                                  |
| 2402                                |       | 22.48              | 20.33             | 0.108           | 4.994             |                            |                                  |

————THE END————