

## 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. 03, 2023

**Test Report No.:** HCT-SR-2305-FC002-R1

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

**FCC ID:**

**A3LSMX818U**

**Equipment Type:**

**Tablet**

**Application Type**

**Certification**

**FCC Rule Part(s):**

**47 CFR part 2.1093**

**Model Name:**

**SM-X818U**

**Date of Test:**

**05/08/2023**

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**



**Dong Seon, Kim**  
**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    | May 9, 2023 | First Approval Report                                       |
| 1    | Jun 3, 2023 | Added the extrapolation equation and R <sup>2</sup> Factor. |

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## 1. Test Methodology

- FCC KDB 680106 D01 RF Exposure Wireless Charging App v03r01
- April 27, 2022. TCB Workshop document (WPT testing Guidance)
- Per FCC Guidance, WPT Function was evaluated for portable exposure condition.

## 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:</b>            | SM-X818U                      |
| <b>EUT Type:</b>         | Tablet                        |
| <b>Application Type:</b> | Certification                 |

The device uses only magnetic induction which is a technology that charges a battery by generating a magnetic field by flowing a current through the transmitter coil, and then entering a magnetic field into the receiver coil to generate an induced current again.

The DUT has two charging coils for charging the S-PEN.

The two coils cannot be operated simultaneously as they are only operated in the tip direction of the S-PEN.

Therefore, RF exposure through measurement and calculation of H-field were investigated.

- Test mode: power is transferred from "Tablet coil" to "S-pen coil"

|                                 |                                   |
|---------------------------------|-----------------------------------|
| <b>Operating Frequency(MHz)</b> | 531 kHz                           |
| <b>Maximum output Power(mW)</b> | 50 mW                             |
| <b>Charging Type</b>            | Inductive wireless Power transfer |
|                                 |                                   |

#### Description of S-PEN:( Model Name : EJ-PX710 FCC ID : A3LEJPX710 )

The device supports S-Pen. The S-Pen is accessories such as touch pen. Usually built into the device, but user take it out, when user uses to note or control on device using BLE mode. The S-Pen is also an electronic product and charges through the device. In this case, S-Pen is charged by WPT(Wireless Power Transfer) function. Charging is the way in which power is transferred from "FPCB's coil in device" to "S-Pen's coil"..

Battery in the EJ-PX710 will be charged wirelessly from Tablet via 531 kHz frequency

More detail description, Please refer to Operational description document.

All Position of S-Pen were investigated and the worst position results are reported.

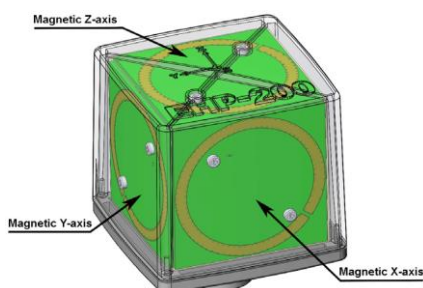
For S-Pen, both fully charged and non-fully charged condition were investigated. Test were performed non-fully charged condition as worst case.

## 4. TEST 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        | EHP-200AC  | Electric and Magnetic Field Probe | 170WX91009 | 07/29/2022  | 07/29/2023 |
| Narda        | EHP-200AC  | Electric and Magnetic Field Probe | 180ZX10229 | 12/06/2022  | 12/06/2023 |

EHP-200AC, the magnetic sensor system is composed by three magnetic loops positioned orthogonal each other. The electric sensor system is composed by three orthogonal parallel plates capacitors installed on the opposite side of the magnetic loops. The uncertainty due to the anisotropy of the magnetic loops and the plates capacitors in the probe is described in the probe manufacturer's specification [1], with values up to  $\pm 0.8\text{dB}$  (10 %). The sensitive elements are located approximately 8 mm below the external surface as shown in below Table



### Measurement probe specification

|                    |                                                                                  |
|--------------------|----------------------------------------------------------------------------------|
| Model              | EHP-200AC                                                                        |
| Frequency          | 3 kHz – 30 MHz                                                                   |
| Linearity          | $\pm 0.5\text{ dB}$ @ 1MHz to full scale                                         |
| Frequency Response | $\pm 0.5\text{ dB}$ for Electric field<br>$\pm 0.8\text{ dB}$ for Magnetic field |
| Anisotropy         | $\pm 0.8\text{ dB}$ (10%) at 1 MHz                                               |
| Dimensions         | 92 × 92 × 109 mm<br>[Center : 46 x 46 x 54.5 mm]                                 |
| Application        | Electric and Magnetic field                                                      |

**The sensitive elements** are located **approximately 8 mm** below the external surface

## 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 to 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.

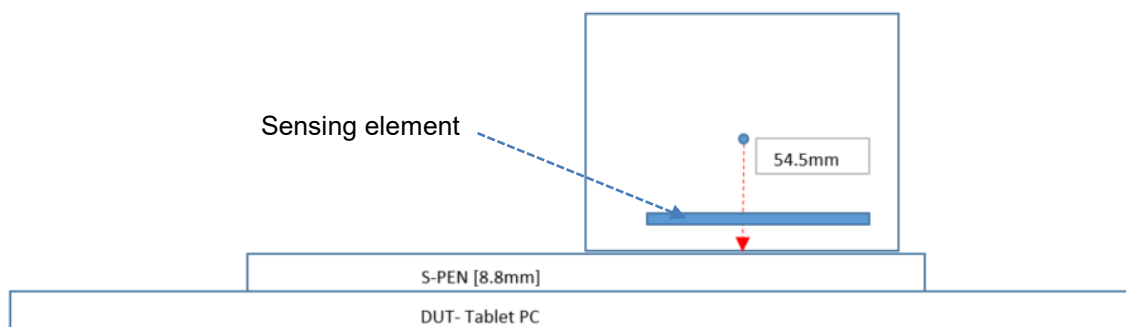
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

## 6. TEST RESULTS

### Measurement Set up

| EUT Position |        |     |      |       |                |
|--------------|--------|-----|------|-------|----------------|
| Rear         | Bottom | Top | Left | Right | Front (screen) |

Note: The Right and Left side are determined with EUT screen facing the user.



#### S-PEN charging test setup in EUT [distance :0 cm]

The EUT's S-PEN charging function was tested in all possible simultaneous operation scenarios. The test results were written in the test report under maximum measurement conditions.

### 6.1 The Isotropy of H-Field Probe Measurement Results

The isotropy of the probe was checked by measuring the XYZ axis direction, and the measurement results satisfied the 10% declared by the manufacturer.

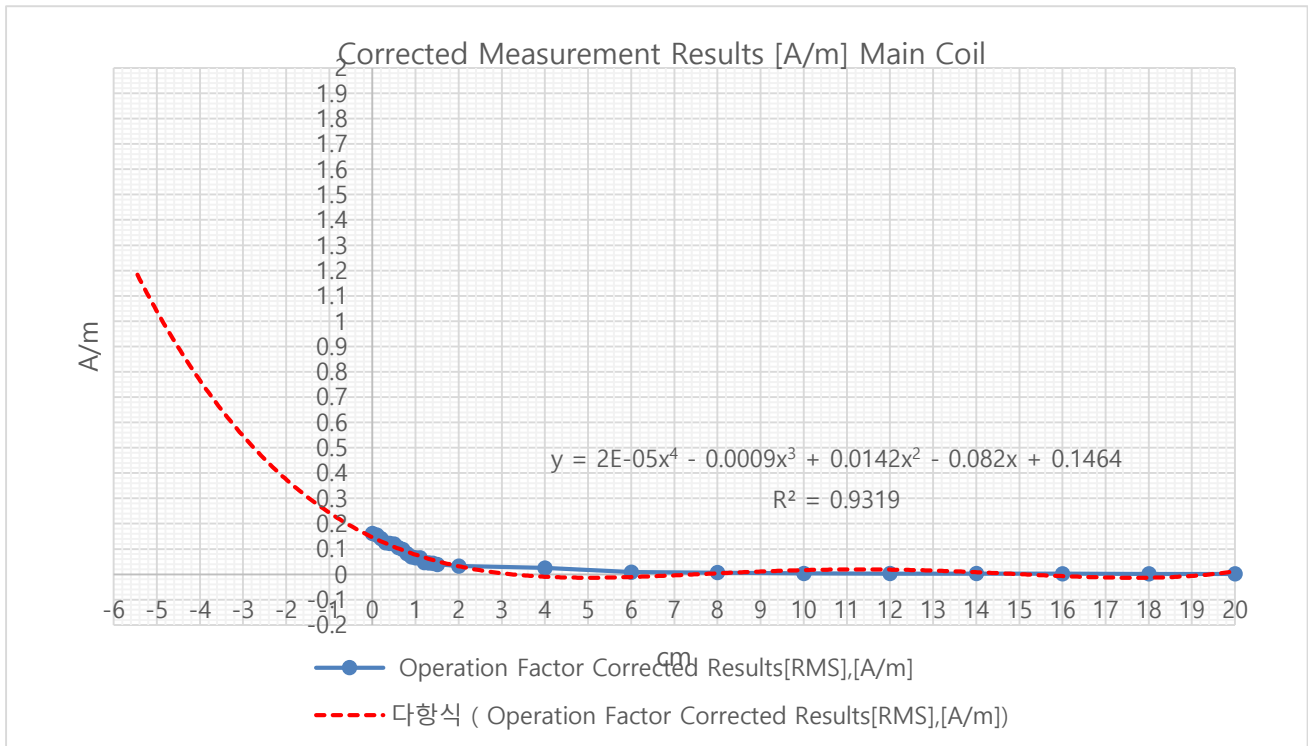
| Coil Configuration | Operational Correction factor | distance [cm] | EUT Position | Probe Orientation(X,Y,Z)<br>Corrected Results[A/m] |        |        |
|--------------------|-------------------------------|---------------|--------------|----------------------------------------------------|--------|--------|
|                    |                               |               |              | Mx                                                 | My     | Mz     |
| Main Coil          | 0.5                           | 2             | Rear         | 0.0305                                             | 0.0315 | 0.0325 |
| Sub Coil           | 0.5                           | 2             | Rear         | 0.0398                                             | 0.0387 | 0.0408 |

Table 1. H-Field Isotropy Measurement

## 6.2 H-Field measurement -Main Coil

| Frequency                                                                                                   | Operational<br>Correction<br>Factor | Distance | Corrected Measured Results [Main Coil],[A/m] |                                                             |        |        |         |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------|----------|----------------------------------------------|-------------------------------------------------------------|--------|--------|---------|
| kHz                                                                                                         |                                     | (cm)     | Rear                                         | Bottom                                                      | Top    | Left   | Right   |
| 531                                                                                                         | 0.5                                 | 0        | 0.1617                                       | 0.003                                                       | 0.0188 | 0.0029 | 0.03225 |
| 531                                                                                                         | 0.5                                 | 0.1      | 0.1552                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.2      | 0.1412                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.3      | 0.12505                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.4      | 0.12185                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.5      | 0.11935                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.6      | 0.1055                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.7      | 0.098                                        |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.8      | 0.08115                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 0.9      | 0.06905                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 1        | 0.06535                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 1.1      | 0.0649                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 1.2      | 0.04625                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 1.3      | 0.045                                        |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 1.4      | 0.04365                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 1.5      | 0.0389                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 2        | 0.0325                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 4        | 0.0251                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 6        | 0.0089                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 8        | 0.00655                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 10       | 0.00375                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 12       | 0.00315                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 14       | 0.0027                                       |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 16       | 0.00215                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 18       | 0.00205                                      |                                                             |        |        |         |
| 531                                                                                                         | 0.5                                 | 20       | 0.002                                        |                                                             |        |        |         |
| 47 CFR §1.1310 – Limits for Maximum Permissible Exposure (MPE)<br>Uncontrolled Exposure/ General Population |                                     |          |                                              | Magnetic field strength<br>1.63 A/m (Averaging Time 30 min) |        |        |         |

Table 2. H-Field Measurement by distance –Main Coil

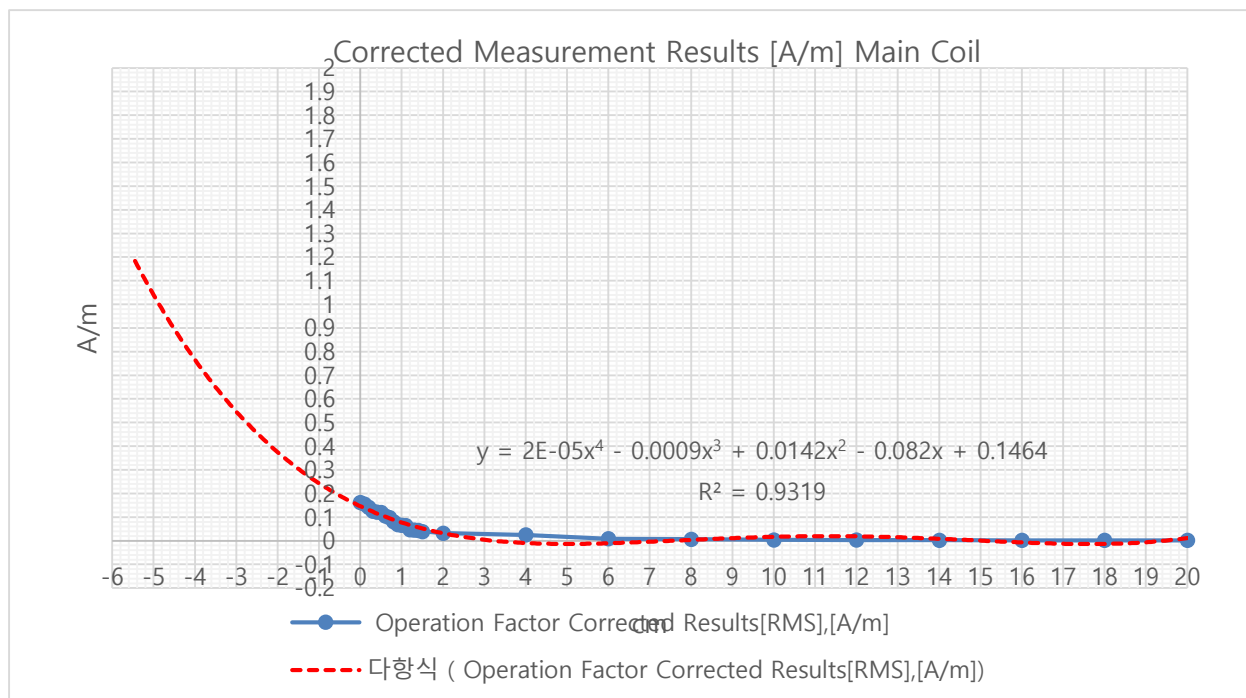


The estimate H-Field result from the center of the probe to the outer edge of Probe[5.45cm] by applying the polynomial method of excel program [1.2 A/m]

### 6.3 H-Field measurement -Sub Coil

| Frequency                                                                                                   | Operational       | Distance | Corrected Measured Results[Sub Coil],[A/m] |                                                             |        |       |         |
|-------------------------------------------------------------------------------------------------------------|-------------------|----------|--------------------------------------------|-------------------------------------------------------------|--------|-------|---------|
| kHz                                                                                                         | Correction Factor | (cm)     | Rear                                       | Bottom                                                      | Top    | Left  | Right   |
| 531                                                                                                         | 0.5               | 0        | 0.17105                                    | 0.0062                                                      | 0.0029 | 0.003 | 0.02075 |
| 531                                                                                                         | 0.5               | 0.1      | 0.16305                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.2      | 0.15455                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.3      | 0.14825                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.4      | 0.14115                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.5      | 0.13455                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.6      | 0.1217                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.7      | 0.11945                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.8      | 0.11005                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 0.9      | 0.10605                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 1        | 0.1011                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 1.1      | 0.0904                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 1.2      | 0.08265                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 1.3      | 0.0807                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 1.4      | 0.07345                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 1.5      | 0.06955                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 2        | 0.0408                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 4        | 0.03295                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 6        | 0.0171                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 8        | 0.0077                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 10       | 0.0044                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 12       | 0.00305                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 14       | 0.00265                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 16       | 0.0029                                     |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 18       | 0.00285                                    |                                                             |        |       |         |
| 531                                                                                                         | 0.5               | 20       | 0.0029                                     |                                                             |        |       |         |
| 47 CFR §1.1310 – Limits for Maximum Permissible Exposure (MPE)<br>Uncontrolled Exposure/ General Population |                   |          |                                            | Magnetic field strength<br>1.63 A/m (Averaging Time 30 min) |        |       |         |

Table 3. H-Field Measurement by distance –Sub Coil



The estimate H-Field result from the center of the probe to the outer edge of Probe[5.45cm] by applying the polynomial method of excel program [1.05 A/m]

#### Test Note:

1. In order to the worst case charging test, the S-PEN charging test was performed with the EUT continuously transmitting the maximum charging output signal
2. The EUT has two coils for S-PEN wireless charging, the main and sub coils, which operate according to the direction of the pen tip of the S-PEN, respectively. Both coils cannot operate at the same time
3. The EUT charger for 15 minutes at maximum illumination to charge. It recharges at maximum illumination when 10 % or more of battery level drop is detected.

Therefore, Operational correction factor for the worst-case charging conditions is:

**Operational Correction factor (applied over 30 minutes) = 0.5**

4. Distance means the distance between the EUT and the probe outer edge.
5. The H-Field of S-PEN charging was estimated from the center of the probe to the outer edge of Probe by applying the polynomial method of excel program.

#### 6. Conclusion:

The H-Field of S-PEN charging were estimated from the center of the probe to the outer edge of Probe by applying the polynomial method of excel program according to TCBC Workshop note in April 2022.

The H-field of S-PEN Charging estimated to the outer edge of the probe for main and sub coil satisfied FCC 's MPE limits.

| FCC 's MPE limits<br>H-Field [A/m] | The Main coil                         |                                                  | The Sub coil                             |                                                   |
|------------------------------------|---------------------------------------|--------------------------------------------------|------------------------------------------|---------------------------------------------------|
|                                    | Maximum Corrected<br>Meas. Data [A/m] | The estimate<br>(to outer edge of<br>probe)[A/m] | Maximum<br>Corrected Meas.<br>Data [A/m] | The estimate<br>(to outer edge of probe)<br>[A/m] |
| 1.63                               | 0.1617                                | 1.2                                              | 0.17105                                  | 1.05                                              |