



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

Representative Laboratory Name ..: **Shenzhen Global Test Service Co.,Ltd.**

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, π/4-DQPSK, 8DPSK, QPSK, 16QAM

Operation 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

Test Report No. :	GTS20200303005-1-10	May. 11, 2020 Date of issue
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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

Test Result:	PASS
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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#
3G	
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; 0.8dBi (max.) For WCDMA Band V
LTE	
LTE Operation Frequency Band	LTE Band 5, 41
LTE Release Version	R9
Type Of Modulation	QPSK/16QAM
Antenna Description	External Antenna; 0.8dBi (max.)
Bluetooth	
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 ≤ 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 ²)	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 ²)*	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 ²)	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 ²)*	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 =20cm, 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
		MCH	23.80
		HCH	23.73

LTE			
Test Mode		Channel	Max Conducted Power (dBm)
			ANT Max. Tune Up Power (dBm)
LTE	Band 5	LCH	22.82
		MCH	22.56
		HCH	22.78
	Band 41	LCH	19.19
		MCH	19.96
		HCH	19.92

6. EVALUATION RESULT

6.1. Standalone MPE

BT

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	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<E

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	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 ≤ 1.0 .

This means that:

Σ of MPE ratios ≤ 1.0

2.4G BT+WCDMA+LTE			
Mode	Σ 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.....