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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: Sep. 30, 2021 Test Report No.: HCT-SR-2109-FC002-R1 Test Site: HCT CO., LTD.
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FCC ID:

A3LSMG990E

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-G990E/DS**

Additional Model Name: **SM-G990E**

Date of Test: Sep 30, 2020

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

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DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
0	Sep 17, 2021	First Approval Report
R1	Sep 30, 2021	Revised Sec.6

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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.

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
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2.2 Test Facilities

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 (Teting No. KT197)

3. DEVICE UNDER TEST DESCRIPTION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Model Name:	SM-G990E/DS
Additional Model Name:	SM-G990E
EUT Type:	Mobile Phone
Application Type:	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. The charging frequency is between 110 kHz to 148 kHz, and the maximum transfer power consumption is 9 W in charging status.

SM-G990E/DS, SM-G990E were tested and the worst case results were reported.
(Worst case : SM-G990E/DS)

3.2 WORST-CASE CONFIGYRATION

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 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 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 15 cm from Edge 2 of the device is 13.9 % 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

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.

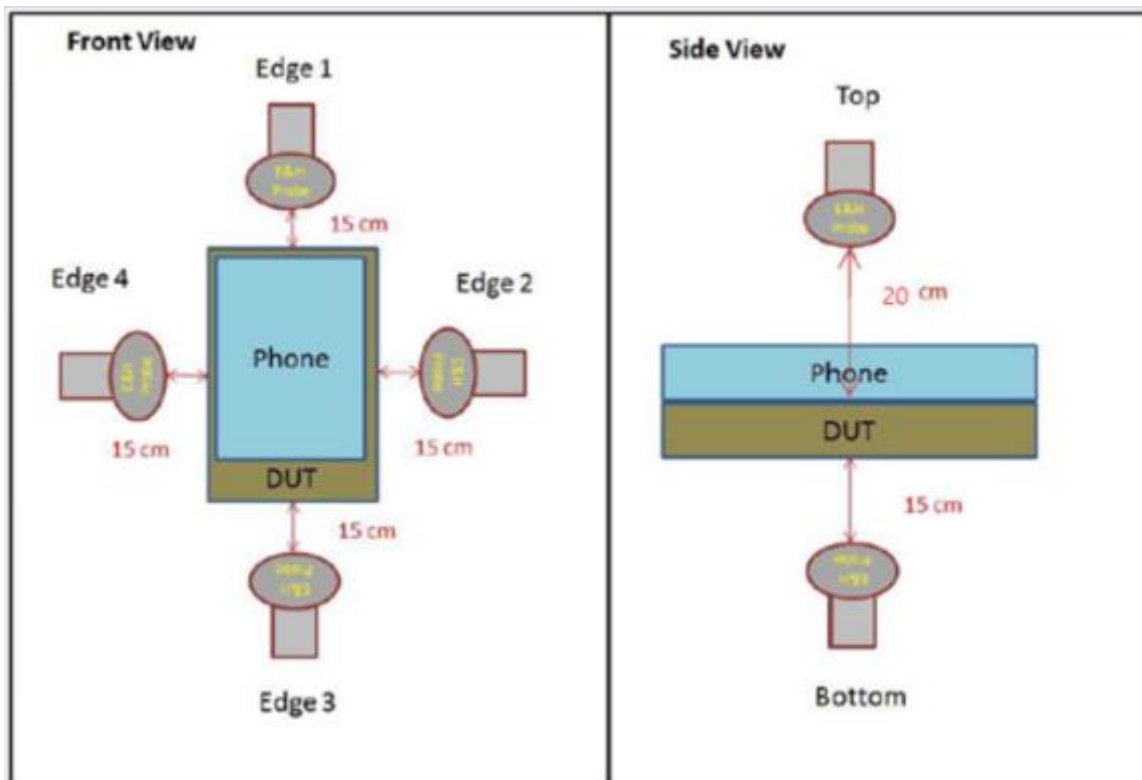
Mode
Operationg (SUPPORT Equipment, <10% Power Charging)
Operationg (SUPPORT Equipment, 50~55% Power Charging)
Operationg (SUPPORT Equipment, 90~95% Power Charging)

MEASUREMENT TEST SETUP

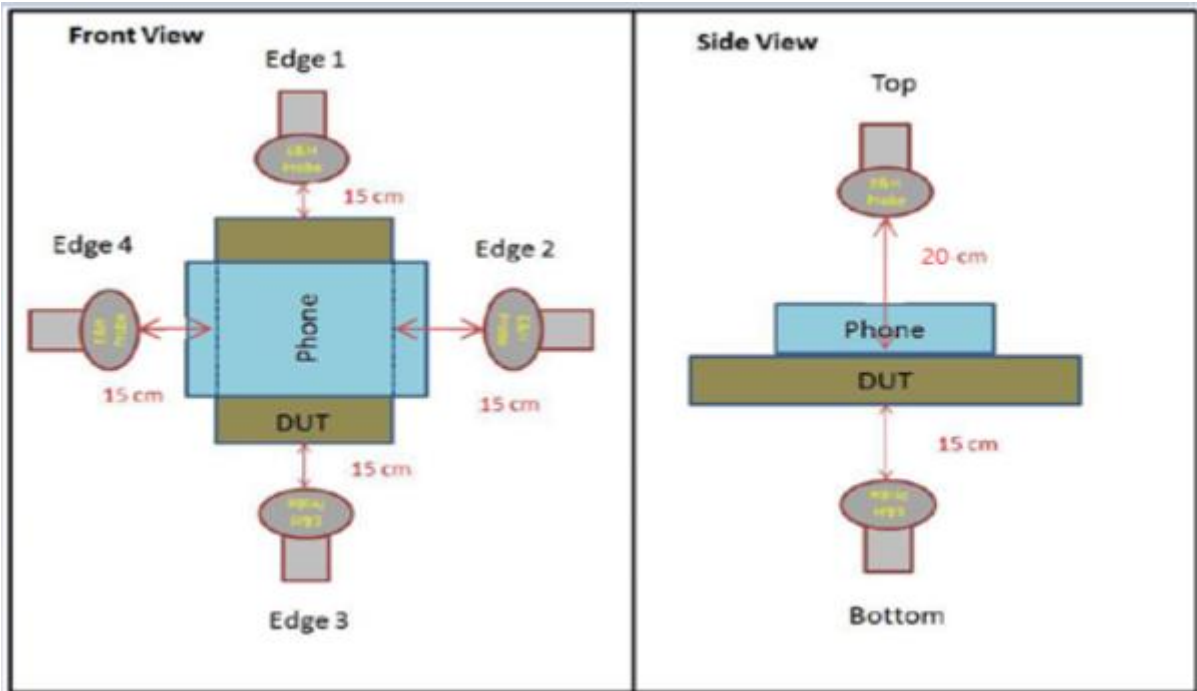
The measurement was taken using a probe place 15 cm from the edges of DUT or 20 cm above the DUT. Measurement were from the top and all sides of the DUT per KDB680106 D01 v03. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements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

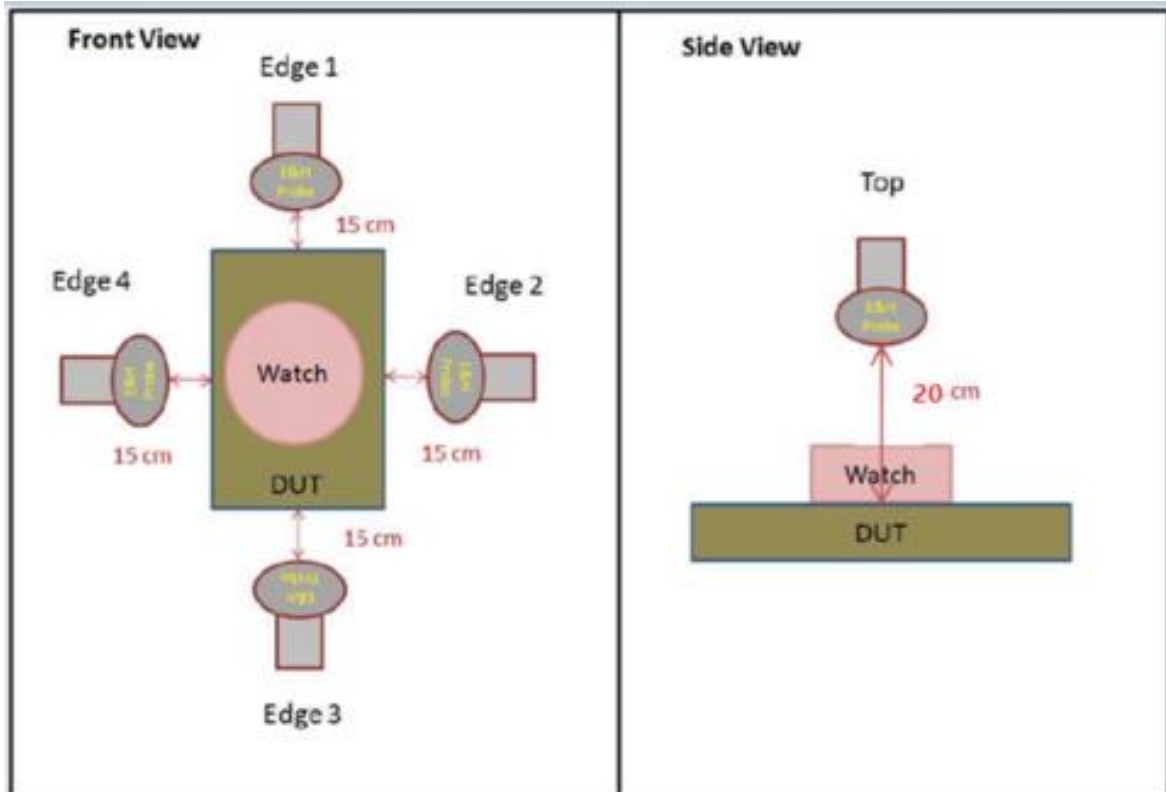
DUT to phone test Configuration 1 & 2



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

5. MAXIMUM PERMISSIBLE RF 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

H-Field Measurements

TEST results of DUT to phone test Comfiguraion 1 &2

FCC RF Exposurs Result					
Test Configuration	Test mode	Test distance	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	0.1316
		15 cm	Bottom		0.1282
			Edge 1		0.1285
			Edge 2		0.1574
			Edge 3		0.1346
			Edge 4		0.1515
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.1294
		15 cm	Bottom		0.1274
			Edge 1		0.1265
			Edge 2		0.1542
			Edge 3		0.1321
			Edge 4		0.1500
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.1280
		15 cm	Bottom		0.1252
			Edge 1		0.1250
			Edge 2		0.1543
			Edge 3		0.1325
			Edge 4		0.1506
Configuration 2	Operation Real Product (Power 50~55% charging)	15 cm	Edge 2	1.63	0.1540

TEST results of DUT to phone test Configuraion 3 &4

FCC RF Exposurs Result					
Test Configuration	Test mode	Test distance	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	0.1346
		15 cm	Bottom		0.1289
			Edge 1		0.1311
			Edge 2		0.2224
			Edge 3		0.1318
			Edge 4		0.1726
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.1318
		15 cm	Bottom		0.1251
			Edge 1		0.1301
			Edge 2		0.2212
			Edge 3		0.1298
			Edge 4		0.1688
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.1341
		15 cm	Bottom		0.1259
			Edge 1		0.1302
Edge 2			0.2193		
Edge 3			0.1298		
Edge 4			0.1711		
Configuration 4	Operation Real Product (Power 50~55% charging)	15 cm	Edge 2	1.63	0.1973

TEST results of DUT to phone test Configuraion 5 &6

FCC RF Exposurs Result						
Test Configuration	Test mode	Test distance	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	0.1378	
		15 cm	Edge 1		0.1226	
			Edge 2		0.1282	
			Edge 3		0.1289	
			Edge 4		0.1251	
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.1356	
		15 cm	Edge 1		0.1217	
			Edge 2		0.1273	
			Edge 3		0.1259	
	Operation Real Product (Power 90~95% charging)	15 cm	Edge 4	0.1246		
			20 cm	Top	1.63	0.1341
			Edge 1	0.1219		
			Edge 2	0.1256		
	Edge 3	0.1278				
	Edge 4	0.1233				
Configuration 6	Operation Real Product (Power 50~55% charging)	15 cm	Top	1.63	0.1355	

6.2 FCC SUMMARYOF RESULTS

H-Field Limit		
FCC RF Exposure (A/m)	Maximum meas data (A/m)	Percentage (%)
1.63	0.2224	13.9

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