

**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

**RF Exposure evaluation****Report Reference No.....: GTS20200303005-1-10****FCC ID.....: 2AWAB-C1N1**

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Date of issue.....: May. 11, 2020

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Address.....: No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

**Applicant's name .....: Hanvo Aviation Technology Co., Ltd.**

Address .....: Middle Section of Longteng Road, Jiulong District, Gaoxin Zone, Yuxi City, Yunnan Province, China

**Test specification .....****47CFR §1.1310**Standard .....: **47CFR §2.1091****KDB447498 v06**

TRF Originator .....: Shenzhen Global Test Service Co.,Ltd.

Master TRF .....: Dated 2014-12

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**Test item description .....: Control and Navigation System**

Trade Mark .....

Manufacturer .....: **Hanvo Aviation Technology Co., Ltd.**

Model/Type reference.....: C1/N1

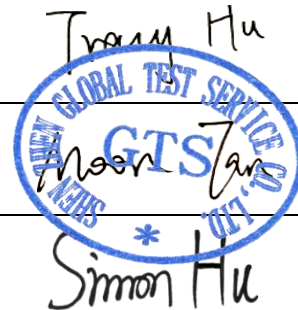
Listed Models .....: N/A

Modulation Type .....: GFSK,  $\pi/4$ -DQPSK, 8DPSK, QPSK, 16QAMOperation Frequency .....: BT: 2402MHz to 2480MHz,WCDMA:band 5  
LTE:band 5&41

Hardware Version .....: V1.0

Software Version .....: V1.0

Rating .....: Input:11V-54V—8A

Result.....: **PASS**

**TEST REPORT**

|  |                                |
|--|--------------------------------|
| <b>Test Report No. :</b> GTS20200303005-1-10 | May. 11, 2020<br>Date of issue |
|--|--------------------------------|

Equipment under Test : Control and Navigation System

Model /Type : C1/N1

Listed model : N/A

**Applicant** : **Hanvo Aviation Technology Co., Ltd.**

Address : Middle Section of Longteng Road, Jiulong District, Gaoxin Zone,  
Yuxi City, Yunnan Province, China

**Manufacturer** : **Hanvo Aviation Technology Co., Ltd.**

Address : Middle Section of Longteng Road, Jiulong District, Gaoxin Zone,  
Yuxi City, Yunnan Province, China

|                     |             |
|---------------------|-------------|
| <b>Test Result:</b> | <b>PASS</b> |
|---------------------|-------------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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## 1. SUMMARY

### 1.1. EUT configuration


The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

|     |              |   |
|-----|--------------|---|
| ● / | Length (m) : | / |
|     | Shield :     | / |
|     | Detachable : | / |

### 1.2. Product Description

|                               |   |
|-------------------------------|---|
| Product Name                  | Control and Navigation System   |
| Trade Mark                    |  |
| Model/Type reference          | C1/N1   |
| List Model                    | N/A   |
| Model Declaration             | N/A   |
| Power supply:                 | Input:11V-54V—8A  |
| Sample ID                     | GTS20200303005-1-1#   |
| <b>3G</b>                     |   |
| UMTS Operation Frequency Band | UMTS FDD Band V   |
| WCDMA Release Version         | R6  |
| HSDPA Release Version         | Release 6   |
| HSUPA Release Version         | Release 6   |
| Modulation Type               | QPSK for UMTS   |
| Antenna Description           | External Antenna;<br>0.8dBi (max.) For WCDMA Band V                               |
| <b>LTE</b>                    |   |
| LTE Operation Frequency Band  | LTE Band 5, 41  |
| LTE Release Version           | R9  |
| Type Of Modulation            | QPSK/16QAM  |
| Antenna Description           | External Antenna;<br>0.8dBi (max.)  |
| <b>Bluetooth</b>              |   |
| Frequency Range               | 2402MHz ~ 2480MHz   |
| Channel Number                | 79 channels for Bluetooth V4.0 (BDR/EDR)  |
| Channel Spacing               | 1MHz for Bluetooth V4.0 (BDR/EDR)   |
| Modulation Type               | GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V4.0 (BDR/EDR)                         |
| Bluetooth Version             | V4.0  |
| Antenna Description           | PCB Antenna, 0dBi (Max.)  |

## 2. TEST ENVIRONMENT

### 2.1. Address of the test laboratory

#### **Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

### 2.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)

Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)

Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

### 2.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
|                       |              |
| Humidity:             | 30-60 %      |
|                       |              |
| Atmospheric pressure: | 950-1050mbar |

### 2.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Global Test Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

| Test Items                  | Measurement Uncertainty | Notes |
|-----------------------------|-------------------------|-------|
| Transmitter power conducted | 0.57 dB                 | (1)   |

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 3. METHOD OF MEASUREMENT

#### 3.1. Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

#### 3.2. Requirement

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is  $\leq 1.0$ . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

#### 3.3. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

| Frequency Range(MHz)                        | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minute) |
|---|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled Exposure |                              |                              |                                     |                         |
| 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                       |

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

| Frequency Range(MHz)                        | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minute) |
|---|------------------------------|------------------------------|-------------------------------------|-------------------------|
| Limits for Occupational/Controlled Exposure |                              |                              |                                     |                         |
| 0.3 – 3.0                                   | 614                          | 1.63                         | (100) *                             | 30                      |
| 3.0 – 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                      |

F=frequency in MHz

\*=Plane-wave equivalent power density

### 3.4. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

As declared by the Applicant, the EUT transmits with the maximum source-based Duty Cycle of 100%-see the User manual, and the EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum mobile separation distance,  $r = 20\text{cm}$ , as well as the gain of the used antenna is 0.0dBi for BT, and the power drift from Turn-up Procedure provide by manufacturer as following states, the RF power density can be obtained..

### 3.5. Antenna Information

C1/N1 can only use antennas certificated as follows provided by manufacturer;

| Internal Identification | Antenna Identification in Internal photos | Antenna type and antenna number | Operate frequency band | Maximum antenna gain |
|-------------------------|---|---------------------------------|------------------------|----------------------|
| Antenna                 | 2.4G BT                                   | PCB antenna                     | 2.4 – 2.4835 GHz       | 0.0dBi(Max.)         |
| Antenna                 | 3G & 4G                                   | External antenna                | 0.8 – 3GHz             | 0.8dBi(Max)          |

## 4. Conducted Power

### Bluetooth

| Mode          | Channel | Frequency (MHz) | Peak Conducted Output Power (dBm) |
|---------------|---------|-----------------|-----------------------------------|
| GFSK          | 0       | 2402            | 2.54                              |
|               | 39      | 2441            | 2.75                              |
|               | 78      | 2480            | 1.70                              |
| $\pi/4$ DQPSK | 0       | 2402            | 3.83                              |
|               | 39      | 2441            | 4.05                              |
|               | 78      | 2480            | 2.95                              |
| 8DPSK         | 0       | 2402            | 4.19                              |
|               | 39      | 2440            | 4.41                              |
|               | 78      | 2480            | 3.25                              |

### <WCDMA Max Conducted Power>

| Test Mode |        | Channel | Frequency (MHz) | Max Conducted Power (dBm) |
|-----------|--------|---------|-----------------|---------------------------|
| WCDMA     | Band V | LCH     | 826.4           | 22.93                     |
|           |        | MCH     | 836.6           | 22.88                     |
|           |        | HCH     | 846.6           | 22.79                     |

### <LTE Max Conducted Power>

| Test Mode |         | Channel | Frequency (MHz) | Max Conducted Power (dBm) |
|-----------|---------|---------|-----------------|---------------------------|
| LTE       | Band 5  | LCH     | 824.7           | 22.61                     |
|           |         | MCH     | 836.5           | 22.39                     |
|           |         | HCH     | 848.3           | 22.55                     |
|           | Band 41 | LCH     | 2560.0          | 22.82                     |
|           |         | MCH     | 2605.0          | 22.67                     |
|           |         | HCH     | 2687.5          | 22.73                     |

## 5. Manufacturing Tolerance

### Bluetooth

| GFSK (Peak)          |           |            |            |
|----------------------|-----------|------------|------------|
| Channel              | Channel 0 | Channel 39 | Channel 78 |
| Target (dBm)         | 2.0       | 2.0        | 1.0        |
| Tolerance $\pm$ (dB) | 1.0       | 1.0        | 1.0        |
| $\pi/4$ DQPSK (Peak) |           |            |            |
| Channel              | Channel 0 | Channel 39 | Channel 78 |
| Target (dBm)         | 3.0       | 4.0        | 2.0        |
| Tolerance $\pm$ (dB) | 1.0       | 1.0        | 1.0        |
| 8DPSK (Peak)         |           |            |            |
| Channel              | Channel 0 | Channel 39 | Channel 78 |
| Target (dBm)         | 4.0       | 4.0        | 3.0        |
| Tolerance $\pm$ (dB) | 1.0       | 1.0        | 1.0        |

### WCDMA

| Test Mode |        | Channel | Max Conducted Power (dBm) | ANT Max. Tune Up Power (dBm) |
|-----------|--------|---------|---------------------------|------------------------------|
| WCDMA     | Band V | LCH     | 23.90                     | 22.0 $\pm$ 1.0               |
|           |        | MCH     | 23.80                     | 22.0 $\pm$ 1.0               |
|           |        | HCH     | 23.73                     | 22.0 $\pm$ 1.0               |

### LTE

| Test Mode |         | Channel | Max Conducted Power (dBm) | ANT Max. Tune Up Power (dBm) |
|-----------|---------|---------|---------------------------|------------------------------|
| LTE       | Band 5  | LCH     | 22.82                     | 22.0 $\pm$ 1.0               |
|           |         | MCH     | 22.56                     | 22.0 $\pm$ 1.0               |
|           |         | HCH     | 22.78                     | 22.0 $\pm$ 1.0               |
|           | Band 41 | LCH     | 19.19                     | 22.0 $\pm$ 1.0               |
|           |         | MCH     | 19.96                     | 22.0 $\pm$ 1.0               |
|           |         | HCH     | 19.92                     | 22.0 $\pm$ 1.0               |



## 6. EVALUATION RESULT

### 6.1. Standalone MPE

#### *BT*

| Modulation Type | Output power |        | Antenna Gain (dBi) | Antenna Gain (linear) | Duty Cycle | MPE (mW/cm <sup>2</sup> ) | MPE Limits (mW/cm <sup>2</sup> ) |
|-----------------|--------------|--------|--------------------|-----------------------|------------|---------------------------|----------------------------------|
|                 | dBm          | mW     |                    |                       |            |                           |                                  |
| GFSK            | 3.00         | 1.9953 | 0.8                | 1.2023                | 100%       | 0.0005                    | 1.0000                           |
| $\pi/4$ DQPSK   | 5.00         | 3.1623 | 0.8                | 1.2023                | 100%       | 0.0008                    | 1.0000                           |
| 8DPSK           | 5.00         | 3.1623 | 0.8                | 1.2023                | 100%       | 0.0008                    | 1.0000                           |

#### WCDMA&LTE

| Modulation Type | Output power |          | Antenna Gain (dBi) | Antenna Gain (linear) | MPE (mW/cm <sup>2</sup> ) | MPE Limits (mW/cm <sup>2</sup> ) |
|-----------------|--------------|----------|--------------------|-----------------------|---------------------------|----------------------------------|
|                 | dBm          | mW       |                    |                       |                           |                                  |
| WCDMA Band V    | 23.00        | 199.5262 | 0.80               | 1.2023                | 0.0477                    | 0.5493                           |
| LTE Band 5      | 23.00        | 199.5262 | 0.80               | 1.2023                | 0.0477                    | 0.5493                           |
| LTE Band 41     | 23.00        | 199.5262 | 0.80               | 1.2023                | 0.0477                    | 1.0000                           |

### 6.2. Simultaneous transmission MPE Considerations

According to KDB447498 :For mobile exposure host platform to qualify for simultaneous transmission MPE test exclusion, all transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is  $\leq 1.0$ .

This means that:

$\sum$  of MPE ratios  $\leq 1.0$

| 2.4G BT+WCDMA+LTE |                   |       |         |
|-------------------|-------------------|-------|---------|
| Mode              | $\sum$ MPE ratios | Limit | Results |
| BT + WCDMA        | 0.048             | 1.00  | Pass    |
| BT+LTE Band 5     | 0.048             | 1.00  | Pass    |
| BT+LTE Band 41    | 0.048             | 1.00  | Pass    |

## 7. CONCLUSION

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

.....End of Report.....