

## Maximum Permissible Exposure Report

### 1. Product Information

|                               |                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------|
| FCC ID                        | 2AG6GH8959-4GSPT                                                                                       |
| Name of EUT                   | Cellular Wi-Fi Router                                                                                  |
| Test Model                    | H8959-4GSPT                                                                                            |
| Additional Model No.:         | H8959-4GTLS, H8959-4GVZW, H8959-4GATT, H8959-4GMEX, H8959, H8959-NM                                    |
| Model Declaration             | PCB board, structure and internal of these model(s) are the same, so no additional models were tested. |
| Modulation Type               | QPSK for WCDMA; QPSK, 16QAM for LTE                                                                    |
| Antenna Gain                  | 3.0dBi (max.) For all WCDMA Band<br>3.0dBi (max.) For all LTE Band<br>5.0dBi (max.) For WLAN           |
| Hardware version              | V10A                                                                                                   |
| Software version              | V7.2.0_SE_Amazon                                                                                       |
| UMTS Operation Frequency Band | UMTS FDD Band II/IV/V                                                                                  |
| LTE Operation Frequency Band  | LTE FDD band 2, 4, 5, 7, 12, 13,17, 25, 26, 41                                                         |
| GSM/EDGE/GPRS                 | Not Supported                                                                                          |
| WCDMA Release Version         | R8                                                                                                     |
| HSDPA Release Version         | Release 8                                                                                              |
| HSUPA Release Version         | Release 6                                                                                              |
| DC-HSUPA Release Version      | Not Supported                                                                                          |
| LTE Release Version           | R9                                                                                                     |
| LTE/UMTS Power Class          | Class 3                                                                                                |
| WLAN FCC Modulation Type      | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g/n: OFDM(64QAM, 16QAM, QPSK, BPSK)                  |
| WLAN FCC Operation frequency  | IEEE 802.11b:2412-2462MHz<br>IEEE 802.11g/n20:2412-2462MHz<br>IEEE 802.11n40:2422-2452MHz              |
| Antenna Type                  | External Antenna                                                                                       |
| Extreme temp. Tolerance       | -20°C to +55°C                                                                                         |
| GPS function                  | Not Supported                                                                                          |
| FM function                   | Not Supported                                                                                          |
| NFC Function                  | Not Supported                                                                                          |
| Extreme vol. Limits           | 10.2VDC to 13.8VDC (nominal: 12VDC)                                                                    |
| Exposure category             | General population/uncontrolled environment                                                            |
| EUT Type                      | Production Unit                                                                                        |
| Device Type                   | Mobile Device                                                                                          |

## 2. Evaluation Method

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 modelled or measured field strengths or power density, is  $\leq 1.0$ . 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. Limit

### 3.1 Refer Evaluation Method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices

### 3.2 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 <sup>2</sup> ) | 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 <sup>2</sup> )*              | 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 <sup>2</sup> ) | 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 <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

\*=Plane-wave equivalent power density

#### 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

#### 5. Antenna Information

Cellular Wi-Fi Router can only use antennas certificated as follows provided by manufacturer;

| Antenna type and antenna number | Operate frequency band | Maximum antenna gain | Notes              |
|---------------------------------|------------------------|----------------------|--------------------|
| External Antenna                | 2400 MHz – 2500 MHz    | 5.0 dBi              | WLAN ANT           |
| External Antenna                | 600 MHz – 3000 MHz     | 3.0 dBi              | WCDMA/LTE Main ANT |

#### 6. Conducted Power

[2.4GWLAN Max Peak Conducted Power]

| Mode              | Channel | Frequency(MHz) | Max Conducted Power (dBm) |
|-------------------|---------|----------------|---------------------------|
| IEEE 802.11b      | 1       | 2412           | 11.06                     |
|                   | 6       | 2437           | 12.08                     |
|                   | 11      | 2462           | 11.31                     |
| IEEE 802.11g      | 1       | 2412           | 11.12                     |
|                   | 6       | 2437           | 11.66                     |
|                   | 11      | 2462           | 11.07                     |
| IEEE 802.11n HT20 | 1       | 2412           | 11.21                     |
|                   | 6       | 2437           | 11.38                     |
|                   | 11      | 2462           | 10.95                     |
| IEEE 802.11n HT40 | 3       | 2422           | 11.72                     |
|                   | 6       | 2437           | 11.57                     |
|                   | 9       | 2452           | 11.82                     |

[WCDMA Max Average Power]

| Test Mode     | Channel | Frequency (MHz) | Max Average Power (dBm) |
|---------------|---------|-----------------|-------------------------|
| WCDMA Band II | Low     | 1852.4          | 23.31                   |
|               | Middle  | 1880            | 23.38                   |
|               | High    | 1907.6          | 23.23                   |
| WCDMA Band IV | Low     | 1712.4          | 23.14                   |
|               | Middle  | 1732.6          | 23.27                   |
|               | High    | 1752.6          | 23.23                   |
| WCDMA Band V  | Low     | 826.4           | 23.25                   |
|               | Middle  | 836.4           | 23.50                   |
|               | High    | 846.6           | 23.41                   |

[LTE Max Average Power]

| Test Mode |                      | Channel | Max Average Power (dBm) |
|-----------|----------------------|---------|-------------------------|
| LTE       | Band 2               | LCH     | 23.10                   |
|           |                      | MCH     | 23.48                   |
|           |                      | HCH     | 23.43                   |
|           | Band 4               | LCH     | 23.35                   |
|           |                      | MCH     | 23.37                   |
|           |                      | HCH     | 24.36                   |
|           | Band 5               | LCH     | 24.29                   |
|           |                      | MCH     | 24.52                   |
|           |                      | HCH     | 24.37                   |
|           | Band 7               | LCH     | 24.56                   |
|           |                      | MCH     | 24.42                   |
|           |                      | HCH     | 23.90                   |
|           | Band 12              | LCH     | 23.61                   |
|           |                      | MCH     | 24.39                   |
|           |                      | HCH     | 24.70                   |
|           | Band 13              | LCH     | 23.48                   |
|           |                      | MCH     | 23.92                   |
|           |                      | HCH     | 24.26                   |
|           | Band 17              | LCH     | 22.86                   |
|           |                      | MCH     | 22.91                   |
|           |                      | HCH     | 22.83                   |
|           | Band 25              | LCH     | 23.93                   |
|           |                      | MCH     | 24.35                   |
|           |                      | HCH     | 23.83                   |
|           | Band 26 (814-824MHz) | LCH     | 22.84                   |
|           |                      | MCH     | 22.57                   |
|           |                      | HCH     | 23.34                   |
|           | Band 26 (824-849MHz) | LCH     | 23.54                   |
|           |                      | MCH     | 24.05                   |
|           |                      | HCH     | 24.20                   |
|           | Band 41              | LCH     | 23.29                   |
|           |                      | MCH     | 23.95                   |
|           |                      | HCH     | 23.91                   |

## 7. Manufacturing Tolerance

[2.4GWLAN Max Conducted Power]

| Test Mode         | Channel | Max Conducted Power (dBm) | ANT Max. Tune Up Power (dBm) |
|-------------------|---------|---------------------------|------------------------------|
| IEEE 802.11b      | LCH     | 11.06                     | 11.0±1.0                     |
|                   | MCH     | 12.08                     | 12.0±1.0                     |
|                   | HCH     | 11.31                     | 11.0±1.0                     |
| IEEE 802.11g      | LCH     | 11.12                     | 11.0±1.0                     |
|                   | MCH     | 11.66                     | 11.0±1.0                     |
|                   | HCH     | 11.07                     | 11.0±1.0                     |
| IEEE 802.11n HT20 | LCH     | 11.21                     | 11.0±1.0                     |
|                   | MCH     | 11.38                     | 11.0±1.0                     |
|                   | HCH     | 10.95                     | 11.0±1.0                     |
| IEEE 802.11n HT40 | LCH     | 11.72                     | 11.0±1.0                     |
|                   | MCH     | 11.57                     | 11.0±1.0                     |
|                   | HCH     | 11.82                     | 11.0±1.0                     |

[WCDMA Max Average Power]

| Test Mode |         | Channel | Max Average Power (dBm) | ANT Max. Tune Up Power (dBm) |
|-----------|---------|---------|-------------------------|------------------------------|
| WCDMA     | Band II | LCH     | 23.31                   | 23.0±1.0                     |
|           |         | MCH     | 23.38                   | 23.0±1.0                     |
|           |         | HCH     | 23.23                   | 23.0±1.0                     |
|           | Band IV | Low     | 23.14                   | 23.0±1.0                     |
|           |         | Middle  | 23.27                   | 23.0±1.0                     |
|           |         | High    | 23.23                   | 23.0±1.0                     |
|           | Band V  | LCH     | 23.25                   | 23.0±1.0                     |
|           |         | MCH     | 23.50                   | 23.0±1.0                     |
|           |         | HCH     | 23.41                   | 23.0±1.0                     |

&lt;LTE Max Average Power&gt;

| Test Mode |                      | Channel | Max Average Power (dBm) | ANT Max. Tune Up Power (dBm) |
|-----------|----------------------|---------|-------------------------|------------------------------|
| LTE       | Band 2               | LCH     | 23.10                   | 23.0±1.0                     |
|           |                      | MCH     | 23.48                   | 23.0±1.0                     |
|           |                      | HCH     | 23.43                   | 23.0±1.0                     |
|           | Band 4               | LCH     | 23.35                   | 23.0±1.0                     |
|           |                      | MCH     | 23.37                   | 23.0±1.0                     |
|           |                      | HCH     | 24.36                   | 24.0±1.0                     |
|           | Band 5               | LCH     | 24.29                   | 24.0±1.0                     |
|           |                      | MCH     | 24.52                   | 24.0±1.0                     |
|           |                      | HCH     | 24.37                   | 24.0±1.0                     |
|           | Band 7               | LCH     | 24.56                   | 24.0±1.0                     |
|           |                      | MCH     | 24.42                   | 24.0±1.0                     |
|           |                      | HCH     | 23.90                   | 23.0±1.0                     |
|           | Band 12              | LCH     | 23.61                   | 23.0±1.0                     |
|           |                      | MCH     | 24.39                   | 24.0±1.0                     |
|           |                      | HCH     | 24.70                   | 24.0±1.0                     |
|           | Band 13              | LCH     | 23.48                   | 23.0±1.0                     |
|           |                      | MCH     | 23.92                   | 23.0±1.0                     |
|           |                      | HCH     | 24.26                   | 24.0±1.0                     |
|           | Band 17              | LCH     | 22.86                   | 22.0±1.0                     |
|           |                      | MCH     | 22.91                   | 22.0±1.0                     |
|           |                      | HCH     | 22.83                   | 22.0±1.0                     |
|           | Band 25              | LCH     | 23.93                   | 22.0±1.0                     |
|           |                      | MCH     | 24.35                   | 24.0±1.0                     |
|           |                      | HCH     | 23.83                   | 23.0±1.0                     |
|           | Band 26 (814-824MHz) | LCH     | 22.84                   | 22.0±1.0                     |
|           |                      | MCH     | 22.57                   | 22.0±1.0                     |
|           |                      | HCH     | 23.34                   | 23.0±1.0                     |
|           | Band 26 (824-849MHz) | LCH     | 23.54                   | 23.0±1.0                     |
|           |                      | MCH     | 24.05                   | 24.0±1.0                     |
|           |                      | HCH     | 24.20                   | 24.0±1.0                     |
|           | Band 41              | LCH     | 23.29                   | 23.0±1.0                     |
|           |                      | MCH     | 23.95                   | 23.0±1.0                     |
|           |                      | HCH     | 23.91                   | 23.0±1.0                     |

## 8. Measurement Results

### 8.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance,  $r=20\text{cm}$ , as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

| Modulation Type   | Output power |       | Antenna Gain (dBi) | Antenna Gain (linear) | MPE ( $\text{mW}/\text{cm}^2$ ) | MPE Limits ( $\text{mW}/\text{cm}^2$ ) |
|-------------------|--------------|-------|--------------------|-----------------------|---------------------------------|----------------------------------------|
|                   | dBm          | mW    |                    |                       |                                 |                                        |
| IEEE 802.11b      | 13.0         | 19.95 | 5.0                | 3.162                 | 0.013                           | 1.0                                    |
| IEEE 802.11g      | 12.0         | 15.85 | 5.0                | 3.162                 | 0.010                           | 1.0                                    |
| IEEE 802.11n HT20 | 12.0         | 15.85 | 5.0                | 3.162                 | 0.010                           | 1.0                                    |
| IEEE 802.11n HT40 | 12.0         | 15.85 | 5.0                | 3.162                 | 0.010                           | 1.0                                    |

| Modulation Type          | Output power |        | Antenna Gain (dBi) | Antenna Gain (linear) | MPE ( $\text{mW}/\text{cm}^2$ ) | MPE Limits ( $\text{mW}/\text{cm}^2$ ) |
|--------------------------|--------------|--------|--------------------|-----------------------|---------------------------------|----------------------------------------|
|                          | dBm          | mW     |                    |                       |                                 |                                        |
| WCDMA Band II            | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 1.0                                    |
| WCDMA Band IV            | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 1.0                                    |
| WCDMA Band V             | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 0.55                                   |
| LTE Band 2               | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 1.0                                    |
| LTE Band 4               | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 1.0                                    |
| LTE Band 5               | 25.0         | 316.23 | 3.0                | 1.995                 | 0.126                           | 0.55                                   |
| LTE Band 7               | 25.0         | 316.23 | 3.0                | 1.995                 | 0.126                           | 1.0                                    |
| LTE Band 12              | 25.0         | 316.23 | 3.0                | 1.995                 | 0.126                           | 0.47                                   |
| LTE Band 13              | 25.0         | 316.23 | 3.0                | 1.995                 | 0.126                           | 0.52                                   |
| LTE Band 17              | 23.0         | 199.53 | 3.0                | 1.995                 | 0.079                           | 0.47                                   |
| LTE Band 25              | 25.0         | 316.23 | 3.0                | 1.995                 | 0.126                           | 1.0                                    |
| LTE Band 26 (814-824MHz) | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 0.54                                   |
| LTE Band 26 (824-849MHz) | 25.0         | 316.23 | 3.0                | 1.995                 | 0.126                           | 0.55                                   |
| LTE Band 41              | 24.0         | 251.19 | 3.0                | 1.995                 | 0.100                           | 1.0                                    |

Remark:

1. Output power including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;
3. We choose the lowest frequency operate to calculate MPE limit as higher frequency will have higher MPE limits;
4.  $MPE \text{ values} = PG/4\pi R^2$ .

### 8.2 Simultaneous Transmission MPE

The sample support one 2.4G WLAN and another one LTE&WCDMA transmit antenna, so need consider simultaneous transmission;

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\Sigma$  of MPE ratios  $\leq 1.0$

| Mode              | $\Sigma$ MPE max ratios | Limit | Results |
|-------------------|-------------------------|-------|---------|
| 2.4G WIFI + WCDMA | 0.195                   | 1.0   | Pass    |
| 2.4G WIFI + LTE   | 0.281                   | 1.0   | Pass    |

## 9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----THE END OF REPORT-----