



Shenzhen Huaxia Testing Technology Co., Ltd

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

Telephone: +86-755-26648640
Fax: +86-755-26648637
Website: www.cqa-cert.com

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RF Exposure Evaluation Report

Report No. : CQASZ20200600577E-06
Applicant: SHENZHEN HOLATEK CO.,LTD.
Address of Applicant: Rm.1001, Unit 4, Bldg. B, Kexing Science Park, Keyuan Road, Nanshan District, Shenzhen, P.R.C
Equipment Under Test (EUT):
Product: Explorer
Model No.: J50-2CA
Brand Name: JMGO
FCC ID: SMC-EXPLORER
Standards: 47 CFR Part 1.1307
 47 CFR Part 1.1310
 KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2020-06-19
Date of Test: 2020-06-19 to 2020-07-22
Date of Issue: 2020-07-22
Test Result : **PASS***

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

Tested By: Jun Li
 (Jun Li)

Reviewed By: Sheek Luo
 (Sheek Luo)

Approved By: Jack Ai
 (Jack Ai)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20200600577E-06	Rev.01	Initial report	2020-07-22

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3 General Information

3.1 Client Information

Applicant:	SHENZHEN HOLATEK CO.,LTD.
Address of Applicant:	Rm.1001, Unit 4, Bldg. B, Kexing Science Park, Keyuan Road, Nanshan District, Shenzhen, P.R.C
Manufacturer:	SHENZHEN HOLATEK CO.,LTD.
Address of Manufacturer:	Rm.1001, Unit 4, Bldg. B, Kexing Science Park, Keyuan Road, Nanshan District, Shenzhen, P.R.C
Factory:	SHENZHEN HOLATEK CO.,LTD.
Address of Factory:	5th floor, Building A1, Yingzhan Industrial Park, Longtian Street, Pingshan New District, Shenzhen, P.R.C

3.2 General Description of EUT

Product Name:	Explorer	
Model No.:	J50-2CA	
Trade Mark:	JMGO	
EUT Supports Radios application	Bluetooth Dual mode 2402-2480MHz 2.4GHz: Wi-Fi:802.11b/g/n(HT20): 2412MHz ~2462 MHz; 802.11b/g/n(HT40): 2422MHz ~2452 MHz 5GHz: Wi-Fi: U-NII-1: 5.15-5.25GHz; U-NII-3: 5.725-5.850GHz	
Hardware Version:	M322 MB VerC, M322 FB VerC, M322 KB VerA, M322 optical VerA	
Software Version:	1.0.5	
Power Supply:	lithium battery: DC 10.8V 5.2Ah, Charge by adapter	
Adapter:	Mode: RJ-AS140420 Input: 100-240V 50/60Hz, 2.0A Output: DC 14V 4.2A	
Product Type:	<input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable <input type="checkbox"/> Fix Location	
Test Software of EUT:	RTL8821CU Tool (manufacturer declare)	
Antenna Type:	Internal Antenna	
Antenna Gain:	BT (for CSR chip)	1.96dBi
	BT&BLE (for REALTEK chip)	2.31dBi
	2.4G WIFI (for REALTEK chip)	2.86dBi
	5G WIFI (for REALTEK chip)	3.04dBi@Band 1, 4.42dBi@Band 4

4 RF Exposure Evaluation

4.1 RF Exposure Compliance Requirement

4.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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 Exposures				
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
(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
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout * G) / (4 * \pi * R^2)$

Where

Pd = power density in mW/cm²

Pout = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm² . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.1.3 EUT RF Exposure Evaluation standalone operations

1) For BT Classic (for CSR chip)

Antenna Gain: 1.96dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.57 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

GFSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.570	2.5±1	3.5	2.239
Middle(2441MHz)	5.340	5.0±1	6.0	3.981
Highest(2480MHz)	6.120	5.5±1	6.5	4.467
π/4DQPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	0.330	0.5±1	1.5	1.413
Middle(2441MHz)	3.860	3.5±1	4.5	2.818
Highest(2480MHz)	4.690	4.5±1	5.5	3.548
8DPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	0.770	0.5±1	1.5	1.413
Middle(2441MHz)	4.180	3.5±1	4.5	2.818
Highest(2480MHz)	5.030	4.5±1	5.5	3.548

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
4.467	1.57	0.0014	1.0	PASS

Note: 1) Refer to report No. CQASZ20200600577E-01 for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (4.467 * 1.57) / (4 * 3.1416 * 20^2) = 0.0014$

2) For BT Classic (for REALTEK chip)

Antenna Gain: 2.31dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.7 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

GFSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.210	2.0±1	3.0	1.995
Middle(2441MHz)	1.560	1.5±1	2.5	1.778
Highest(2480MHz)	1.360	1.5±1	2.5	1.778
π/4DQPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.170	2.0±1	3.0	1.995
Middle(2441MHz)	1.430	1.5±1	2.5	1.778
Highest(2480MHz)	1.340	1.5±1	2.5	1.778
8DPSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.370	2.0±1	3.0	1.995
Middle(2441MHz)	1.780	1.5±1	2.5	1.778
Highest(2480MHz)	1.590	1.5±1	2.5	1.778

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
1.995	2.31	0.0007	1.0	PASS

Note: 1) Refer to report No. CQASZ20200600577E-02 for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (1.995 * 1.7) / (4 * 3.1416 * 20^2) = 0.0007$

3) For BLE (for REALTEK chip)

Antenna Gain: 2.31dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.7 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

GFSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	-1.37	-1.0±1	0	1.000
Middle(2440MHz)	-2.09	-2.0±1	-1	0.794
Highest(2480MHz)	-2.63	-2.0±1	-1	0.794

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
1.0	2.31	0.0004	1.0	PASS

Note: 1) Refer to report No. CQASZ20200600577E-03 for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (1.0 * 1.7) / (4 * 3.1416 * 20^2) = 0.0004$

4) For 2.4G WIFI

Antenna Gain: 2.86dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.93 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

802.11b mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	12.24	12.0±1	13.0	19.953
Middle(2437MHz)	12.38	12.0±1	13.0	19.953
Highest(2462MHz)	12.88	12.0±1	13.0	19.953
802.11g mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	11.57	11.0±1	12.0	15.849
Middle(2437MHz)	11.74	11.0±1	12.0	15.849
Highest(2462MHz)	11.28	11.0±1	12.0	15.849
802.11n(HT20)mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	9.34	9.0±1	10.0	10.000
Middle(2437MHz)	9.29	9.0±1	10.0	10.000
Highest(2462MHz)	9.47	9.0±1	10.0	10.000
802.11n(HT40)mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2422MHz)	9.26	9.0±1	10.0	10.000
Middle(2437MHz)	9.14	9.0±1	10.0	10.000
Highest(2452MHz)	9.11	9.0±1	10.0	10.000

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
19.953	2.86	0.0077	1.0	PASS

Note: 1) Refer to report No. CQASZ20200600577E-03 for EUT test Max Conducted Average Output Power value.

$$2) Pd = (Pout * G) / (4 * \pi * R^2) = (19.953 * 1.93) / (4 * 3.1416 * 20^2) = 0.0077$$

5) For 5G WIFI

Antenna Gain: 3.04dBi@Band 1, 4.42dBi@Band 4

Antenna Gain: The maximum Gain measured in fully anechoic chamber is Band 1: 2.01, Band 4: 2.77 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

802.11a mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
5180	8.7	8.5±1.0	9.5	8.913
5200	8.85	8.5±1.0	9.5	8.913
5240	9.3	8.5±1.0	9.5	8.913
5745	8.85	8.5±1.0	9.5	8.913
5785	7.85	8.5±1.0	9.5	8.913
5825	7.71	8.5±1.0	9.5	8.913
802.11n(HT20) SISO mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
5180	8.56	8.5±1.0	9.5	8.913
5200	8.79	8.5±1.0	9.5	8.913
5240	9.22	8.5±1.0	9.5	8.913
5745	8.71	8.5±1.0	9.5	8.913
5785	7.8	8.5±1.0	9.5	8.913
5825	7.68	8.5±1.0	9.5	8.913
802.11n(HT40) SISO mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
5190	8.76	8.5±1.0	9.5	8.913
5230	8.76	8.5±1.0	9.5	8.913
5755	8.42	8.5±1.0	9.5	8.913
5795	8.37	8.5±1.0	9.5	8.913
802.11ac(VHT20) SISO mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
5180	8.66	8.5±1.0	9.5	8.913
5200	8.96	8.5±1.0	9.5	8.913
5240	9.27	8.5±1.0	9.5	8.913
5745	9.19	8.5±1.0	9.5	8.913

5785	7.85	8.5±1.0	9.5	8.913
5825	7.79	8.5±1.0	9.5	8.913
802.11ac(VHT40) SISO mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
5190	8.96	8.5±1.0	9.5	8.913
5230	8.94	8.5±1.0	9.5	8.913
5755	8.53	8.5±1.0	9.5	8.913
5795	8.52	8.5±1.0	9.5	8.913
802.11ac(VHT80) SISO mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
5210	8.92	8.5±1.0	9.5	8.913
5775	8.41	8.5±1.0	9.5	8.913

For Band 1

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
8.913	3.04	0.0036	1.0	PASS

Note: 1) Refer to report No. CQASZ20200600577E-05 for EUT test Max Conducted average Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (8.913 * 2.01) / (4 * 3.1416 * 20^2) = 0.0036$$

For Band 4

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
8.913	3	0.0049	1.0	PASS

Note: 1) Refer to report No. CQASZ20200600577E-05 for EUT test Max Conducted average Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (8.913 * 2.77) / (4 * 3.1416 * 20^2) = 0.0049$$