74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea
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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. 3, 2023 **Test Report No.: HCT-SR-2305-FC007-R1** **Test Site: HCT CO., LTD.**

FCC ID:	**A3LSMX810**
Equipment Type:	**Tablet**
Application Type	**Certification**
FCC Rule Part(s):	**47 CFR part 2.1093**
Model Name:	**SM-X810**
Date of Test:	**05/08/2023**

This device has been shown to be capable of compliance for the above standars 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

DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
0	May 16, 2023	First Approval Report
1	Jun 03, 2023	Added the extrapolation equation and R^2 Factor.

Table of Contents

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 Fuction was evaluated for portable exposure condition.

2. Test Location.

2.1 Test Laboratory.

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

2.2 Test Facillities

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

Korea:	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Tesing No. KT197)

3. DEVICE UNDER TEST DESCRIPTION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Model:	SM-X810
EUT Type:	Tablet
Application Type:	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”

Operating Frequency(MHz)	531 kHz
Maximum output Power(mW)	50 mW
Charging Type	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.

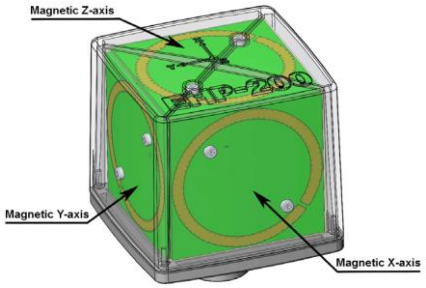
For S-Pen, both fully charged and non-fully charged condition were investigated. Test were performed non-fully charged condition as worst case.

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 ± 0.8dB (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	± 0.5 dB @ 1MHz to full scale
Frequency Response	± 0.5 dB for Electric field ± 0.8 dB for Magnetic field
Anisotropy	±0.8 dB (10%) at 1 MHz
Dimensions	92 × 92 × 109 mm [Center : 46 x 46 x54.5 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 envirimental impact of human exposure to radio-frequency(RF) ragiation as specified in 1.1307(b), except in the case of portable devices which shall ge evaluated according th 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^2)	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^2)	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^2)	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^2)	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.

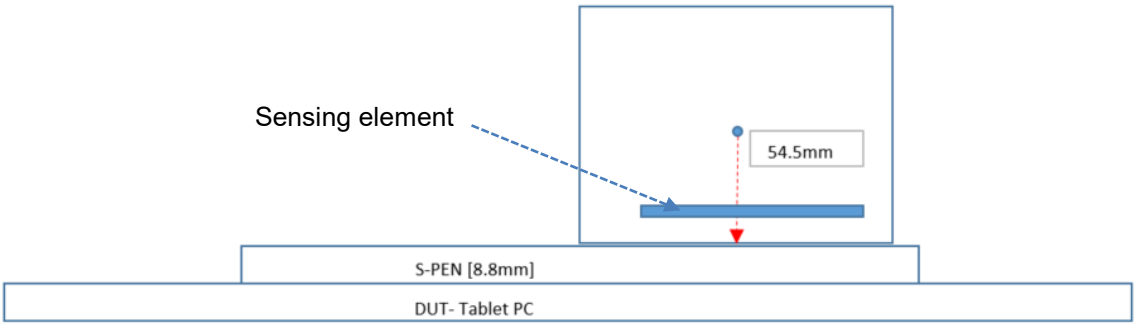
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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.

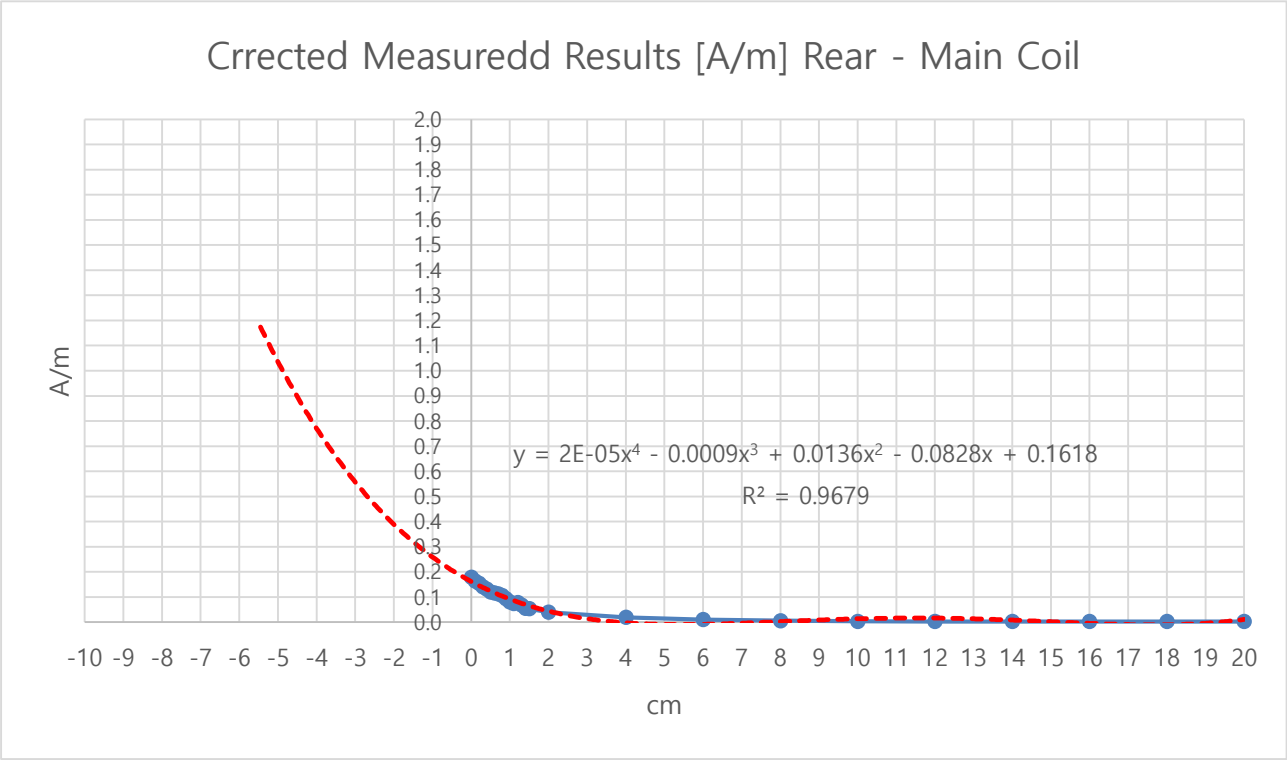
Coil Configuration	Operational Correction factor	distance [cm)	EUT Position	Probe Orientation(X,Y,Z) Corrected Results[A/m]		
				Mx	My	Mz
Main Coil	0.5	2	Rear	0.0396	0.0394	0.0399
Sub Coil	0.5	2	Rear	0.0418	0.0418	0.0420

Table 1. H-Field Isotropy Measurement

6.2 H-Field measurement -Main Coil

Frequency	Operational Correction Factor	Distance	Corrected Measured Results [Main Coil],[A/m]				
kHz		(cm)	Rear	Bottom	Top	Left	Right
531	0.5	0	0.1794	0.0029	0.017	0.0029	0.0270
531	0.5	0.1	0.1636				
531	0.5	0.2	0.1544				
531	0.5	0.3	0.1408				
531	0.5	0.4	0.1312				
531	0.5	0.5	0.1202				
531	0.5	0.6	0.1162				
531	0.5	0.7	0.1130				
531	0.5	0.8	0.1064				
531	0.5	0.9	0.0929				
531	0.5	1	0.0803				
531	0.5	1.1	0.0748				
531	0.5	1.2	0.0779				
531	0.5	1.3	0.0677				
531	0.5	1.4	0.0555				
531	0.5	1.5	0.0539				
531	0.5	2	0.0399				
531	0.5	4	0.0191				
531	0.5	6	0.0105				
531	0.5	8	0.0057				
531	0.5	10	0.0031				
531	0.5	12	0.0029				
531	0.5	14	0.0029				
531	0.5	16	0.0030				
531	0.5	18	0.0028				
531	0.5	20	0.0029				
47 CFR §1.1310 – Limits for Maximum Permissible Exposure (MPE) Uncontrolled Exposure/ General Population			Magnetic field strength 1.63 A/m (Averaging Time 30 min)				

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

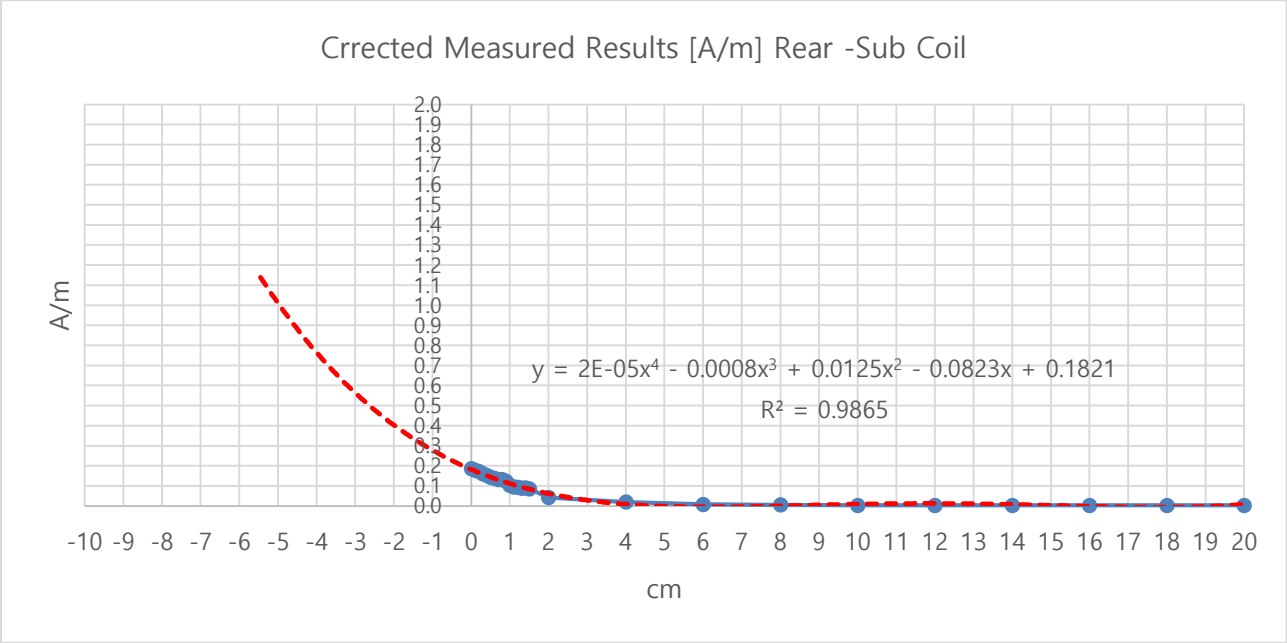


The estimate H-Field result from the center of the probe to the outer edge of Probe[5.45cm] by applying the polynomial method of excel program [1.2 A/m]

6.3 H-Field measurement -Sub Coil

Frequency	Operational Correction Factor	Distance	Corrected Measured Results[Sub Coil],[A/m]				
kHz		(cm)	Rear	Bottom	Top	Left	Right
531	0.5	0	0.1859	0.0054	0.0027	0.0035	0.0216
531	0.5	0.1	0.1773				
531	0.5	0.2	0.1713				
531	0.5	0.3	0.1604				
531	0.5	0.4	0.1531				
531	0.5	0.5	0.1425				
531	0.5	0.6	0.1389				
531	0.5	0.7	0.1314				
531	0.5	0.8	0.1324				
531	0.5	0.9	0.1232				
531	0.5	1	0.1028				
531	0.5	1.1	0.0952				
531	0.5	1.2	0.0930				
531	0.5	1.3	0.0885				
531	0.5	1.4	0.0909				
531	0.5	1.5	0.0860				
531	0.5	2	0.0420				
531	0.5	4	0.0194				
531	0.5	6	0.0081				
531	0.5	8	0.0051				
531	0.5	10	0.0032				
531	0.5	12	0.0027				
531	0.5	14	0.0028				
531	0.5	16	0.0030				
531	0.5	18	0.0027				
531	0.5	20	0.0029				
47 CFR §1.1310 – Limits for Maximum Permissible Exposure (MPE) Uncontrolled Exposure/ General Population			Magnetic field strength 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 [1.1 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 H-Field [A/m]	The Main coil		The Sub coil	
	Maximum Corrected Meas. Data [A/m]	The estimate (to outer edge of probe)[A/m]	Maximum Corrected Meas. Data [A/m]	The estimate (to outer edge of probe) [A/m]
1.63	0.1794	1.2	0.1859	1.1