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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<br>2.4GHz: Wi-Fi:802.11b/g/n(HT20): 2412MHz ~2462 MHz;<br>802.11b/g/n(HT40): 2422MHz ~2452 MHz<br>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<br>Input: 100-240V 50/60Hz, 2.0A<br>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 <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 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                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3–1.34 .....                                                 | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30 .....                                                  | 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

Friis Formula

Friis transmission formula:  $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = 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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. 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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm²) | 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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | 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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | 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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm²) | 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.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (19.953 * 1.93) / (4 * 3.1416 * 20^2) = 0.0077$$

### 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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(dBm) | Tune up tolerance<br>(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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | 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<br>(mW) | Antenna Gain<br>(dBi) | Power Density<br>at R = 20 cm<br>(mW/cm <sup>2</sup> ) | 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.

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