74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea
TEL: +82-31-645-6300 FAX: +82-31-645-6401

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:** Dec. 12, 2021 **Test Report No.:** HCT-SR-2110-FC016-R3 **Test Site: HCT CO., LTD.**

FCC ID:	**A3LSMS901B**
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-S901B/DS**
Date of Test:	Oct. 25, 2021, Dec. 10, 2021

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

Jung Hun, Park
Test Engineer
SAR Team
Certification Division

Reviewed By

Yun-jeang, Heo
Technical Manager
SAR Team
Certification Division

DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
0	Oct. 31,2021	First Approval Report
1	Nov.07,2021	Revised Sec.1 and Sec.6
2	Nov. 12, 2021	Revised Sec.3.4
3	Dec. 15, 2021	Added test results for changes.(Renesas & S.LSI)

Table of Contents

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.

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-S901B/DS
EUT Type:	Mobile Phone
Application Type:	Certification
DUT serial number	UIF2178M (PCB Rev.0.7, Renesas, Basic model) , UKT1940M(PCB Rev.0.7A, Renesas) , UKU0970M(PCB Rev.0.7A+S.LSI)

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. The charing frequency is between 110 kHz to 148 kHz, and the maximum transfer power consumption is 9.0 W in charging status.

The WPT measurement results for each chipset condition are included on a modified PCB (Rev.0.7 to 0.7A) to use the Renesas chipset and S.LSI chipset for the WPT function of this device.Renesas.

3.2 WORST-CASE CONFIGYRATION

Test configration	Description
DUT to Phone test configuration 1	Charging from Phone to DUT
DUT to Phone test configuration 2	Charging from Phone to DUT(TA Carging 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 Carging 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 Carging from DUT)

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

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

Requirement	Device
(1) Power transfer frequenct 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 9.0 Watts.
(3) The transfer system includes onlt 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 15 cm from the device are 8.75 % of the FCC H field limit.

3.4 DESCRUPTION 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

TEST SETUP

The following three modes are tested in test configuration;

Mode
Operationg (SUPPORT Equipment, <10% Power Charging)
Operationg (SUPPORT Equipment, 50~55% Power Charging)
Operationg (SUPPORT Equipment, 90~95% Power Charging)

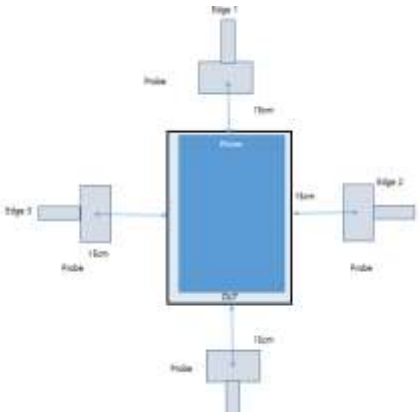
MEASUREMENT TEST SETUP

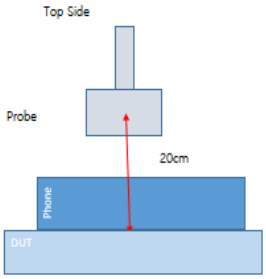
The measurement was taken using a probe place 15 cm from the edges of DUT or20 cm above the DUT. Measurement were from the top and all sides of the DUT per KDB680106 D01 v03r01. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements were performed 'below' th DUT by flipping the DUT/phone so that the DUT was uppermost.

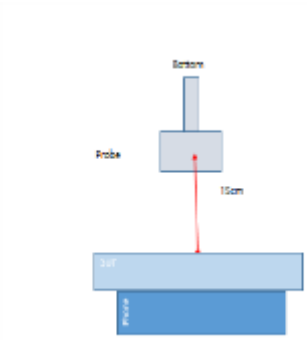
The probe was moved along the edges or above the DUT to a position that showed the maximum field strength. This position was used for the measurement result

The Narda EHP-200AC has physical dimensions of 92 x 92 x 109mm. So the center of the probe would be at 46 x 46 x 54mm. When the probe measures the H-field of the device,, the long axis of the probe (109mm) is perpendicular to the rear surface of the DUT. So when the probe is in direct contact with the rear of the device, the center of the probe would be 54mm away.

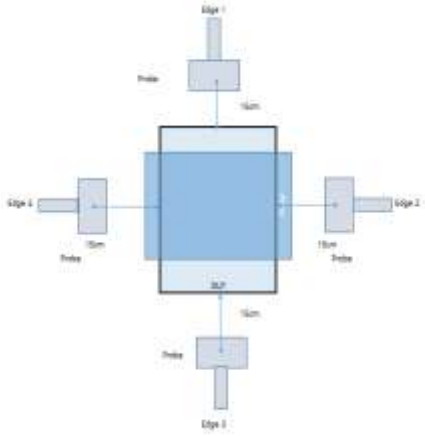
DUT to phone test Configuration 1 & 2

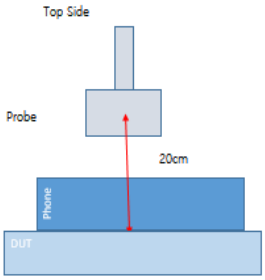


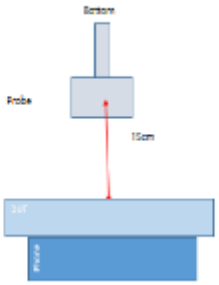




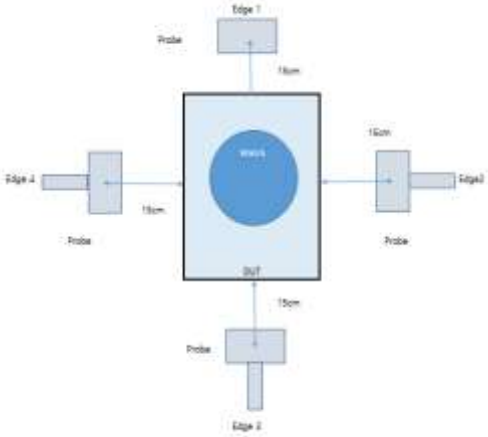
DUT to phone test Configuration 3 & 4

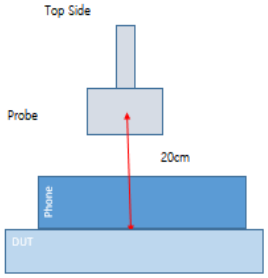






DUT to phone test Configuration 5 & 6





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	EHP-200AC	Electric and Magnetic Field Probe	170WX91009	11/22/2019	11/22/2021
Narda	EHP-200AC	Electric and Magnetic Field Probe	170WX91009	12/08/2021	12/08/2023

The Narda EHP-200AC has physical dimensions of 92 x 92 x 109mm. So the center of the probe would be at 46 x 46 x 54mm. When the probe measures the H-field of the device,, the long axis of the probe (109mm) is perpendicular to the rear surface of the DUT. So when the probe is in direct contact with the rear of the device, the center of the probe would be 54mm away.

5. MAXIMUM PERMISSIBLE RE EXPOSURE

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/cm²)	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/f²)	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/f²)	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/cm²)	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

6.1 Measurement RESULTS _PCB Rev.0.7+Renesas

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 * √Duty Cycle]

TEST results of DUT to phone test Comfiguraion 1 &2

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 1	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0439
		15 cm	Bottom		0.0430
			Edge 1		0.0418
			Edge 2		0.0637
			Edge 3		0.0421
			Edge 4		0.0646
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0394
		15 cm	Bottom		0.0386
			Edge 1		0.0395
			Edge 2		0.0617
			Edge 3		0.0400
			Edge 4		0.0602
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0395
		15 cm	Bottom		0.0389
			Edge 1		0.0398
			Edge 2		0.0637
			Edge 3		0.0377
			Edge 4		0.0645
Configuration 2	Operation Real Product (Power <10% charging)	15 cm	**Edge 4**	1.63	0.0597

TEST results of DUT to phone test Comfiguraion 3 &4

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 3	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0427
		15 cm	Bottom		0.0439
			Edge 1		0.0452
			Edge 2		0.0416
			Edge 3		0.0683
			Edge 4		**0.1427**
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0427
		15 cm	Bottom		0.0417
			Edge 1		0.0408
			Edge 2		0.0394
			Edge 3		0.0643
			Edge 4		0.1383
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0422
		15 cm	Bottom		0.0395
			Edge 1		0.0410
			Edge 2		0.0411
			Edge 3		0.0678
			Edge 4		0.1425
Configuration 4	Operation Real Product (Power <10% charging)	15 cm	**Edge 4**	1.63	0.1398

TEST results of DUT to phone test Comfiguraion 5 &6

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 5	Operation Real Product (Power <10% charging)	20 cm	**Top**	1.63	0.0563
		15 cm	Edge 1		0.0407
			Edge 2		0.0404
			Edge 3		0.0449
			Edge 4		0.0418
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0523
		15 cm	Edge 1		0.0384
			Edge 2		0.0399
			Edge 3		0.0448
			Edge 4		0.0417
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0562
		15 cm	Edge 1		0.0363
			Edge 2		0.0361
			Edge 3		0.0429
			Edge 4		0.0393
Configuration 6	Operation Real Product (Power <10% charging)	15 cm	**Top**	1.63	0.0563

6.2 Measurement RESULTS _PCB Rev.0.7A+Renesas

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 * √Duty Cycle]

TEST results of DUT to phone test Comfiguraion 1 &2

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 1	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0339
		15 cm	Bottom		0.0411
			Edge 1		0.0412
			Edge 2		0.0523
			Edge 3		0.0431
			Edge 4		**0.0711**
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0342
		15 cm	Bottom		0.0398
			Edge 1		0.0385
			Edge 2		0.0601
			Edge 3		0.0395
			Edge 4		0.0688
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0395
		15 cm	Bottom		0.0389
			Edge 1		0.0398
			Edge 2		0.0551
			Edge 3		0.0421
			Edge 4		0.0698
Configuration 2	Operation Real Product (Power <10% charging)	15 cm	Edge 4	1.63	0.0663

TEST results of DUT to phone test Comfiguraion 3 &4

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 3	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0423
		15 cm	Bottom		0.0447
			Edge 1		0.0398
			Edge 2		0.0459
			Edge 3		0.0533
			Edge 4		**0.1294**
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0409
		15 cm	Bottom		0.0403
			Edge 1		0.0412
			Edge 2		0.0396
			Edge 3		0.0607
			Edge 4		0.1142
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0433
		15 cm	Bottom		0.0401
			Edge 1		0.0413
			Edge 2		0.0417
			Edge 3		0.0635
			Edge 4		0.0994
Configuration 4	Operation Real Product (Power <10% charging)	15 cm	**Edge 4**	1.63	0.1068

TEST results of DUT to phone test Comfiguraion 5 &6

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 5	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0611
		15 cm	Edge 1		0.0411
			Edge 2		0.0455
			Edge 3		0.0463
			Edge 4		0.0422
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0588
		15 cm	Edge 1		0.0399
			Edge 2		0.0367
			Edge 3		0.0452
			Edge 4		0.0419
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0605
		15 cm	Edge 1		0.0399
			Edge 2		0.0387
			Edge 3		0.0442
			Edge 4		0.0376
Configuration 6	Operation Real Product (Power <10% charging)	15 cm	Top	1.63	0.0611

6.3 Measurement RESULTS _PCB Rev.0.7A+S.LSI

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 * √Duty Cycle]

TEST results of DUT to phone test Comfiguraion 1 &2

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 1	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0493
		15 cm	Bottom		0.0308
			Edge 1		0.0401
			Edge 2		0.0407
			Edge 3		0.0525
			Edge 4		**0.0689**
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0443
		15 cm	Bottom		0.0349
			Edge 1		0.0464
			Edge 2		0.0481
			Edge 3		0.0586
			Edge 4		0.0626
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0428
		15 cm	Bottom		0.0319
			Edge 1		0.0406
			Edge 2		0.0471
			Edge 3		0.0594
			Edge 4		0.0677
Configuration 2	Operation Real Product (Power <10% charging)	15 cm	**Edge 4**	1.63	0.0653

TEST results of DUT to phone test Comfiguraion 3 &4

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 3	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.0354
		15 cm	Bottom		0.0313
			Edge 1		0.0401
			Edge 2		0.0439
			Edge 3		0.0612
			Edge 4		**0.0979**
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0411
		15 cm	Bottom		0.0348
			Edge 1		0.0436
			Edge 2		0.0443
			Edge 3		0.0609
			Edge 4		0.0963
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0408
		15 cm	Bottom		0.0318
			Edge 1		0.0407
			Edge 2		0.0413
			Edge 3		0.0611
			Edge 4		0.0951
Configuration 4	Operation Real Product (Power <10% charging)	15 cm	**Edge 4**	1.63	0.0956

TEST results of DUT to phone test Comfiguraion 5 &6

FCC RF Exposurs Result					
Test Configuration	**Test mode**	**Test distance from the edge of the device to the center of the probe**	**Test Position**	**H-Field Limit (A/m)**	**H-Field meas data (A/m)**
Configuration 5	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	**0.0709**
		15 cm	Edge 1		0.0627
			Edge 2		0.0628
			Edge 3		0.0671
			Edge 4		0.0622
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0697
		15 cm	Edge 1		0.0582
			Edge 2		0.0569
			Edge 3		0.0656
			Edge 4		0.0561
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0715
		15 cm	Edge 1		0.0529
			Edge 2		0.0563
			Edge 3		0.0579
			Edge 4		0.0642
Configuration 6	Operation Real Product (Power <10% charging)	15 cm	Top	1.63	0.0702

6.4 SUMMARY OF RESULTS

FCC RF Exposure H-Field Limit (A/m)	Maximum meas data (A/m)	Percentage(%)
1.63	**0.1427**	8.75

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