

## WPC RF Exposure Report

**Applicant Name:**

**SAMSUNG Electronics Co., Ltd.**

129, Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677 Rep. of Korea

**Date of Issue:** Jun. 17, 2022

**Test Report No.:** HCT-SR-2206-FC002

**Test Site:** HCT CO., LTD.

**FCC ID:**

**A3LSMG990B2**

**Equipment Type:**

**Mobile Phone**

**Application Type**

**Certification**

**FCC Rule Part(s):**

**FCC Part 1 SUBPART I  
FCC Part 2 SUBPART J  
KDB 680106 D01**

**Model Name:**

**SM-G990B2/DS**

**Additional Model Name:**

**SM-G990B2**

**Date of Test:**

**Jun.14, 2022**

This device has been shown to be capable of compliance for the above standards for uncontrolled environment/general population exposure limits specified in FCC KDB procedures and had been tested in accordance with the measurement procedures specified in FCC KDB procedures.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

**Tested By**



**Chanmin, Ko  
Test Engineer  
SAR Team  
Certification Division**

**Reviewed By**



**Yun-jeang, Heo  
Technical Manager  
SAR Team  
Certification Division**

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## DOCUMENT HISTORY

| Rev. | DATE          | DESCRIPTION           |
|------|---------------|-----------------------|
| 0    | Jun. 17, 2022 | First Approval Report |

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## 1. Test Methodology

The DUT was assessed in accordance with FCC KDB 680106 D01 RF Exposure Wireless Charging App v03r01.

## 2. Test Location.

### 2.1 Test Laboratory.

|                      |                                                                                          |
|----------------------|------------------------------------------------------------------------------------------|
| <b>Company Name:</b> | HCT Co., LTD                                                                             |
| <b>Address:</b>      | 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of Korea |
| <b>Telephone:</b>    | +82 31 645 6300                                                                          |
| <b>Fax.:</b>         | +82 31 645 6401                                                                          |

### 2.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

|               |                                                         |
|---------------|---------------------------------------------------------|
| <b>Korea:</b> | National Radio Research Agency (Designation No. KR0032) |
|               | KOLAS (Testing No. KT197)                               |

### 3. DEVICE UNDER TEST DESCRIPTION

|                               |                               |
|-------------------------------|-------------------------------|
| <b>Applicant Name:</b>        | SAMSUNG Electronics Co., Ltd. |
| <b>Model Name:</b>            | SM-G990B2/DS                  |
| <b>Additional Model Name:</b> | SM-G990B2                     |
| <b>EUT Type:</b>              | Mobile Phone                  |
| <b>Application Type:</b>      | Certification                 |

#### 3.1 Description of DUT

The DUT is a mobile phone with a WPT (Wireless Power Transfer) feature using an inductive charging coil to charge a phone or watch or EarBuds. The charging frequency is between 110 kHz to 148 kHz, and the maximum transfer power consumption is 9 W in charging status.

SM-G990B2/DS, SM-G990B2 were tested and the worst case results were reported.  
(Worst case : SM-G990B2/DS)

#### 3.2 TEST Configuration

| Test configuration                | Description                                        |
|-----------------------------------|----------------------------------------------------|
| DUT to Phone test configuration 1 | Charging from Phone to DUT                         |
| DUT to Phone test configuration 2 | Charging from Phone to DUT( TA Charging from DUT)  |
| DUT to Phone test configuration 3 | Charging from Phone to DUT                         |
| DUT to Phone test configuration 4 | Charging from Phone to DUT( TA Charging from DUT)  |
| DUT to Phone test configuration 5 | Charging from Watch to DUT                         |
| DUT to Phone test configuration 6 | Charging from Watch to DUT(TA Charging from DUT)   |
| DUT to Phone test configuration 7 | Charging from EarBuds to DUT                       |
| DUT to Phone test configuration 8 | Charging from EarBuds to DUT(TA Charging from DUT) |

Note :

1. Configuration 2,4,6 and 8 were tested with the worst case of configuration 1,3,5 and 7

### 3.3 KDB 680106 D01 v03 SECTION 5.b) EQUIPMENT APPROVAL CONSIDERATIONS

| Requirement                                                                                                                                                                                                                                | Device                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| (1) Power transfer frequency is less than 1 MHz.                                                                                                                                                                                           | Yes. Operation Frequency is between 110 kHz to 148 Khz.                                 |
| (2) Output power from each primary coil is less than or equal to 15 watts.                                                                                                                                                                 | Yes. Maximum power is 9 Watts.                                                          |
| (3) The transfer system includes only single primary and secondart coils. This includes charging systems that may have multiple primary coils and client that are able to detect and allow coupling only between individual pairs of coils | Yes.                                                                                    |
| (4) Client device is placed directly in contact with the transmitter.                                                                                                                                                                      | Yes.                                                                                    |
| (5) Mobile expousure conditions only(portable exposure conditions are not convered by this exclusion).                                                                                                                                     | Yes.                                                                                    |
| (6) The aggregate H-field strengths at 15 cm surrounding the device and 20 cm above the top surface from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit.                                        | Yes. The aggregate field at 20 cm from the device are 19.51 % of the FCC H field limit. |

### 3.4 DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT & PERIPHERALS

| SUPPORT EQUIPMENT & PERIPHERALS LIST |                               |             |               |            |
|--------------------------------------|-------------------------------|-------------|---------------|------------|
| Description                          | Manufacturer                  | Model       | Serial Numver | FCC ID     |
| Watch                                | SAMSUNG Electronics Co., Ltd. | SM-R835F    | RFAM80Q6NJW   | A3LSMR835  |
| Phone                                | SAMSUNG Electronics Co., Ltd. | SM-G986B/DS | RF8M70ZA4FH   | A3LSMG986B |
| EarBuds                              | SAMSUNG Electronics Co., Ltd. | SM-R180N-L  | A2101112033   | A3LSMR180L |
|                                      | SAMSUNG Electronics Co., Ltd. | SM-R180N-R  | A2101112034   | A3LSMR180R |

#### TEST SETUP

The following three modes are tested in test configuration;

All Position of client device were investigated and the worst position results are reported.

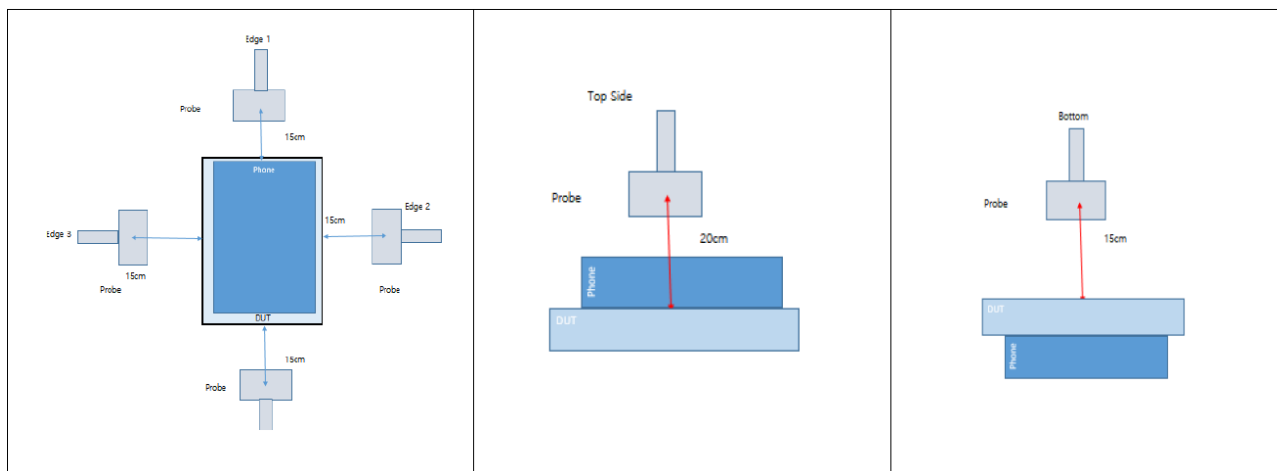
| Mode                                                    |
|---------------------------------------------------------|
| Operating<br>(SUPPORT Equipment, <10% Power Charging)   |
| Operating<br>(SUPPORT Equipment, 50~55% Power Charging) |
| Operating<br>(SUPPORT Equipment, 90~95% Power Charging) |

## **MEASUREMENT TEST SETUP**

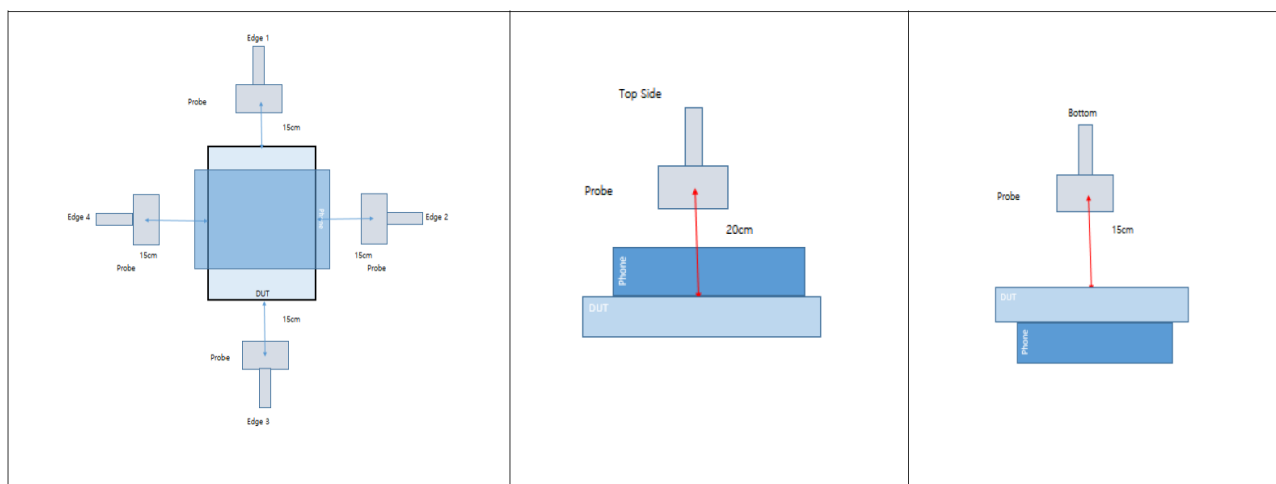
The measurement was taken using a probe place 15 cm from the edges of DUT or 20 cm above the DUT. Measurement were from the top and all sides of the DUT per KDB680106 D01 v03. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements were performed 'below' th DUT by flipping the DUT/phone so that the DUT was uppermost.

The probe was moved along the edges or above the DUT to a position that showed the maximum field strength. This position was used for the reported result.

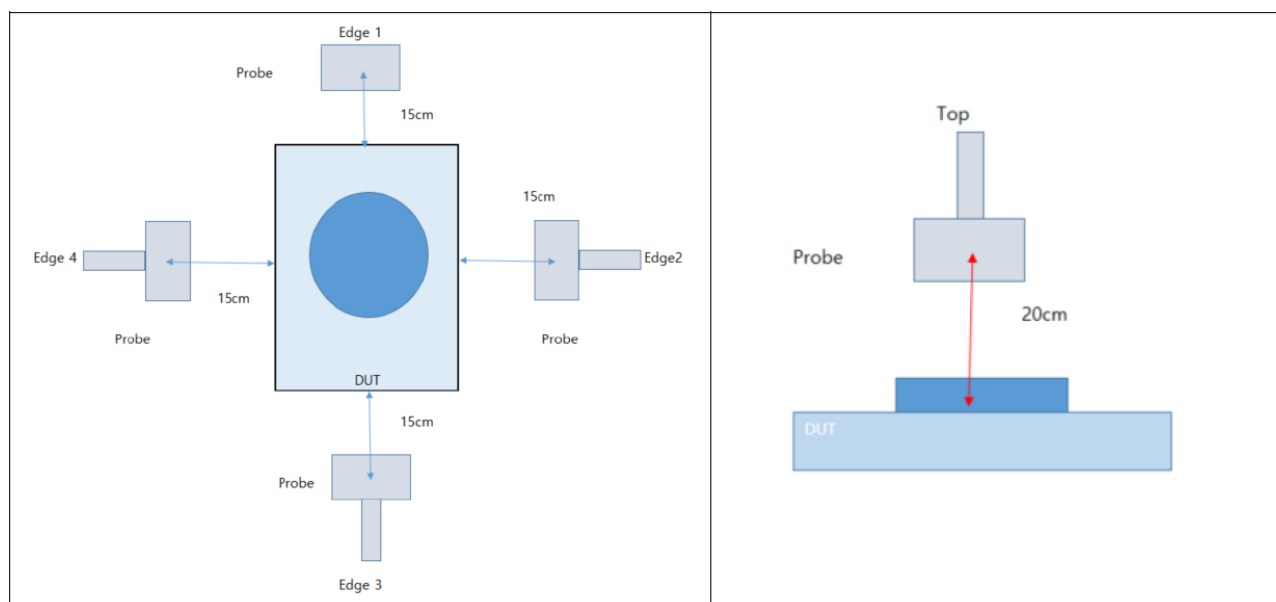
### **DUT to phone test Configuration 1 & 2**



### DUT to phone test Configuration 3 & 4



### DUT to Watch(5 & 6)/EarBuds(7 & 8) test Configuration



## 4. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was used for the tests documented in this report :

| Manufacturer | Model namr                  | Description           | S/N    | Calib. Date | Calib.Due  |
|--------------|-----------------------------|-----------------------|--------|-------------|------------|
| Narda        | ELT-400                     | Exposure Level Tester | N-0538 | 11/05/2021  | 11/05/2022 |
| Narda        | ELT-3 cm <sup>2</sup> Probe | Magnetic (B) field    | C-0171 | 04/18/2022  | 04/18/2023 |

## 5. MAXIMUM PERMISSIBLE RE EXPOSURE

### 5.1 FCC RULES

1.13010 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency(RF) radiation as specified in 1.1307(b), except in the case of portable devices which shall be evaluated according the provisions of 2.1093 of this chapter.

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) |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                               |                               |                                     |                          |
| 0.3–3.0 .....                                           | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0–30 .....                                            | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30–300 .....                                            | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300–1500 .....                                          | .....                         | .....                         | f/300                               | 6                        |
| 1500–100,000 .....                                      | .....                         | .....                         | 5                                   | 6                        |
| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
| 0.3–1.34 .....                                          | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30 .....                                           | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| 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

NOTE 1 TO TABLE 1: 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.

NOTE 2 TO TABLE 1: 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.

## 6. TEST RESULTS

### H-Field Measurements

Note : peak measurements were performed. RMS values were calculated from the peak measurement.

Please refer to the formula for calculating the RMS value: [Field Strength \*  $\sqrt{\text{Duty Cycle}}$ ]

### TEST results of DUT to phone test Configuration 1 &2

| FCC RF Exposure Result |                                                |               |               |                     |                                |
|------------------------|------------------------------------------------|---------------|---------------|---------------------|--------------------------------|
| Test Configuration     | Test mode                                      | Test distance | Test Position | H-Field Limit (A/m) | H-Field Measured Results (A/m) |
| Configuration 1        | Operation Real Product (Power <10% charging)   | 20 cm         | Top           | 1.63                | 0.310                          |
|                        |                                                | 15 cm         | Bottom        |                     | 0.301                          |
|                        |                                                |               | Edge 1        |                     | 0.296                          |
|                        |                                                |               | Edge 2        |                     | 0.301                          |
|                        |                                                |               | Edge 3        |                     | 0.300                          |
|                        |                                                |               | Edge 4        |                     | 0.302                          |
|                        | Operation Real Product (Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.309                          |
|                        |                                                | 15 cm         | Bottom        |                     | 0.300                          |
|                        |                                                |               | Edge 1        |                     | 0.289                          |
|                        |                                                |               | Edge 2        |                     | 0.296                          |
|                        |                                                |               | Edge 3        |                     | 0.293                          |
|                        |                                                |               | Edge 4        |                     | 0.300                          |
|                        | Operation Real Product (Power 90~95% charging) | 20 cm         | Top           | 1.63                | 0.306                          |
|                        |                                                | 15 cm         | Bottom        |                     | 0.297                          |
|                        |                                                |               | Edge 1        |                     | 0.296                          |
|                        |                                                |               | Edge 2        |                     | 0.301                          |
|                        |                                                |               | Edge 3        |                     | 0.299                          |
|                        |                                                |               | Edge 4        |                     | 0.292                          |
| Configuration 2        | Operation Real Product (Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.309                          |

### TEST results of DUT to phone test Configuration 3 &4

| FCC RF Exposurs Result |                                                   |               |               |                     |                                |
|------------------------|---------------------------------------------------|---------------|---------------|---------------------|--------------------------------|
| Test Configuration     | Test mode                                         | Test distance | Test Position | H-Field Limit (A/m) | H-Field Measured Results (A/m) |
| Configuration 3        | Operation Real Product<br>(Power <10% charging)   | 20 cm         | Top           | 1.63                | 0.311                          |
|                        |                                                   | 15 cm         | Bottom        |                     | 0.309                          |
|                        |                                                   |               | Edge 1        |                     | 0.304                          |
|                        |                                                   |               | Edge 2        |                     | 0.298                          |
|                        |                                                   |               | Edge 3        |                     | 0.299                          |
|                        |                                                   |               | Edge 4        |                     | 0.310                          |
|                        | Operation Real Product<br>(Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.308                          |
|                        |                                                   | 15 cm         | Bottom        |                     | 0.307                          |
|                        |                                                   |               | Edge 1        |                     | 0.297                          |
|                        |                                                   |               | Edge 2        |                     | 0.299                          |
|                        |                                                   |               | Edge 3        |                     | 0.293                          |
|                        |                                                   |               | Edge 4        |                     | 0.300                          |
|                        | Operation Real Product<br>(Power 90~95% charging) | 20 cm         | Top           | 1.63                | 0.301                          |
|                        |                                                   | 15 cm         | Bottom        |                     | 0.306                          |
|                        |                                                   |               | Edge 1        |                     | 0.297                          |
|                        |                                                   |               | Edge 2        |                     | 0.294                          |
|                        |                                                   |               | Edge 3        |                     | 0.291                          |
|                        |                                                   |               | Edge 4        |                     | 0.304                          |
| Configuration 4        | Operation Real Product<br>(Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.308                          |

**TEST results of DUT to phone test Configuration 5 &6[Watch]**

| FCC RF Exposure Result |                                                   |               |               |                     |                                |
|------------------------|---------------------------------------------------|---------------|---------------|---------------------|--------------------------------|
| Test Configuration     | Test mode                                         | Test distance | Test Position | H-Field Limit (A/m) | H-Field Measured Results (A/m) |
| Configuration 5        | Operation Real Product<br>(Power <10% charging)   | 20 cm         | Top           | 1.63                | 0.318                          |
|                        |                                                   | 15 cm         | Edge 1        |                     | 0.295                          |
|                        |                                                   |               | Edge 2        |                     | 0.300                          |
|                        |                                                   |               | Edge 3        |                     | 0.302                          |
|                        |                                                   |               | Edge 4        |                     | 0.306                          |
|                        | Operation Real Product<br>(Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.309                          |
|                        |                                                   | 15 cm         | Edge 1        |                     | 0.295                          |
|                        |                                                   |               | Edge 2        |                     | 0.294                          |
|                        |                                                   |               | Edge 3        |                     | 0.297                          |
|                        |                                                   |               | Edge 4        |                     | 0.297                          |
|                        | Operation Real Product<br>(Power 90~95% charging) | 20 cm         | Top           | 1.63                | 0.314                          |
|                        |                                                   | 15 cm         | Edge 1        |                     | 0.288                          |
|                        |                                                   |               | Edge 2        |                     | 0.301                          |
|                        |                                                   |               | Edge 3        |                     | 0.296                          |
|                        |                                                   |               | Edge 4        |                     | 0.305                          |
| Configuration 6        | Operation Real Product<br>(Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.315                          |

### TEST results of DUT to phone test Configuration 7 &8[EarBuds]

| FCC RF Exposure Result |                                                   |               |               |                     |                                |
|------------------------|---------------------------------------------------|---------------|---------------|---------------------|--------------------------------|
| Test Configuration     | Test mode                                         | Test distance | Test Position | H-Field Limit (A/m) | H-Field Measured Results (A/m) |
| Configuration 7        | Operation Real Product<br>(Power <10% charging)   | 20 cm         | Top           | 1.63                | 0.309                          |
|                        |                                                   | 15 cm         | Edge 1        |                     | 0.298                          |
|                        |                                                   |               | Edge 2        |                     | 0.308                          |
|                        |                                                   |               | Edge 3        |                     | 0.294                          |
|                        |                                                   |               | Edge 4        |                     | 0.303                          |
|                        | Operation Real Product<br>(Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.308                          |
|                        |                                                   | 15 cm         | Edge 1        |                     | 0.289                          |
|                        |                                                   |               | Edge 2        |                     | 0.303                          |
|                        |                                                   |               | Edge 3        |                     | 0.288                          |
|                        |                                                   |               | Edge 4        |                     | 0.296                          |
|                        | Operation Real Product<br>(Power 90~95% charging) | 20 cm         | Top           | 1.63                | 0.307                          |
|                        |                                                   | 15 cm         | Edge 1        |                     | 0.292                          |
|                        |                                                   |               | Edge 2        |                     | 0.298                          |
|                        |                                                   |               | Edge 3        |                     | 0.286                          |
|                        |                                                   |               | Edge 4        |                     | 0.299                          |
| Configuration 8        | Operation Real Product<br>(Power 50~55% charging) | 20 cm         | Top           | 1.63                | 0.308                          |

### H-Field TEST results of DUT to phone test Configuration 5

| Results of H-Field Measurement (A/m) at the Worst case configuration     |                     |
|--------------------------------------------------------------------------|---------------------|
| The Distance from the device to the center of the measurement probe (cm) | H-Field Meas. (A/m) |
| 0 (3 cm)                                                                 | 4.843               |
| 2 (5 cm)                                                                 | 3.987               |
| 4 (7 cm)                                                                 | 1.930               |
| 6 (9 cm)                                                                 | 0.737               |
| 8 (11 cm)                                                                | 0.433               |
| 10 (13 cm)                                                               | 0.324               |
| 12 (15 cm)                                                               | 0.317               |
| 14 (17 cm)                                                               | 0.317               |
| 16 (19 cm)                                                               | 0.316               |
| 18 (21 cm)                                                               | 0.316               |
| 20 (23 cm)                                                               | 0.317               |

\*The contact distance between the device and the probe is 3cm from the center of the probe.

## 6.2 SUMMARY OF RESULTS

| H-Field Limit            |                            |                |
|--------------------------|----------------------------|----------------|
| FCC RF Exposure<br>(A/m) | Maximum meas data<br>(A/m) | Percentage (%) |
| 1.63                     | 0.318                      | 19.51          |

H-Field test result was less than 50% of MPE limit.