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CNAS L0310



## FCC Maximum Permissible Exposure(MPE) Estimation Report

Product Name: LTE CPE

Model: B612s-51d

Report No.: SYBH(Z-SAR)013022017-2

FCC ID: QISB612S-51D

|      | APPROVED<br>(Lab Manager) | PREPARED<br>(Test Engineer) |
|------|---------------------------|-----------------------------|
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| DATE | 2017-03-03                | 2017-03-03                  |

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※ ※ **Notice** ※ ※

1. The laboratory has passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01 & 2174.02 & 2174.03
3. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named as “Global Compliance and Testing Center of Huawei Technologies Co., Ltd”, the both names have coexisted since 2009.
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## ※ ※ Modified History ※ ※

| REV.    | DESCRIPTION                 | ISSUED DATE | REMARK |
|---------|-----------------------------|-------------|--------|
| Rev.1.0 | Initial Test Report Release | 2017-03-03  | Li Wei |
|         |                             |             |        |
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## 1 EUT Description

| Device Information:              |           |                                                                                          |           |           |
|----------------------------------|-----------|------------------------------------------------------------------------------------------|-----------|-----------|
| Product Name :                   |           | LTE CPE                                                                                  |           |           |
| Model :                          |           | B612s-51d                                                                                |           |           |
| FCC ID:                          |           | QISB612S-51D                                                                             |           |           |
| Device Type :                    |           | Mobile Device                                                                            |           |           |
| Device Phase:                    |           | Identical Prototype                                                                      |           |           |
| Exposure Category:               |           | Uncontrolled environment/general population                                              |           |           |
| Hardware Version :               |           | WL1B612SW                                                                                |           |           |
| Software Version :               |           | 11.187.01.01.00                                                                          |           |           |
| Antenna Type :                   |           | Internal Antenna &External Antenna                                                       |           |           |
| Device Operating Configurations: |           |                                                                                          |           |           |
| Supporting Mode(s)               |           | GSM850/1900,UMTS Band II / IV / V, LTE band II / IV / V / VII / XXXVIII / XLI ,WiFi 2.4G |           |           |
| Test Modulation                  |           | GSM(GMSK/8PSK),UMTS(QPSK),LTE(QPSK/16QAM),Wi Fi(DSSS/OFDM)                               |           |           |
| Operating Frequency Range(s)*    | Frequency | Band                                                                                     | Tx (MHz)  | Rx (MHz)  |
|                                  |           | GSM850                                                                                   | 824-849   | 869-894   |
|                                  |           | GSM1900                                                                                  | 1850-1910 | 1930-1990 |
|                                  |           | UMTS Band II                                                                             | 1850-1910 | 1930-1990 |
|                                  |           | UMTS Band IV                                                                             | 1710-1755 | 2110-2155 |
|                                  |           | UMTS Band V                                                                              | 824-849   | 869-894   |
|                                  |           | LTE Band II                                                                              | 1850-1910 | 1930-1990 |
|                                  |           | LTE Band IV                                                                              | 1710-1755 | 2110-2155 |
|                                  |           | LTE Band V                                                                               | 824-849   | 869-894   |
|                                  |           | LTE Band VII                                                                             | 2500-2570 | 2620-2690 |
|                                  |           | LTE Band XXXVIII                                                                         | 2570-2620 | 2570-2620 |
|                                  |           | LTE Band XLI                                                                             | 2545-2655 | 2545-2655 |
|                                  |           | WiFi 2.4G                                                                                | 2412-2462 | 2412-2462 |

Note: \* The device only supports downlink LTE CA. The maximum tune-up power and antenna gain when downlink carrier aggregation is active are the same as those when downlink carrier aggregation is inactive. So additional MPE evaluation for downlink LTE CA is not required.

## **1.1 General Description**

B612s-51d LTE/DC-HSPA+/WCDMA/EDGE/GPRS/GSM multi-mode LTE CPE is subscriber equipment in the LTE/UMTS/GSM system and support WLAN 802.11a/b/g/n/ac. B612s-51d implement such functions as RF signal receiving/transmitting, LTE/DC-HSPA+/WCDMA and EDGE/GPRS/GSM protocol processing, data service etc. It provides USIM card interface, RJ45/RJ11 Ethernet interface, USB port and external antenna interfaces.

## 2 Test specification(s)

|                     |                                                                                                                               |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------|
| ANSI Std C95.1-1992 | Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991) |
| KDB 447498 D01      | General RF Exposure Guidance v06                                                                                              |

## 3 Testing laboratory

|                        |                                                                                                                                                                      |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Site              | The Reliability Laboratory of Huawei Technologies Co., Ltd.                                                                                                          |
| Test Location          | Section G1,Huawei Base Bantian, Longgang District, Shenzhen 518129, P.R. China                                                                                       |
| Telephone              | +86 755 28780808                                                                                                                                                     |
| Fax                    | +86 755 89652518                                                                                                                                                     |
| State of accreditation | The Test laboratory (area of testing) is accredited according to ISO/IEC 17025.<br>CNAS Registration number: L0310<br>A2LA TESTING CERT #2174.01 & 2174.02 & 2174.03 |

## 4 Applicant and Manufacturer

|              |                                                                                                                             |
|--------------|-----------------------------------------------------------------------------------------------------------------------------|
| Company Name | HUAWEI TECHNOLOGIES CO., LTD                                                                                                |
| Address      | Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C |

## 5 Application details

|                    |            |
|--------------------|------------|
| Start Date of test | 2017-03-03 |
| End Date of test   | 2017-03-03 |

## 6 Ambient Condition

|                     |             |
|---------------------|-------------|
| Ambient temperature | 20°C – 24°C |
| Relative Humidity   | 30% – 70%   |

## 7 RF Exposure Requirements

An estimation of MPE in this application for product is used to ensure if it complies to the rules of the standard in the regulation list above.

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation:

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator

R= distance to the centre of radiation of the antenna

EIRP = P\*G

The antenna of the product, under normal use condition is at least 20 cm away from the

body of the user. Warning statement to the user for keeping at least 20cm separation distance and the prohibition of operating to a person has been printed on the user's manual. Therefore, the S of the device is calculated with R=20cm, and if it is below the limit S, then we can conclude the device complies with the rules.

## 7.1 FCC MPE Limits

We analysis if it comply with the limits for General population/uncontrolled exposure. The FCC MPE limits for field strength and power density are given in 47CFR 1.1310(Table below).These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

**Table: Limits For Maximum Permissible Exposure (MPE)**

| <b>(A) Limits for Occupational/controlled Exposure</b>         |                                 |                                 |                                        |                                                                |
|----------------------------------------------------------------|---------------------------------|---------------------------------|----------------------------------------|----------------------------------------------------------------|
| Frequency Range(MHz)                                           | Electric Field Strength(E)(V/m) | Magnetic Field Strength(H)(A/m) | Power Density (S)(mW/cm <sup>2</sup> ) | Averaging Time (minute) E  <sup>2</sup> , H  <sup>2</sup> or S |
| 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> |                                 |                                 |                                        |                                                                |
| Frequency Range(MHz)                                           | Electric Field Strength(E)(V/m) | Magnetic Field Strength(H)(A/m) | Power Density (S)(mW/cm <sup>2</sup> ) | Averaging Time (minute) E  <sup>2</sup> , H  <sup>2</sup> or S |
| 0.3-1.34                                                       | 614                             | 1.63                            | (100)*                                 | 30                                                             |
| 1.34-30                                                        | 824/f                           | 2.19/f                          | (180/f)*                               | 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   |                                                                |

## 8 RF Exposure Evaluation

### 8.1 Operation in GSM850

(uplink: 824-849MHz, downlink: 869-894MHz)

| Antenna          | Mode      | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion |
|------------------|-----------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|------------|
| Internal Antenna | GSM CS    | 35.00               | 1.50       | 36.50       | 558.35    | 20    | 0.111                   | 0.549                           | PASS       |
|                  | 1TS*(1/8) | 35.00               | 1.50       | 36.50       | 558.35    | 20    | 0.111                   | 0.549                           | PASS       |
|                  | 2TS*(2/8) | 35.00               | 1.50       | 36.50       | 1116.71   | 20    | 0.222                   | 0.549                           | PASS       |
|                  | 3TS*(3/8) | 33.20               | 1.50       | 34.70       | 1106.70   | 20    | 0.220                   | 0.549                           | PASS       |
|                  | 4TS*(4/8) | 32.00               | 1.50       | 33.50       | 1119.36   | 20    | 0.223                   | 0.549                           | PASS       |
| External Antenna | GSM CS    | 35.00               | 3.00       | 38.00       | 788.70    | 20    | 0.157                   | 0.549                           | PASS       |
|                  | 1TS*(1/8) | 35.00               | 3.00       | 38.00       | 788.70    | 20    | 0.157                   | 0.549                           | PASS       |
|                  | 2TS*(2/8) | 35.00               | 3.00       | 38.00       | 1577.39   | 20    | 0.314                   | 0.549                           | PASS       |
|                  | 3TS*(3/8) | 33.20               | 3.00       | 36.20       | 1563.26   | 20    | 0.311                   | 0.549                           | PASS       |
|                  | 4TS*(4/8) | 32.00               | 3.00       | 35.00       | 1581.14   | 20    | <b>0.315</b>            | 0.549                           | PASS       |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.315mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.2 Operation in GSM1900

(uplink: 1850-1910MHz, downlink: 1930-1990MHz)

| Antenna          | Mode      | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion |
|------------------|-----------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|------------|
| Internal Antenna | GSM CS    | 32.00               | 3.50       | 35.50       | 443.52    | 20    | 0.088                   | 1.000                           | PASS       |
|                  | 1TS*(1/8) | 32.00               | 3.50       | 35.50       | 443.52    | 20    | 0.088                   | 1.000                           | PASS       |
|                  | 2TS*(2/8) | 32.00               | 3.50       | 35.50       | 887.03    | 20    | <b>0.177</b>            | 1.000                           | PASS       |
|                  | 3TS*(3/8) | 30.20               | 3.50       | 33.70       | 879.09    | 20    | 0.175                   | 1.000                           | PASS       |
|                  | 4TS*(4/8) | 29.00               | 3.50       | 32.50       | 889.14    | 20    | <b>0.177</b>            | 1.000                           | PASS       |
| External Antenna | GSM CS    | 32.00               | 3.00       | 35.00       | 395.28    | 20    | 0.079                   | 1.000                           | PASS       |
|                  | 1TS*(1/8) | 32.00               | 3.00       | 35.00       | 395.28    | 20    | 0.079                   | 1.000                           | PASS       |
|                  | 2TS*(2/8) | 32.00               | 3.00       | 35.00       | 790.57    | 20    | 0.157                   | 1.000                           | PASS       |
|                  | 3TS*(3/8) | 30.20               | 3.00       | 33.20       | 783.49    | 20    | 0.156                   | 1.000                           | PASS       |
|                  | 4TS*(4/8) | 29.00               | 3.00       | 32.00       | 792.45    | 20    | 0.158                   | 1.000                           | PASS       |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.177 mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

### 8.3 Operation in UMTS Band II

(uplink: 1850-1910MHz, downlink: 1930-1990MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 3.50       | 29.20       | 831.76    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

### 8.4 Operation in UMTS Band IV

(uplink: 1710-1755MHz, downlink: 2110-2155MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 3.50       | 29.20       | 831.76    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

### 8.5 Operation in UMTS Band V

(uplink: 824-849MHz, downlink: 869-894MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 1.50       | 27.20       | 524.81    | 20    | 0.104                   | 0.549                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | <b>0.148</b>            | 0.549                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.148mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.6 Operation in LTE Band II

(uplink: 1850-1910MHz, downlink: 1930-1990MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 3.50       | 29.20       | 831.76    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166 mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.7 Operation in LTE Band IV

(uplink: 1710-1755MHz, downlink: 2110-2155MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 3.50       | 29.20       | 831.76    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166 mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.8 Operation in LTE Band V

(uplink: 824-849MHz, downlink: 869-894MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 1.50       | 27.20       | 524.81    | 20    | 0.104                   | 0.549                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | <b>0.148</b>            | 0.549                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.148mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.9 Operation in LTE Band VII

(uplink: 2500-2570MHz, downlink: 2620-2690MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 3.50       | 29.20       | 831.76    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.10 Operation in LTE Band XXXVIII

(uplink: 2570-2620MHz, downlink: 2570-2620MHz)

| Antenna            | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|--------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna   | 25.70               | 3.50       | 29.20       | 831.76    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna 1 | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.11 Operation in LTE Band XLI

(uplink: 2545-2655MHz, downlink: 2545-2655MHz)

| Antenna          | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|------------------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Internal Antenna | 25.70               | 3.50       | 29.20       | 831.80    | 20    | <b>0.166</b>            | 1.000                           | <b>PASS</b> |
| External Antenna | 25.70               | 3.00       | 28.70       | 741.31    | 20    | 0.148                   | 1.000                           | <b>PASS</b> |

Note:\*- based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.166mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 8.12 Operation in WLAN 2.4G

(uplink: 2412-2462MHz, downlink: 2412-2462MHz)

| Antenna   | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Conclusion  |
|-----------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|-------------|
| Antenna 1 | 18.00               | 1.00       | 19.00       | 79.43     | 20    | <b>0.016</b>            | 1.000                           | <b>PASS</b> |
| Antenna 2 | 18.00               | 1.00       | 19.00       | 79.43     | 20    | <b>0.016</b>            | 1.000                           | <b>PASS</b> |

Note:\* - based on the maximum tune-up tolerance limit declared by manufacturer.

According to the Table, we can conclude the max power density level at 20 cm is 0.016mW/cm<sup>2</sup>, which is below the uncontrolled exposure limit, so we can conclude it is into compliance.

## 9 Exposure calculations for multiple sources

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table(A) and Table(B). To comply with the MPE, the fraction of the MPE in terms of  $E^2$ ,  $H^2$  (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

| Simultaneous Tx Combination | Configuration                |
|-----------------------------|------------------------------|
| 1                           | WLAN 2.4G MIMO               |
| 2                           | GSM/UMTS/LTE +WLAN SISO/MIMO |

Note:

- 1) The device has one GSM/UMTS/LTE Internal antenna, one GSM/UMTS/LTE External antenna and two WLAN antennas.
- 2) The GSM/UMTS/LTE Internal antenna and GSM/UMTS/LTE External antenna cannot transmit simultaneously.
- 3) The two WLAN antennas support 2\*2 MIMO.

### 9.1 Estimation for WLAN2.4G MIMO

| Antenna   | Tune-up limit (dBm) | Gain (dBi) | EIRP* (dBm) | EIRP (mW) | R(cm) | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Calculation result | Conclusion |
|-----------|---------------------|------------|-------------|-----------|-------|-------------------------|---------------------------------|--------------------|------------|
| Antenna 1 | 16.00               | 1.00       | 17.00       | 50.10     | 20    | 0.010                   | 1.000                           | 0.014              | PASS       |
| Antenna 2 | 16.00               | 1.00       | 17.00       | 50.10     | 20    | 0.010                   | 1.000                           |                    |            |

Note: \*- based on the maximum tune-up tolerance limit declared by manufacturer

### 9.2 Estimation for GSM850& WLAN2.4G

| No. | Mode                     | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Calculation result | Conclusion |
|-----|--------------------------|-------------------------|---------------------------------|--------------------|------------|
| 1   | GSM850                   | 0.315                   | 0.549                           | 0.590              | PASS       |
|     | WLAN 2.4G SISO           | 0.016                   | 1.000                           |                    |            |
| 2   | GSM850                   | 0.315                   | 0.549                           | 0.594              | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                   | 1.000                           |                    |            |
|     | WLAN MIMO with Antenna 2 | 0.010                   | 1.000                           |                    |            |

### 9.3 Estimation for GSM1900& WLAN2.4G

| No. | Mode                     | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Calculation result | Conclusion |
|-----|--------------------------|-------------------------|---------------------------------|--------------------|------------|
| 1   | GSM1900                  | 0.177                   | 1.000                           | 0.193              | PASS       |
|     | WLAN SISO                | 0.016                   | 1.000                           |                    |            |
| 2   | GSM1900                  | 0.177                   | 1.000                           | 0.197              | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                   | 1.000                           |                    |            |
|     | WLAN MIMO with Antenna 2 | 0.010                   | 1.000                           |                    |            |

### 9.4 Estimation for UMTS Band II & WLAN2.4G

| No. | Mode                     | S (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) | Calculation result | Conclusion |
|-----|--------------------------|-------------------------|---------------------------------|--------------------|------------|
| 1   | UMTS Band II             | 0.166                   | 1.000                           | 0.182              | PASS       |
|     | WLAN SISO                | 0.016                   | 1.000                           |                    |            |
| 2   | UMTS Band II             | 0.166                   | 1.000                           | 0.186              | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                   | 1.000                           |                    |            |
|     | WLAN MIMO with Antenna 2 | 0.010                   | 1.000                           |                    |            |

### 9.5 Estimation for UMTS Band IV & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | UMTS Band IV             | 0.166                      | 1.000                              | 0.182                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | UMTS Band IV             | 0.166                      | 1.000                              | 0.186                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.6 Estimation for UMTS Band V & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | UMTS Band V              | 0.148                      | 0.549                              | 0.286                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | UMTS Band V              | 0.148                      | 0.549                              | 0.290                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.7 Estimation for LTE Band II & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | LTE Band II              | 0.166                      | 1.000                              | 0.182                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | LTE Band II              | 0.166                      | 1.000                              | 0.186                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.8 Estimation for LTE Band IV & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | LTE Band IV              | 0.166                      | 1.000                              | 0.182                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | LTE Band IV              | 0.166                      | 1.000                              | 0.186                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.9 Estimation for LTE Band V & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | LTE Band V               | 0.148                      | 0.549                              | 0.286                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | LTE Band V               | 0.148                      | 0.549                              | 0.290                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.10 Estimation for LTE Band VII & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | LTE Band VII             | 0.166                      | 1.000                              | 0.182                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | LTE Band VII             | 0.166                      | 1.000                              | 0.186                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.11 Estimation for LTE Band XXXVIII & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | LTE Band XXXVIII         | 0.166                      | 1.000                              | 0.182                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | LTE Band XXXVIII         | 0.166                      | 1.000                              | 0.186                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

### 9.12 Estimation for LTE Band XLI & WLAN2.4G

| No. | Mode                     | S<br>(mW/cm <sup>2</sup> ) | MPE Limit<br>(mW/cm <sup>2</sup> ) | Calculation<br>result | Conclusion |
|-----|--------------------------|----------------------------|------------------------------------|-----------------------|------------|
| 1   | LTE Band XLI             | 0.166                      | 1.000                              | 0.182                 | PASS       |
|     | WLAN SISO                | 0.016                      | 1.000                              |                       |            |
| 2   | LTE Band XLI             | 0.166                      | 1.000                              | 0.186                 | PASS       |
|     | WLAN MIMO with Antenna 1 | 0.010                      | 1.000                              |                       |            |
|     | WLAN MIMO with Antenna 2 | 0.010                      | 1.000                              |                       |            |

According to the Table above, we can conclude that the calculation results of all simultaneous transmission possibilities are less than 1, so it is into compliance.

Therefore the product also meets the requirements under multiple sources condition.

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