

MPE Test Report

Applicant: Wuhan KQ GEO INSTRUMENTS CO., LTD.

Address of Applicant: 1401-A1, Hangyu Bld., Wuhan University Sci & Tech Park,
Wuhan, China

Manufacturer: Wuhan KQ GEO INSTRUMENTS CO., LTD.

Address of Manufacturer: 1401-A1, Hangyu Bld., Wuhan University Sci & Tech Park,
Wuhan, China

Equipment Under Test (EUT)

Product Name: satellite signals receiver

Model No.: M8

Trade Mark: KQ GEO

FCC ID: 2AMQ4-KQGEOM8

Applicable standards: FCC CFR Title 47 Part 2.1091 (b)
KDB447498 v05r02

Date of sample receipt: June 08, 2017

Date of Test: June 09-24, 2017

Date of report issued: June 26, 2017

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

A circular blue ink stamp from GTS Global United Technology Services Co., Ltd. is visible. The stamp contains the text "GTS", "GLOBAL TESTING", and "WUHAN, CHINA". Overlaid on the stamp is a handwritten signature in black ink, which appears to be "Robinson Lo".

Robinson Lo

Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	June 26, 2017	Original

Prepared By:

Edward Pan

Date:

June 26, 2017

Project Engineer

Check By:

Andy Wu

Date:

June 26, 2017

Reviewer

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4 Summary

4.1 Product Description

Product Name:	satellite signals receiver
Model No.:	M8
Frequency Range	410MHz~469.9875MHz
Support Bandwidth	12.5KHz & 6.25KHz
Type of modulation	GMSK
Antenna Type	Integral antenna
Antenna Gain	5dBi
Power supply:	DC 7.4V 6800mAh lithium battery Battery charge by DC 8.4V

4.2 Test frequency selection

Mode	Channels frequency (MHz)		
	Low Ch.	Mid Ch.	High Ch.
6.25KHz Bandwidth	410.00	440.00	469.9875
12.5KHz Bandwidth	410.00	440.00	469.9875

4.3 EUT operation mode

Test mode
6.25KHz Bandwidth
12.5KHz Bandwidth

4.4 Other Information Requested by the Customer

None.

4.5 Description of Support Units

None.

5 Test environment

5.1 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

5.2 Environmental conditions

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

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

5.3 Measurement Uncertainty

Test Item	Measurement Uncertainty	Notes
Transmitter power conducted	$\pm 2.00\text{dB}$	(1)
Transmitter power Radiated	$\pm 4.24\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of $k=2$ and a level of confidence of 95%.

5.4 Test Instruments list

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Field Meter	AR	FM 5004	300239	June. 28 2017	June. 27 2018
2	Field Probe	ETS-LINDGREN	HI-6005	00064170	June. 28 2017	June. 27 2018

6 Method of measurement

6.1 Applicable Standard

According to FCC Part 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 FCC Part 1.1310 and FCC Part 2.1091 RF exposure is calculated.

IEEE Std C95.1: 2005: "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz".

FCC OET Bulletin 65, Edition 97-01: "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields".

FCC Supplement C to OET Bulletin 65, Edition 01-01: "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emission".

IEEE Std C95.3: 2002: "IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz – 300 GHz",

KDB447498 v05r02: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

6.2 Limit

FCC Part 1.1310(e):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) 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
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f=frequency in MHz

*=Plane-wave equivalent power density

6.3 Calculating the Safe Distance

Before starting EME measurements, we calculated the safe distance, R_{safe} using the following formula:

$$R_{safe} = \sqrt{\frac{P_{max} \cdot G_n \cdot \eta}{4\pi \cdot S}}$$

G_n : antenna gain (numeric)(EUT antenna gain=5dBi)

P_{max} : maximum power input to the antenna (W)

S : power density limit (W/m²) respectively

η : duty cycle (decimal number), for these measurements $\eta = 0.5$

The results of R_{safe} calculations:

FCC Part 2.1091:

RF Field Strength Limits for Occupational/Controlled Exposure

6.25 KHz Bandwidth

Test Frequency (MHz)	Max Output Power (W)	Antenna Gain (Numeric)	Power Density (mW/cm2)	Safe Distance (m)
410	2.59	3.162	1.36060	0.25
440	2.58	3.162	1.35123	0.25
469.9875	2.48	3.162	1.30236	0.24

12.5 KHz Bandwidth

Test Frequency (MHz)	Max Output Power (W)	Antenna Gain (Numeric)	Power Density (mW/cm2)	Safe Distance (m)
410	2.66	3.162	1.39872	0.25
440	2.81	3.162	1.47479	0.26
469.9875	2.72	3.162	1.42801	0.26

Note:Max Output Power (W)= Rated Output Power (W)+ 20%*Rated Output Power (W)

6.4 Measurement Procedure

1. Polarization of the EUT's antenna was vertical, which is its polarization in actual use.
2. The EUT at the chosen modulation was set to transmit at the chosen frequency at maximum RF power and at 50% duty cycle (50% duty cycle is simulated either by lowering the radio's power by 3dB or by using a 3 dB pad on the output of the radio). During preliminary measurements, we set the distance between the power density probe and the investigated EUT's antenna equal to the average calculated R_{safe} applicable either for controlled or uncontrolled environments.
3. Power density measurements were taken at different heights of the probe from the ground (0.1 to 2 meters) while rotating versus azimuth (from 0° to 360°) the antenna.
4. The azimuth between the probe and the antenna position corresponding to the highest MPE level was chosen as the "worst case" position for the final measurements.
5. For the final measurements, we adjusted the distance between the test probe and the tested antenna to the real safe distance, R_{real}, such that the measured highest power density in the "worst case" position was the same or slightly less than the test limit.
6. The measurement results of final measurements conducted at the chosen azimuth and different heights of the probe above the ground.
7. Average values of power density were calculated for the imaginary whole human body (0.1–2.0 m), for the lower part of the body (0.1–0.9 m) and for the upper part of the body (1.0–2.0 m).

6.5 Test Results

6.25 KHz Bandwidth

EME Data:

Measuring Antenna Height (cm)	FCC Part 2.1091			
	Controlled RF Exposure(mW/cm ²)			
	5dBi Antenna 25cm	5dBi Antenna 35cm	5dBi Antenna 45cm	5dBi Antenna 55cm
10	0.027	0.016	0.006	0.001
20	0.074	0.048	0.025	0.014
30	0.141	0.106	0.102	0.075
40	0.215	0.186	0.159	0.128
50	0.269	0.238	0.208	0.186
60	0.314	0.268	0.238	0.200
70	0.371	0.316	0.286	0.238
80	0.402	0.358	0.305	0.276
90	0.438	0.406	0.362	0.305
100	0.392	0.367	0.307	0.272
110	0.348	0.300	0.270	0.241
120	0.292	0.261	0.235	0.202
130	0.245	0.211	0.185	0.151
140	0.202	0.169	0.142	0.126
150	0.162	0.127	0.100	0.069
160	0.105	0.078	0.081	0.035
170	0.068	0.039	0.052	0.018
180	0.049	0.028	0.018	0.012
190	0.025	0.016	0.009	0.008
200	0.012	0.005	0.001	0.006

EME for Body Parts:

Part of the body/averaging points (m)	FCC Part 2.1091
	Controlled RF Exposure
	5dBi Antenna 26cm (mW/cm ²)
Whole body (0.1 to 2.0)	0.41
Lower body (0.1 to 0.9)	0.42
Upper body (0.1 to 2.0)	0.36

12.5 KHz Bandwidth

EME Data:

Measuring Antenna Height (cm)	FCC Part 2.1091			
	Controlled RF Exposure(mW/cm ²)			
	5dBi Antenna 26cm	5dBi Antenna 36cm	5dBi Antenna 46cm	5dBi Antenna 56cm
10	0.030	0.017	0.007	0.003
20	0.077	0.050	0.027	0.017
30	0.143	0.107	0.103	0.077
40	0.217	0.187	0.160	0.130
50	0.270	0.240	0.210	0.187
60	0.317	0.270	0.240	0.203
70	0.373	0.317	0.287	0.240
80	0.403	0.360	0.307	0.277
90	0.440	0.407	0.363	0.307
100	0.393	0.370	0.310	0.273
110	0.350	0.303	0.273	0.243
120	0.293	0.263	0.237	0.203
130	0.247	0.213	0.187	0.153
140	0.203	0.170	0.143	0.127
150	0.163	0.130	0.103	0.070
160	0.107	0.080	0.083	0.037
170	0.070	0.040	0.053	0.020
180	0.050	0.030	0.020	0.013
190	0.027	0.017	0.010	0.010
200	0.013	0.007	0.003	0.007

EME for Body Parts:

Part of the body/averaging points (m)	FCC Part 2.1091
	Controlled RF Exposure
	5dBi Antenna 26cm (mW/cm ²)
Whole body (0.1 to 2.0)	0.42
Lower body (0.1 to 0.9)	0.44
Upper body (0.1 to 2.0)	0.39

6.6 Conclusion

The User Manual shall include RF radiation safety warnings and the following:

Antenna	Safe Distance, R _{safe} , (cm)
	FCC Part 2.1091
	Controlled RF Exposure
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