

|                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                     |                                                                                                                                                  |                             |                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------|
| <b>Prüfbericht-Nr.:</b><br><i>Test Report No.:</i>                                                                                                                                                                                                                                                                                                                                                                                     | <b>14050838 001</b>                                                                                                                 | <b>Auftrags-Nr.:</b><br><i>Order No.:</i>                                                                                                        | <b>144157211</b>            | <b>Seite 1 von 23</b><br><i>Page 1 of 23</i> |
| <b>Kunden-Referenz-Nr.:</b><br><i>Client Reference No.:</i>                                                                                                                                                                                                                                                                                                                                                                            | N/A                                                                                                                                 | <b>Auftragsdatum:</b><br><i>Order date.:</i>                                                                                                     | 09 Aug, 2017                |                                              |
| <b>Auftraggeber:</b><br><i>Client:</i>                                                                                                                                                                                                                                                                                                                                                                                                 | HK TECH SCIENCE & TECHNOLOGY CO., LTD<br>Xiehe Industrial B Zone, Laimei Road, Chenghai District, 515800, Shantou, Guangdong, China |                                                                                                                                                  |                             |                                              |
| <b>Prüfgegenstand:</b><br><i>Test item:</i>                                                                                                                                                                                                                                                                                                                                                                                            | Short Range Device -<br>Radio Controlled Toy<br>Helicopter (2.4GHz)                                                                 | <b>FCC ID:</b><br><i>FCC ID:</i>                                                                                                                 | 2AFDJHKFX27                 |                                              |
| <b>Bezeichnung / Typ-Nr.:</b><br><i>Identification / Type No.:</i>                                                                                                                                                                                                                                                                                                                                                                     | FX-27E                                                                                                                              |                                                                                                                                                  |                             |                                              |
| <b>Auftrags-Inhalt:</b><br><i>Order content:</i>                                                                                                                                                                                                                                                                                                                                                                                       | TUV Rheinland - EMC service                                                                                                         |                                                                                                                                                  |                             |                                              |
| <b>Prüfgrundlage:</b><br><i>Test specification:</i>                                                                                                                                                                                                                                                                                                                                                                                    | CFR47 FCC Part 15: Subpart C Section 15.247<br>CFR47 FCC Part 15: Subpart C Section 15.207<br>FCC KDB Publication 447498 D01 v06    |                                                                                                                                                  |                             |                                              |
| <b>Wareneingangsdatum:</b><br><i>Date of receipt:</i>                                                                                                                                                                                                                                                                                                                                                                                  | 06 Oct, 2017                                                                                                                        |                                                               |                             |                                              |
| <b>Prüfmuster-Nr.:</b><br><i>Test sample No.:</i>                                                                                                                                                                                                                                                                                                                                                                                      | A000629626-001                                                                                                                      |                                                                                                                                                  |                             |                                              |
| <b>Prüfzeitraum:</b><br><i>Testing period:</i>                                                                                                                                                                                                                                                                                                                                                                                         | Refer to test report                                                                                                                |                                                                                                                                                  |                             |                                              |
| <b>Ort der Prüfung:</b><br><i>Place of testing:</i>                                                                                                                                                                                                                                                                                                                                                                                    | Refer to section 2.1                                                                                                                |                                                                                                                                                  |                             |                                              |
| <b>Prüflaboratorium:</b><br><i>Testing laboratory:</i>                                                                                                                                                                                                                                                                                                                                                                                 | TÜV Rheinland (Guangdong) Ltd.                                                                                                      |                                                                                                                                                  |                             |                                              |
| <b>Prüfergebnis*:</b><br><i>Test result*:</i>                                                                                                                                                                                                                                                                                                                                                                                          | Pass                                                                                                                                |                                                                                                                                                  |                             |                                              |
| <b>geprüft von / tested by:</b>                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                     | <b>kontrolliert von / reviewed by:</b>                                                                                                           |                             |                                              |
| <br>25 Oct, 2017 Lambert Tang/ Senior Project Engineer                                                                                                                                                                                                                                                                                              |                                                                                                                                     | <br>25 Oct, 2017 Amy Wang/ Project Manager                  |                             |                                              |
| <b>Datum</b><br><i>Date</i>                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Name/Stellung</b><br><i>Name/Position</i>                                                                                        | <b>Unterschrift</b><br><i>Signature</i>                                                                                                          | <b>Datum</b><br><i>Date</i> | <b>Name/Stellung</b><br><i>Name/Position</i> |
| <b>Sonstiges / Other:</b>                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                     |                                                                                                                                                  |                             |                                              |
| This report covers partial test requirement under CFR47 FCC Part 15: Subpart C Section 15.247.<br>This report should be read in conjunction with report number 171018004RFC-1.                                                                                                                                                                                                                                                         |                                                                                                                                     |                                                                                                                                                  |                             |                                              |
| <b>Zustand des Prüfgegenstandes bei Anlieferung:</b><br><i>Condition of the test item at delivery:</i>                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                     | <b>Prüfmuster vollständig und unbeschädigt</b><br><i>Test item complete and undamaged:</i>                                                       |                             |                                              |
| * Legende: 1 = sehr gut 2 = gut 3 = befriedigend<br>P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n)<br>Legend: 1 = very good 2 = good 3 = satisfactory<br>P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s)                                                                                                                                            |                                                                                                                                     | 4 = ausreichend 5 = mangelhaft<br>N/A = nicht anwendbar N/T = nicht getestet<br>4 = sufficient 5 = poor<br>N/A = not applicable N/T = not tested |                             |                                              |
| <b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines</b><br><i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i> |                                                                                                                                     |                                                                                                                                                  |                             |                                              |

## ***Test Summary***

**5.1.1 ANTENNA REQUIREMENT**

*RESULT: Passed*

**5.1.2 6dB BANDWIDTH MEASUREMENT**

*RESULT: Passed*

**5.1.3 MAXIMUM CONDUCTED OUTPUT POWER**

*RESULT: Passed*

**5.1.4 POWER SPECTRAL DENSITY**

*RESULT: Passed*

**5.1.5 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 kHz BANDWIDTH**

*RESULT: Passed*

**5.1.6 CONDUCTED EMISSIONS**

*RESULT: N/A*

**6.1.1 ELECTROMAGNETIC FIELDS**

*RESULT: Passed*

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## 1 General Remarks

### 1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix 1: Test result

## 2 Test Sites

### 2.1 Test Facilities

**TÜV RHEINLAND (GUANGDONG) LTD.**

No.102, 1F of Southwest and No.205, 2F of West Warehouse Building, No.767 Tianyuan Road, Tianhe District, Guangzhou 510650, Guangdong, P.R. China.

### 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

| Name of Equipment                                                                                                                                        | Manufacturer    | Model | Serial Number | Calibration Due |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------|---------------|-----------------|
| <b>6dB Bandwidth Measurement / Maximum Conducted (Average) Output Power / Power Spectral Density / Conducted Spurious Emissions in 100 kHz Bandwidth</b> |                 |       |               |                 |
| Spectrum Analyzer                                                                                                                                        | Rohde & Schwarz | FSP30 | 100610        | 15 Oct 2017     |
| Power Sensor                                                                                                                                             | Boonton         | 55006 | 9910          | 16 Nov 2017     |

### 2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

## 2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

## 2.5 Measurement Uncertainty

Uncertainty for conducted emissions measurements is 2.40dB.

Uncertainty for radiated emissions measurements is 4.40dB (30M-1GHz) and 4.40dB (> 1GHz).

The reported expanded uncertainty is based on a standard uncertainty multiply by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%.

## 2.6 Location of original data

The original copies of test data taken during actual testing were attached at Appendix 1 of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Guangdong) file for certification follow-up purposes.

## 2.7 Status of facility used for testing

### **TÜV RHEINLAND (GUANGDONG) LTD.**

No.102, 1F of Southwest and No.205, 2F of West Warehouse Building, No.767 Tianyuan Road, Tianhe District, Guangzhou 510650, Guangdong, P.R. China whose designation number is CN1207.

### 3 General Product Information

#### 3.1 Product Function and Intended Use

The submitted sample FX-27E is radio controlled toy helicopter embedded with WiFi camera. It is intended to use in following electromagnetic environment: residential and urban outdoors.

#### 3.2 Ratings and System Details

**Table 2: Rating of EUT**

| Kind of Equipment | Radio controlled toy helicopter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type Designation  | FX-27E, FX-2, FX-3, FX-3V, FX-4, FX-4VCI, FX-4V, FX-5, FX-5W, FX-6, FX-6C, FX-6CI, FX-7, FX-7C, FX-7CI, FX-7S, FX-8A, FX-8E, FX-8C, FX-9A, FX-9E, FX-9C, FX-11, FX-12V, FX-12, FX-13, FX-14, FX-15, FX-15C, FX-15CI, FX-16, FX-16C, FX-16CI, FX-17, FX-18, FX-19, FX-20, FX-21, FX-22A, FX-22E, FX-22C, FX-23, FX-24, FX-25, FX-25CI, FX-26, FX-26CI, FX-27A, FX-27C, FX-28, FX-29, FX-29CI, FX-30, FX-31, FX-32, FX-33, FX-34, FX-35A, FX-35E, FX-35C, FX-36, FX-37, D2, D3, D3V, D4, D4VCI, D4V, D5, D5W, D6, D6C, D6CI, D7, D7C, D7CI, D7S, D8A, D8E, D8C, D9A, D9E, D9C, D11, D12V, D12, D13, D14, D15, D15C, D15CI, D16, D16C, D16CI, D17, D18, D19, D20, D21, D22A, D22E, D22C, D23, D24, D25, D25CI, D26, D27A, D27E, D27C, D28, D29, D29CI, D30, D31, D32, D33, D34, D35A, D35E, D35C, D36, D37 |
| FCC ID            | 2AFDJHKFX27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Table 3: Technical Specification of WiFi**

| Technical Specification | Value                                                                           |
|-------------------------|---------------------------------------------------------------------------------|
| Operating Frequency     | 2417 MHz (Single Channel)                                                       |
| Operation Voltage       | DC 3.7V                                                                         |
| Modulation              | 802.11b: DSSS (CCK, DQPSK, DBPSK)<br>802.11g: OFDM (64-QAM, 16-QAM, QPSK, BPSK) |
| Antenna Type            | Internal Antenna, Non-User Replaceable                                          |
| Antenna Gain            | 0 dBi                                                                           |
| RF Output Power         | 0.2207W (23.068dBm)                                                             |

**Table 4: RF channel and frequency**

| RF Channel | Frequency (MHz) |
|------------|-----------------|
| 0          | 2417.00         |

### **3.3 Independent Operation Modes**

The basic operation modes are:

A. On

1. Transmitting on channel 0 under IEEE802.11B
2. Transmitting on channel 0 under IEEE802.11G

B. On, WiFi connecting mode

### **3.4 Noise Generating and Noise Suppressing Parts**

Refer to the Circuit Diagram.

### **3.5 Submitted Documents**

1. Block Diagram
2. Circuit Diagram
3. Operation Description
4. PCB Layout
5. BOM
6. FCC label and location
7. User Manual
8. Internal Photos
9. External Photos
10. Application form

## 4 Test Set-up and Operation Modes

### 4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

### 4.2 Test Operation and Test Software

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

All testing were performed according to the procedures in ANSI C63.4: 2014 & ANSI C63.10: 2013.

### 4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

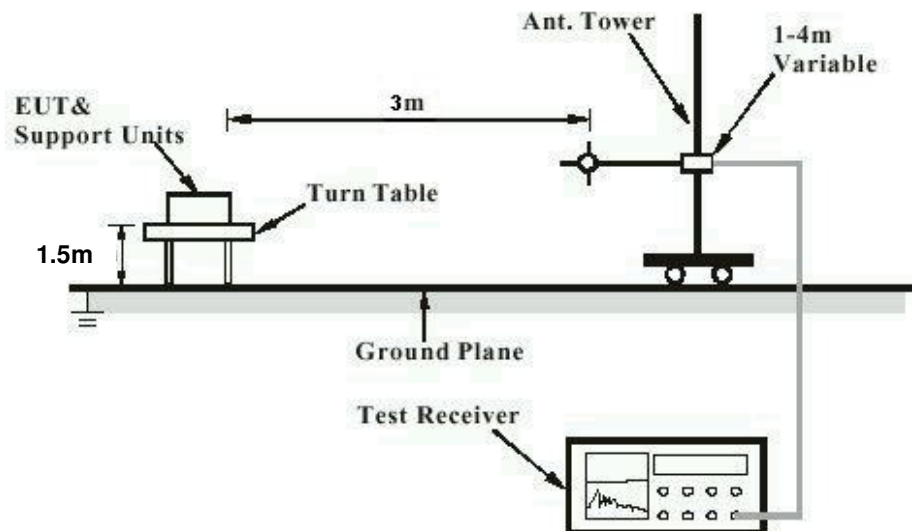
| Kind of Equipment | Manufacturer | Model Name | S/N      |
|-------------------|--------------|------------|----------|
| Notebook          | Lenovo       | 80Q6       | PF0BEWWR |

### 4.4 Countermeasures to achieve EMC Compliance

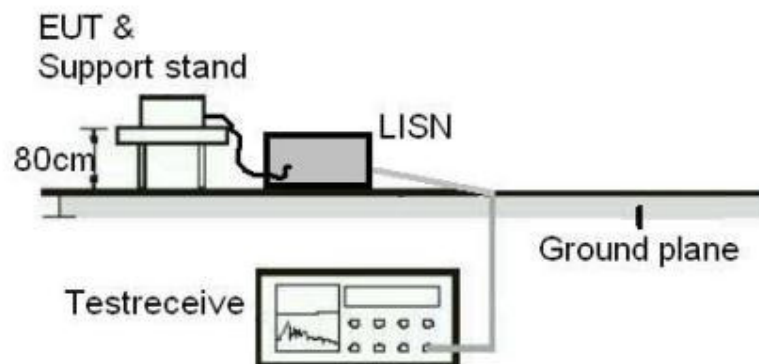
The test sample, which has been tested, contained the noise suppression parts as described in the technical document. No additional measures were employed to achieve compliance.

## 4.5 Test set-up

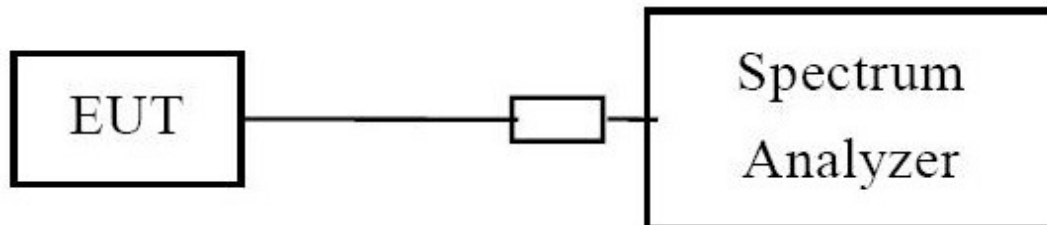
### Diagram of Measurement Configuration for Radiation Test



### Diagram of Measurement Configuration for Mains Conduction Measurement



**Diagram of Measurement Configuration for Conducted Transmitter Measurement**



## 5 Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:** **Passed**

**Test Specification**

|               |                                                                       |
|---------------|-----------------------------------------------------------------------|
| Test standard | : FCC Part 15.247(b)(4) and Part 15.203                               |
| Limits        | : the use of antennas with directional gains that do not exceed 6 dBi |

According to the manufacturer declared, the EUT has an internal antenna, the directional gain of antenna is 0 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

For more details, refer to EUT photo.

## 5.1.2 6dB Bandwidth Measurement

### RESULT:

**Passed**

#### Test Specification

|                   |                                                      |
|-------------------|------------------------------------------------------|
| Test standard     | : FCC Part 15.247(a)(2)                              |
| Basic standard    | : ANSI C63.10: 2013                                  |
| Limits            | : The minimum 6dB bandwidth shall be at least 500kHz |
| Kind of test site | : Shielded Room                                      |

#### Test Setup

|                      |                |
|----------------------|----------------|
| Date of testing      | : 06 Oct, 2017 |
| Power supply         | : DC 3.7V      |
| Operation mode       | : A (See 3.3)  |
| Test channel         | : Channel 0    |
| Ambient temperature  | : 23.2 °C      |
| Relative Humidity    | : 55 %         |
| Atmospheric pressure | : 101 kPa      |

For the measurement records, refer to the appendix 1.

**Table 5: Test result of 6dB Bandwidth, IEEE 802.11B**

| Channel   | Channel Frequency (MHz) | 6dB Left (MHz) | 6dB Right (MHz) | 6dB Bandwidth (MHz) |
|-----------|-------------------------|----------------|-----------------|---------------------|
| Channel 0 | 2417                    | 2411.900       | 2422.460        | 10.56               |

**Table 6: Test result of 6dB Bandwidth, IEEE 802.11G**

| Channel   | Channel Frequency (MHz) | 6dB Left (MHz) | 6dB Right (MHz) | 6dB Bandwidth (MHz) |
|-----------|-------------------------|----------------|-----------------|---------------------|
| Channel 0 | 2417                    | 2408.720       | 2425.280        | 16.56               |

### 5.1.3 Maximum Conducted Output Power

**RESULT:**

**Passed**

**Test Specification**

|                   |                                                                                                                    |
|-------------------|--------------------------------------------------------------------------------------------------------------------|
| Test standard     | : FCC Part 15.247(b)(3)                                                                                            |
| Basic standard    | : ANSI C63.10: 2013                                                                                                |
| Limits            | : For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm) |
| Kind of test site | : Shielded Room                                                                                                    |

**Test Setup**

|                      |                |
|----------------------|----------------|
| Date of testing      | : 06 Oct, 2017 |
| Power supply         | : DC 3.7V      |
| Operation mode       | : A (See 3.3)  |
| Test channel         | : Channel 0    |
| Ambient temperature  | : 23.2 °C      |
| Relative Humidity    | : 55 %         |
| Atmospheric pressure | : 101 kPa      |

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**Table 7: Test result of Output Power, IEEE 802.11B**

| Channel   | Channel Frequency (MHz) | Measured Output Power (dBm) | Limit (W / dBm) |
|-----------|-------------------------|-----------------------------|-----------------|
| Channel 0 | 2417                    | 17.133                      | 1 / 30.0        |

**Table 8: Test result of Output Power, IEEE 802.11G**

| Channel   | Channel Frequency (MHz) | Measured Output Power (dBm) | Limit (W / dBm) |
|-----------|-------------------------|-----------------------------|-----------------|
| Channel 0 | 2417                    | 23.068                      | 1 / 30.0        |

#### **5.1.4 Power Spectral Density**

**RESULT:**

**Passed**

**Test Specification**

|                   |                                                                                                                                                                                                                             |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test standard     | : FCC Part 15.247(e)                                                                                                                                                                                                        |
| Basic standard    | : ANSI C63.10: 2013                                                                                                                                                                                                         |
| Limits            | : For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. |
| Kind of test site | : Shielded Room                                                                                                                                                                                                             |

**Test Setup**

|                      |                |
|----------------------|----------------|
| Date of testing      | : 06 Oct, 2017 |
| Power supply         | : DC 3.7V      |
| Operation mode       | : A (See 3.3)  |
| Test channel         | : Channel 0    |
| Ambient temperature  | : 23.2 °C      |
| Relative Humidity    | : 55 %         |
| Atmospheric pressure | : 101 kPa      |

For the measurement records, refer to the appendix 1.

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**Table 9: Test result of Power Spectral Density, IEEE 802.11B**

| Channel   | Channel Frequency (MHz) | Measured Power Density (dBm) | Limit (dBm) |
|-----------|-------------------------|------------------------------|-------------|
| Channel 0 | 2417                    | 5.63                         | 8.0         |

**Table 10: Test result of Power Spectral Density, IEEE 802.11G**

| Channel   | Channel Frequency (MHz) | Measured Power Density (dBm) | Limit ( dBm) |
|-----------|-------------------------|------------------------------|--------------|
| Channel 0 | 2417                    | 3.57                         | 8.0          |

### 5.1.5 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

**RESULT:**

**Passed**

**Test Specification**

|                |                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------|
| Test standard  | : FCC Part 15.247(d)                                                                                              |
| Basic standard | : ANSI C63.10: 2013                                                                                               |
| Limits         | : 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); |

In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)

|                   |                 |
|-------------------|-----------------|
| Kind of test site | : Shielded Room |
|-------------------|-----------------|

**Test Setup**

|                      |                |
|----------------------|----------------|
| Date of testing      | : 06 Oct, 2017 |
| Power supply         | : DC 3.7V      |
| Operation mode       | : A (See 3.3)  |
| Test channel         | : Channel 0    |
| Ambient temperature  | : 23.2 °C      |
| Relative Humidity    | : 55 %         |
| Atmospheric pressure | : 101 kPa      |

All emissions are more than 20dB below fundamental, compliance is achieved as well.

For the measurement records, refer to the appendix 1.

### 5.1.6 Conducted Emissions

**RESULT:**

**N/A**

**Test Specification**

|                   |                      |
|-------------------|----------------------|
| Test standard     | : FCC part 15.207    |
| Basic standard    | : ANSI C63.4: 2014   |
| Frequency range   | : 0.15 – 30MHz       |
| Limits            | : FCC Part 15.207(a) |
| Kind of test site | : Shielded Room      |

This test is not applicable due to there is no AC power input or output ports on the EUT.

## 6 Safety Human exposure

### 6.1 Radio Frequency Exposure Compliance

#### 6.1.1 Electromagnetic Fields

**RESULT:**

**Passed**

**Test Specification**

Test standard : FCC KDB Publication 447498 v06

According to the manufacturer's instruction, the EUT operating in standalone mobile exposure conditions which minimum test separation distance is 20cm between the antenna and radiating structures of the device and nearby persons.

For Maximum Permissible Exposure (MPE) evaluation, the maximum power density at 20 cm from this mobile transmitter shall be less than the General Population / Uncontrolled MPE limit in OET Bulletin 65 and meet the requirement listed in KDB447498.

The maximum conducted output power of WiFi is 23.068dBm or 202.675mW,

The power density at 20cm =  $(202.675\text{mW} \times 1) / 4\pi R^2 = 0.040 \text{ mWcm}^{-2}$

In the frequency range of 1,500 - 100,000MHz, the MPE limit is  $1.0 \text{ mWcm}^{-2}$  for general population and uncontrolled exposure. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structures and body of the user or nearby persons.

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