

# TEST REPORT

FCC ID: SY4-B01010

Product: Handheld GNSS Data Collector

Model No.: HCE320

Additional Model No.: N/A

Trade Mark:



Report No.: TCT180111E030

Issued Date: Mar. 01, 2018

Issued for:

**Shanghai Huace Navigation Technology LTD.**

**Building C, 599 Gaojing Road, Qingpu District, Shanghai, China**

Issued By:

**Shenzhen Tongce Testing Lab.**

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## 1. Test Certification

<b>Product:</b>	Handheld GNSS Data Collector
<b>Model No.:</b>	HCE320
<b>Additional Model No.:</b>	N/A
<b>Applicant:</b>	
<b>Address:</b>	Shanghai Huace Navigation Technology LTD.
<b>Manufacturer:</b>	Building C, 599 Gaojing Road, Qingpu District, Shanghai, China
<b>Address:</b>	Shanghai Huace Navigation Technology LTD.
<b>Date of Test:</b>	Building C, 599 Gaojing Road, Qingpu District, Shanghai, China
<b>Applicable Standards:</b>	FCC CFR Title 47 Part 15 Subpart C Section 15.225

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

**Tested By:**

*Ride Cheng*

**Date:**

**Mar. 01, 2018**

**Ride Cheng**

**Reviewed By:**

*Joe Zhou*

**Date:**

**Mar. 01, 2018**

**Joe Zhou**

**Approved By:**

*Tomsin*

**Date:**

**Mar. 01, 2018**

**Tomsin**




## 2. Test Result Summary

Requirement	CFR 47 Section IC Paragraph	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Spurious emissions	§15.225/ §15.209 §2.1053, §2.1057	PASS
Occupied Bandwidth	§15.215 (c) §2.1049	PASS
Frequency stability	§15.225 §2.1055	PASS

**Note:**

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

### 3. EUT Description

<b>Product Name:</b>	Handheld GNSS Data Collector
<b>Model :</b>	HCE320
<b>Additional Model:</b>	N/A
<b>Trade Mark:</b>	
<b>Operation Frequency:</b>	13.56MHz
<b>Modulation Technology:</b>	ASK
<b>Antenna Type:</b>	Coil Antenna
<b>Antenna Gain:</b>	20dBi
<b>Power Supply:</b>	DC 3.8V by battery or DC 5V from adapter

## 4. Genera Information

### 4.1. Test Environment and Mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation
<p>The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.</p>	

### 4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
Adapter	EA1012AVRU-050	/	/	Huntkey

**Note:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 5. Facilities and Accreditations

### 5.1. Facilities

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

- FCC - Registration No.: 572331

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

### 5.2. Location

Shenzhen TCT Testing Technology Co., Ltd.

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

Tel: +86-755-27673339

### 5.3. Measurement Uncertainty

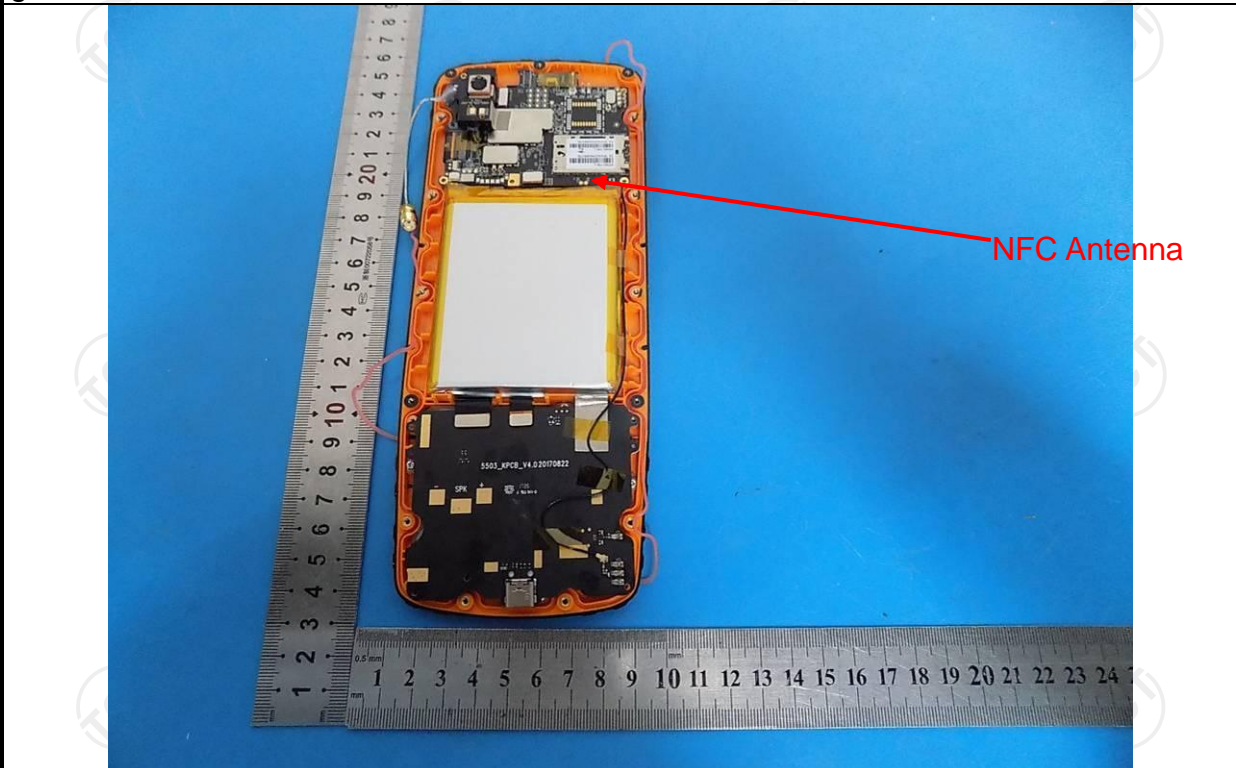
The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$



## 6. Test Results and Measurement Data

### 6.1. Antenna Requirement

<b>Standard requirement:</b>	FCC Part15 C Section 15.203
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.</p>	
<b>E.U.T Antenna:</b>	
<p>The NFC antennas is coil antennas which permanently attached, and the best case gain of the antenna is 20dBi.</p>	
	



## 6.2. Conducted Emission

### 6.2.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.207														
<b>Test Method:</b>	ANSI C63.10:2013														
<b>Frequency Range:</b>	150 kHz to 30 MHz														
<b>Receiver setup:</b>	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
<b>Limits:</b>	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
<b>Test Setup:</b>	<p><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
<b>Test Mode:</b>	Refer to section 4.1 for details														
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</li> </ol>														
<b>Test Result:</b>	PASS														

**6.2.2. Test Instruments**

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	100139	Aug. 11, 2018
LISN	Schwarzbeck	NSLK 8126	8126453	Aug. 16, 2018
Coax cable (9kHz-40GHz)	TCT	CE-05	N/A	Aug. 11, 2018
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

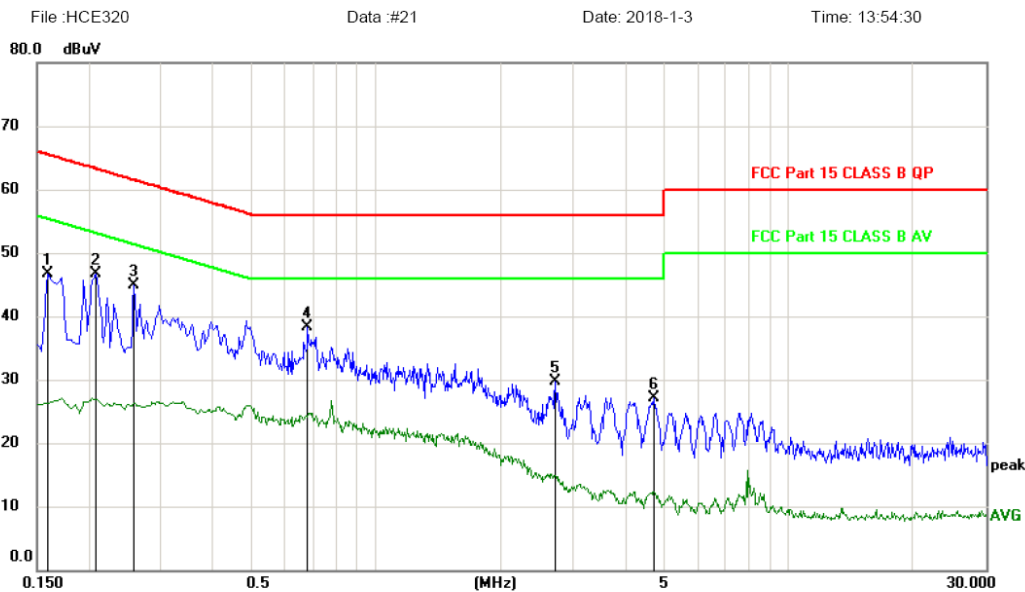
6.2.3. Test data

Please refer to following diagram for individual

**Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)**

Site LAB	Phase: <b>L1</b>	Temperature: 24.9
Limit: FCC Part 15 CLASS B QP	Power: AC 120V/60Hz	Humidity: 47 %
EUT: Handheld GNSS Data Collector		
M/N: HCE320		
Mode: NFC		
Note:		
Engineer Signature:		

**Conducted Emission Measurement**



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1590	37.01	9.73	46.74	65.52	-18.78	peak	
2	*	0.2085	36.94	9.74	46.68	63.26	-16.58	peak	
3		0.2580	35.10	9.76	44.86	61.50	-16.64	peak	
4		0.6809	28.59	9.80	38.39	56.00	-17.61	peak	
5		2.7105	19.77	10.02	29.79	56.00	-26.21	peak	
6		4.7040	16.87	10.18	27.05	56.00	-28.95	peak	

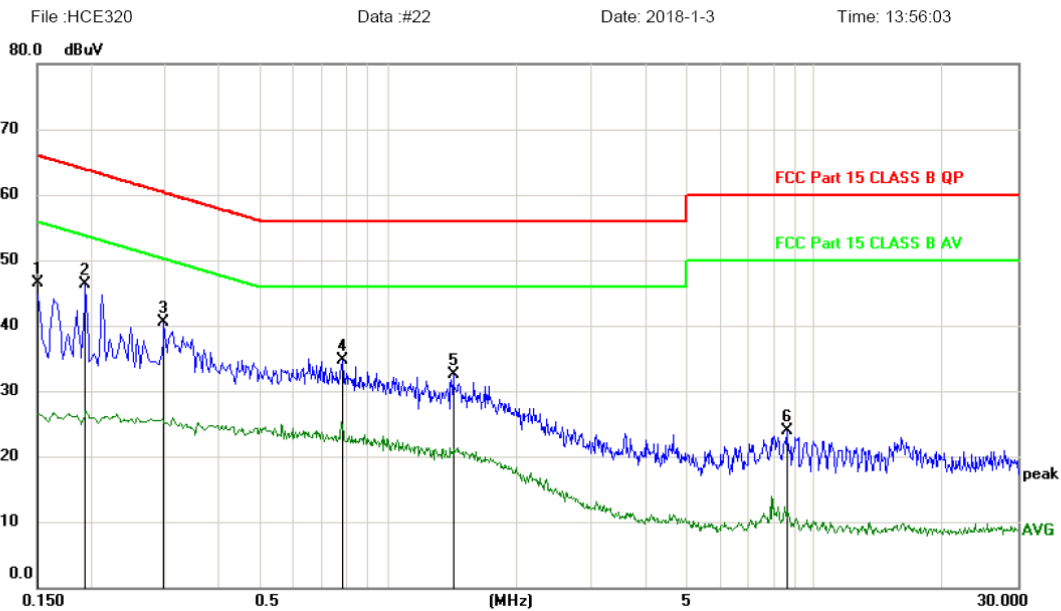
\*:Maximum data x:Over limit !:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

## Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)

Site LAB	Phase: <b>N</b>	Temperature: 24.9
Limit: FCC Part 15 CLASS B QP	Power: AC 120V/60Hz	Humidity: 47 %
EUT: Handheld GNSS Data Collector		
M/N: HCE320		
Mode: NFC		
Note:		
Engineer Signature:		

### Conducted Emission Measurement



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1500	36.68	9.73	46.41	66.00	-19.59	peak	
2	*	0.1949	36.58	9.74	46.32	63.83	-17.51	peak	
3		0.2985	30.65	9.76	40.41	60.28	-19.87	peak	
4		0.7799	24.86	9.80	34.66	56.00	-21.34	peak	
5		1.4190	22.60	9.86	32.46	56.00	-23.54	peak	
6		8.5965	13.56	10.29	23.85	60.00	-36.15	peak	

\*:Maximum data    x:Over limit    !:over margin

Note: Measurement=Reading Level+Correc Factor.    Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

### 6.3. Radiated Emission Measurement

#### 6.3.1. Test Specification

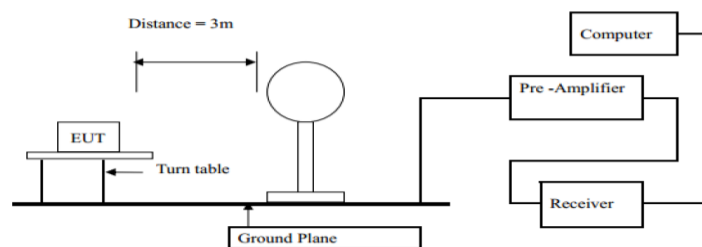
<b>Test Requirement:</b>	FCC Part15 C Section 15.225				
<b>Test Method:</b>	ANSI C63.10: 2013				
<b>Frequency Range:</b>	9 kHz to 1000 MHz				
<b>Measurement Distance:</b>	3 m				
<b>Antenna Polarization:</b>	Horizontal & Vertical				
<b>Receiver Setup:</b>	Frequency	Detector	RBW	VBW	Remark
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	100kHz	300kHz	Quasi-peak Value
<b>Limit:</b>	FCC Part15 C Section 15.225				
	<b>Frequency (MHz)</b>	<b>Limit (uV/m @30m)</b>	<b>Limit (dBuV/m @3m)</b>	<b>Detector</b>	
	13.110-13.410	106	80.5	QP	
	13.410-13.553	334	90.5	QP	
	13.553-13.567	15848	124.0	QP	
	13.567-13.7110	224	90.5	QP	
	13.710-14.010	106	80.5	QP	
	<b>Note:</b> RF Voltage (dBuV) = 20 log RF Voltage (uV) Limit (dBuV/m @3m) = 20log(Limit (uV/m @30m)) + 40				
	FCC Part15 C Section 15.209				
	<b>Frequency Range (MHz)</b>	<b>Distance (m)</b>	<b>Field strength (dBµ V/m)</b>	<b>Detector</b>	
	0.009-0.490	3	20log 2400/F (kHz) + 80	QP	
0.490-1.705	3	20log 24000/F (kHz) + 40	QP		
1.705-30	3	20log 30 + 40	QP		
30-88	3	40.0	40.0		
88-216	3	43.5	43.5		
216-960	3	46.0	46.0		
Above 960	3	54.0	54.0		
<b>Note:</b>					
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)					
2. In the Above Table, the tighter limit applies at the band edges.					
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT					
4. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.					
5. If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula $Ld1 = Ld2 * (d2/d1)$					

**Test Procedure:**

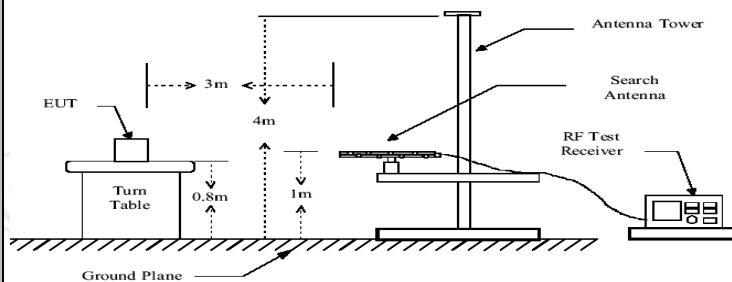
1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

**Test setup:**

For radiated emissions below 30MHz



30MHz to 1GHz



**Test Mode:**

Refer to section 4.1 for details

**Test results:**

PASS

### 6.3.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESPI Test Receiver	ROHDE&SCHW ARZ	ESVD	100008	Aug. 11, 2018
Spectrum Analyzer	ROHDE&SCHW ARZ	FSEM	848597/001	Aug. 11, 2018
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Aug. 11, 2018
Pre-amplifier	HP	8447D	2727A05017	Aug. 11, 2018
Loop antenna	ZHINAN	ZN30900A	12024	Aug. 13, 2018
Broadband Antenna	Schwarzbeck	VULB9163	340	Aug. 13, 2018
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Aug. 13, 2018
Coax cable (9kHz-40GHz)	TCT	N/A	N/A	Aug. 12, 2018
Coax cable (9kHz-40GHz)	TCT	N/A	N/A	Aug. 12, 2018
Coax cable (9kHz-40GHz)	TCT	N/A	N/A	Aug. 12, 2018
Coax cable (9kHz-40GHz)	TCT	N/A	N/A	Aug. 12, 2018
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.3.3. Test Data

#### Field Strength of Fundamental

Frequency (MHz)	Emission (dBuV/m)	Limits (dBuV/m)	Margin (dB)
13.56	47.36	124.00	-76.64




**Spurious Emissions**

Frequency (MHz)	Emission Level (dBuA/m)	Emission Level (dBuV/m)	Horizontal /Vertical	Limit Line (dBuV/m)	Detector	Margin (dB)
5.38	-25.03	26.47	V	69.54	QP	-43.07
27.12	-25.89	25.61	V	69.54	QP	-43.93
40.68	/	28.43	H	40	QP	-11.57
40.68	/	35.49	V	40	QP	-4.51
54.24	/	32.17	H	40	QP	-7.83
54.24	/	29.58	V	40	QP	-10.42

**Note :** 1) QP= Quasi-peak  
2) dBuA/m= dBuV/m-51.5

## 6.4. Occupied Bandwidth

### 6.4.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.215(c)
<b>Test Method:</b>	ANSI C63.10: 2013
<b>Limit:</b>	N/A
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.</li> <li>2. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; <math>RBW \geq 1\%</math> of the 20 dB bandwidth; <math>VBW \geq RBW</math>; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>4. Measure and record the results in the test report.</li> </ol>
<b>Test setup:</b>	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>
<b>Test Mode:</b>	Refer to section 4.1 for details
<b>Test results:</b>	PASS

### 6.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Aug. 11, 2018

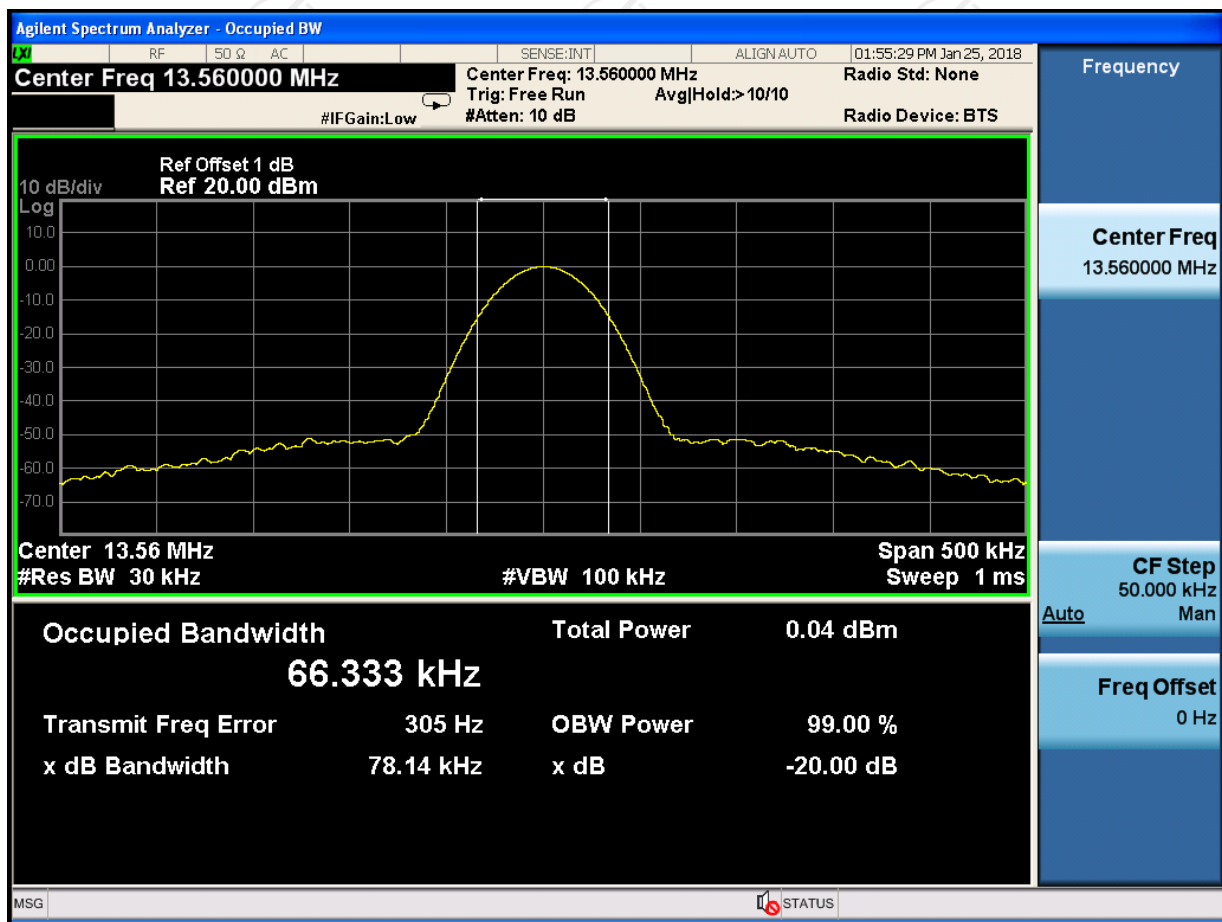
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.4.3. Test data

Frequency(MHz)	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
13.56	78.14	---	PASS

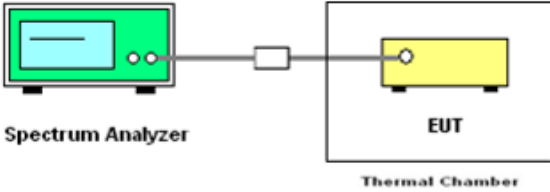
Test plots as follows:

Lowest channel



## 6.5. Frequency stability

### 6.5.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.225
<b>Test Method:</b>	ANSI C63.10 : 2013
<b>Operation mode:</b>	Refer to item 4.1
<b>Limit:</b>	+/-0.01%
<b>Test Setup:</b>	 <p>The diagram illustrates the test setup. On the left is a Spectrum Analyzer (green and blue). A cable connects it to a Thermal Chamber (yellow box). Inside the Thermal Chamber is the Equipment Under Test (EUT), represented by a yellow rectangle with a small circle on its side. The labels 'Spectrum Analyzer' and 'Thermal Chamber' are placed below their respective components, and 'EUT' is placed below the device inside the chamber.</p>
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The equipment under test was connected to an external DC power supply and input rated voltage.</li> <li>2. RF output was connected to a spectrum analyzer.</li> <li>3. The EUT was placed inside the temperature chamber.</li> <li>4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.</li> <li>5. Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.</li> <li>6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.</li> </ol>
<b>Test Result:</b>	PASS

### 6.5.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Aug. 11, 2018
DC Power	GW	GPR-6030 D	/	Aug. 13, 2018

**6.5.3. Test Data**

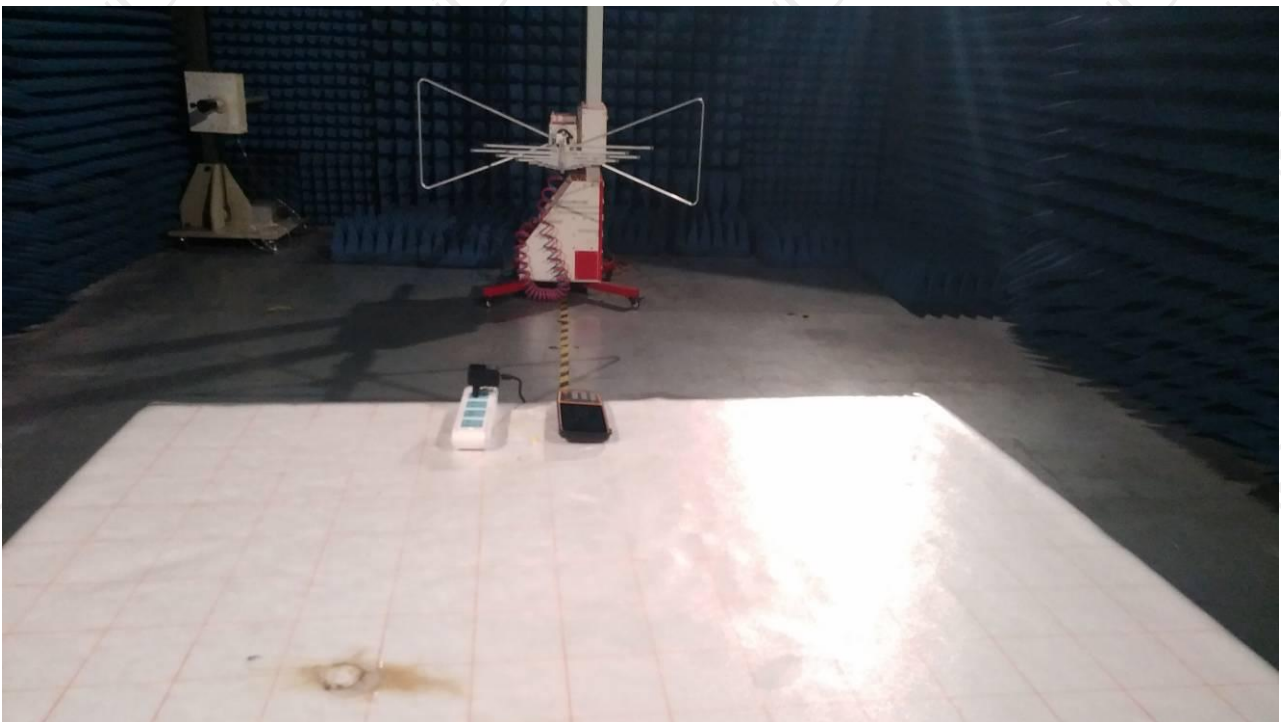
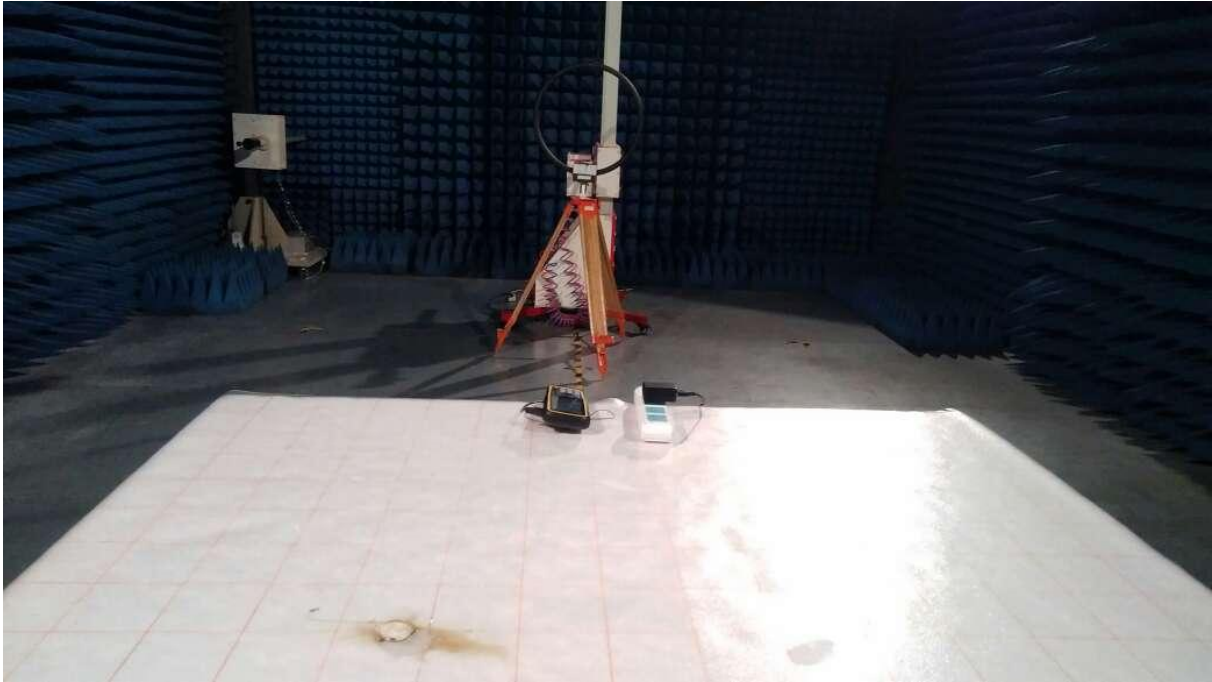
Voltage (Vdc)	Temperature (°C)	Frequency (MHz)	Deviation (%)	Limit (%)
5.0	-20	13.55	-0.001	+/-0.01
5.0	-10	13.52	-0.003	
5.0	0	13.55	-0.001	
5.0	10	13.59	0.002	
5.0	20	13.55	-0.001	
5.0	30	13.50	-0.004	
5.0	40	13.57	0.001	
5.0	50	13.55	-0.001	
5.5	20	13.55	0.000	
4.5	20	13.55	-0.001	

## Appendix A: Photographs of Test Setup

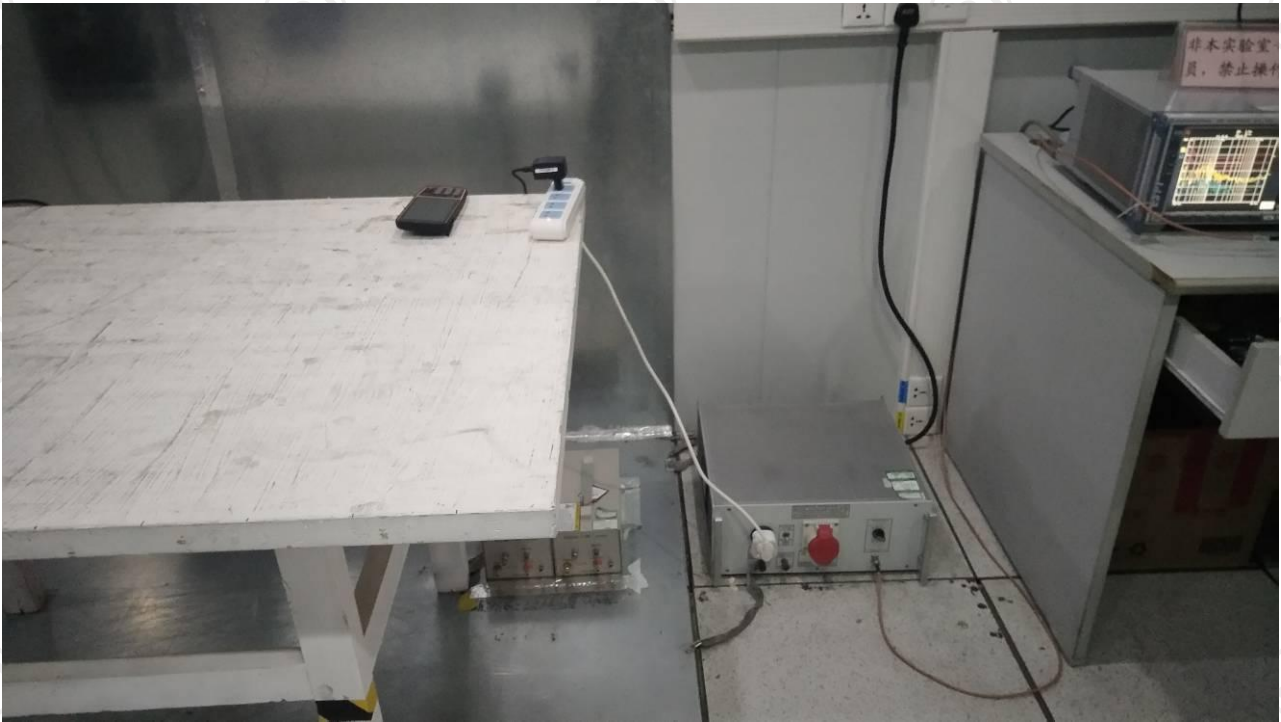
Product: Handheld GNSS Data Collector

Model: HCE320

Radiated Emission



Conducted Emission





## Appendix B: Photographs of EUT

Refer to test report TCT180111E031

**\*\*\*\*\*END OF REPORT\*\*\*\*\***