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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: Jun. 15, 2021 Test Report No.: HCT-SR-2105-FC008-R2 Test Site: HCT CO., LTD.
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FCC ID:

A3LSMG990U

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-G990U
Additional Model Name:	SM-G990U1/DS, SM-G990U1
Date of Test:	May.10, 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
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DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
0	May. 26, 2021	First Approval Report
1	Jun. 08, 2021	Revised Page 5
2	Jun. 15, 2021	Add Additional Model Name.

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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
Fax.:	+82 31 645 6401

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-G990U
Additional Model Name:	SM-G990U1/DS, SM-G990U1
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-G990U, SM-G990U1/DS were tested and the worst case results were reported.
(Worst case : SM-G990U)

3.2 WORST-CASE 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)

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 the device are 8.71 % 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.

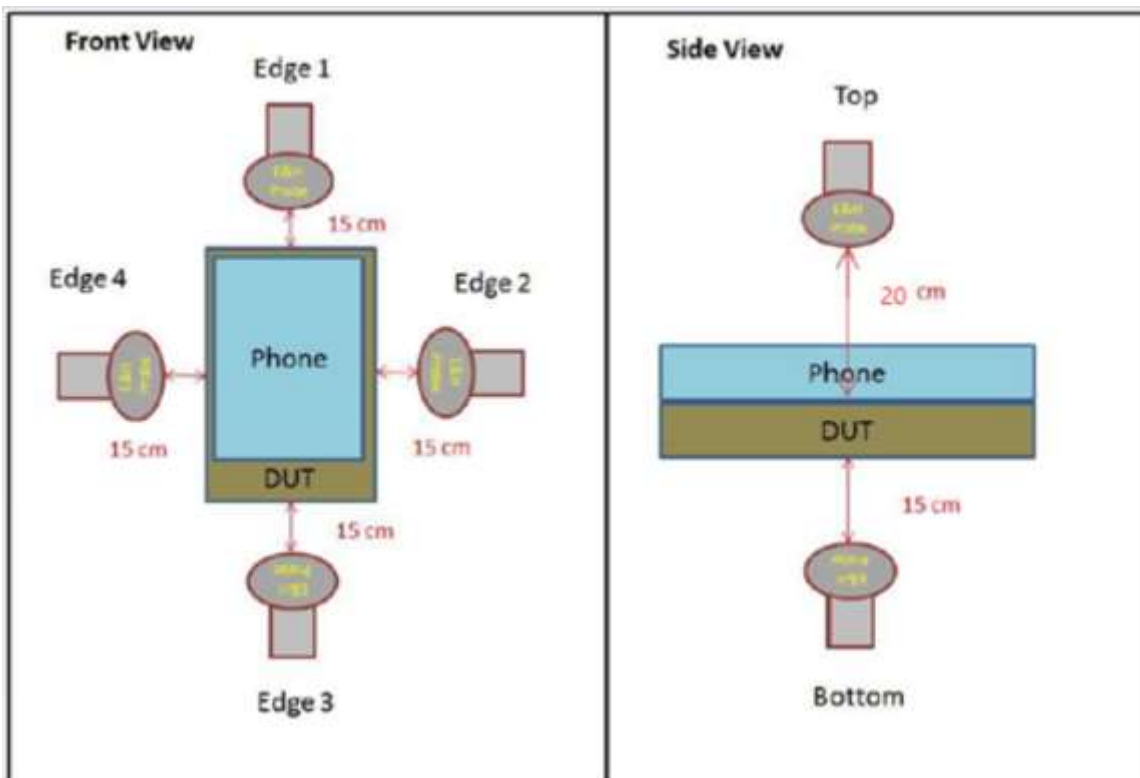
Mode
Operationg (SUPPORT Equipment, <10% Power Charging)
Operationg (SUPPORT Equipment, 50~55% Power Charging)
Operationg (SUPPORT Equipment, 90~95% Power Charging)

MEASUREMENT TEST SETUP

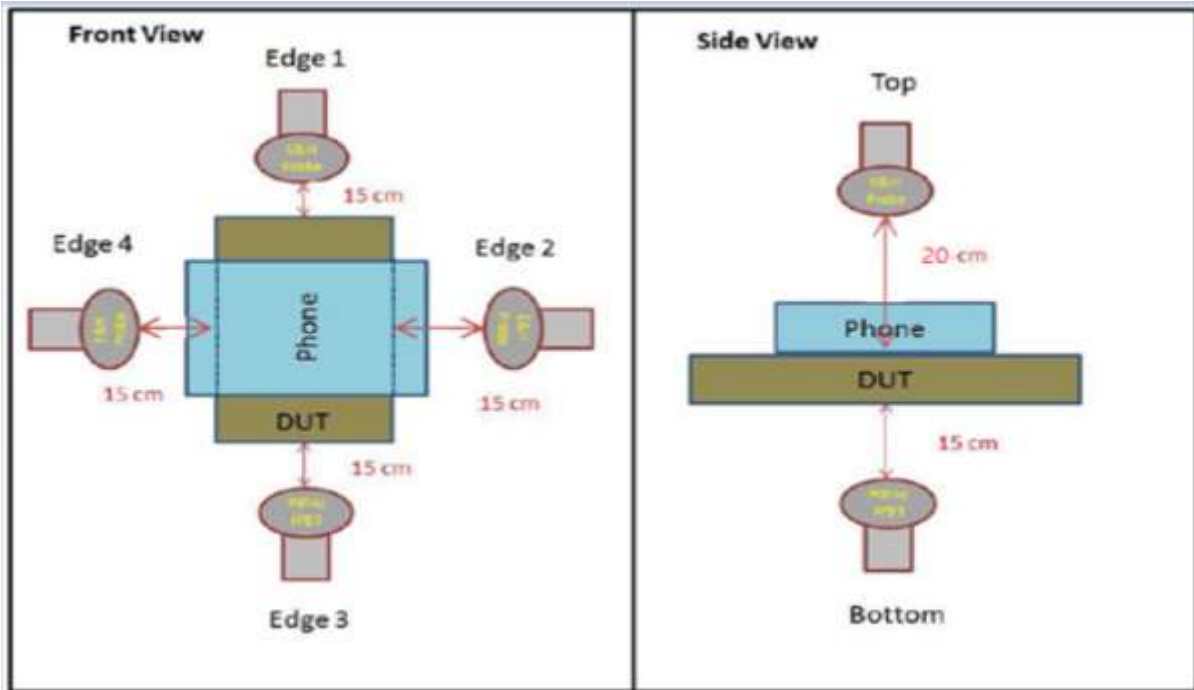
The measurement was taken using a probe place 15 cm from the edges of DUT or 20 cm above the DUT. Measurement were from the top and all sides of the DUT per KDB680106 D01 v03. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements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

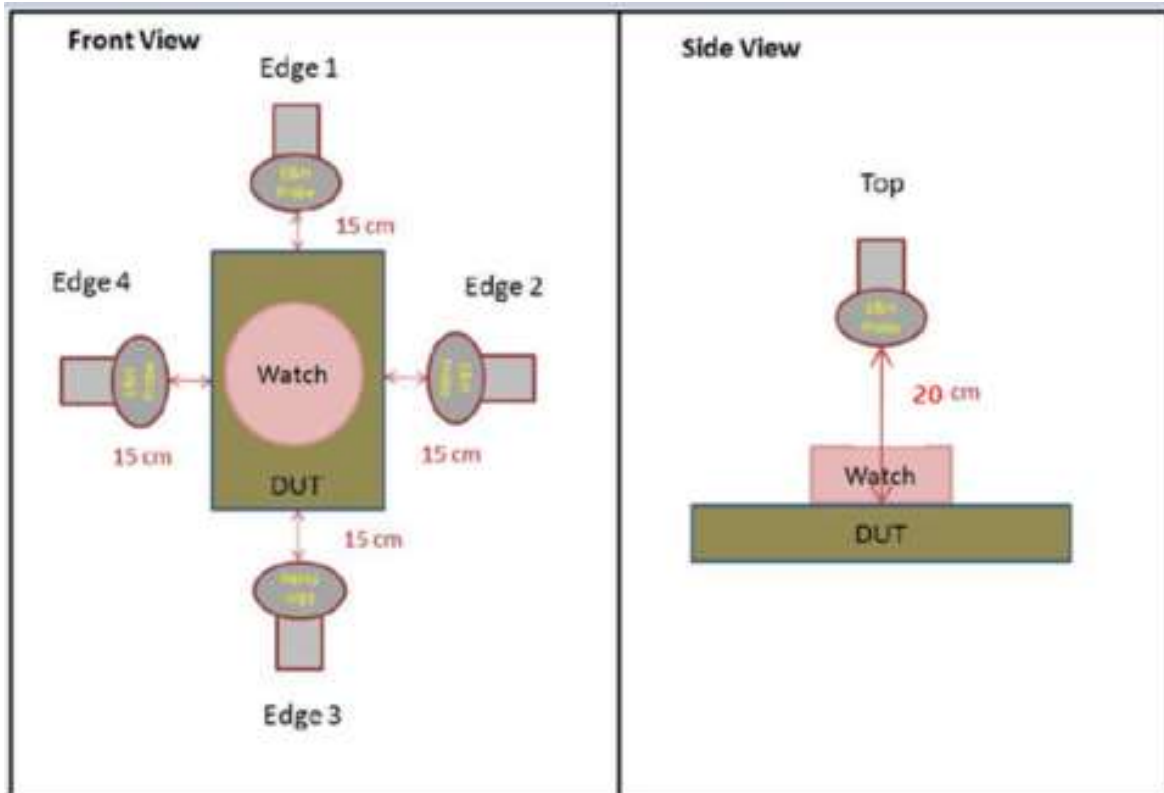
DUT to phone test Configuration 1 & 2



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 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

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 Configuraion 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	0.118
		15 cm	Bottom		0.120
			Edge 1		0.121
			Edge 2		0.122
			Edge 3		0.119
			Edge 4		0.119
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.108
		15 cm	Bottom		0.105
			Edge 1		0.111
			Edge 2		0.102
			Edge 3		0.104
			Edge 4		0.109
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.108
		15 cm	Bottom		0.110
			Edge 1		0.096
Edge 2			0.102		
Edge 3			0.114		
Edge 4			0.109		
Configuration 2	Operation Real Product (Power 50~55% charging)	15 cm	Edge 2	1.63	0.119

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	0.119
		15 cm	Bottom		0.121
			Edge 1		0.119
			Edge 2		0.142
			Edge 3		0.120
			Edge 4		0.119
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.119
		15 cm	Bottom		0.101
			Edge 1		0.119
			Edge 2		0.122
			Edge 3		0.115
			Edge 4		0.099
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.094
		15 cm	Bottom		0.121
			Edge 1		0.099
Edge 2			0.117		
Edge 3			0.115		
Edge 4			0.099		
Configuration 4	Operation Real Product (Power 50~55% charging)	15 cm	Edge 2	1.63	0.236

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	0.119
		15 cm	Edge 1		0.119
			Edge 2		0.121
			Edge 3		0.120
			Edge 4		0.121
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.104
		15 cm	Edge 1		0.094
			Edge 2		0.111
			Edge 3		0.120
			Edge 4		0.101
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.104
		15 cm	Edge 1		0.094
			Edge 2		0.101
			Edge 3		0.100
			Edge 4		0.106
Configuration 6	Operation Real Product (Power 50~55% charging)	15 cm	Edge 2	1.63	0.124

6.2 FCC SUMMARY OF RESULTS

H-Field Limit		
FCC RF Exposure	Maximum meas data (A/m)	Percentage (%)
1.63	0.142	8.71

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