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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: May. 25, 2022 Test Report No.: HCT-SR-2205-FC001-R2 Test Site: HCT CO., LTD.
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FCC ID:

A3LSMG990U2

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-G990U2

Multi Model Name: SM-G990U3/DS

Date of Test: May.11, 2022

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

Jung Hun, Park
Test Engineer
SAR Team
Certification Division

Reviewed By

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DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
0	May. 13, 2022	First Approval Report
1	May. 20, 2022	Revised Sec.3, 6
2	May. 25, 2022	Revised Sec. 3

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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-G990U2
Multi-Model Name:	SM-G990U3/DS
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, watch or EarBuds. The charging frequency is between 110 kHz to 148 kHz, and the maximum transfer power consumption is 7.5 W in charging status.

SM-G990U2, SM-G990U3/DS were tested and the worst case results were reported.
(Worst case : SM-G990U2)

3.2 TEST 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)
DUT to Phone test configuration 7	Charging from EarBuds to DUT
DUT to Phone test configuration 8	Charging from EarBuds to DUT(TA Charging from DUT)

Note :

1. Configuration 2,4,6 and 8 were tested with the worst case of configuration 1,3,5 and 7

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 7.5 Watts.
(3) The transfer system includes only single primary and secondary 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 exposure conditions only(portable exposure conditions are not covered 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 strengths at 20 cm from the device is 9.3 % and at 15cm from the device is 8.3% 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
EarBuds	SAMSUNG Electronics Co., Ltd.	SM-R180N-L	A2101112033	A3LSMR180L
	SAMSUNG Electronics Co., Ltd.	SM-R180N-R	A2101112034	A3LSMR180R

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.

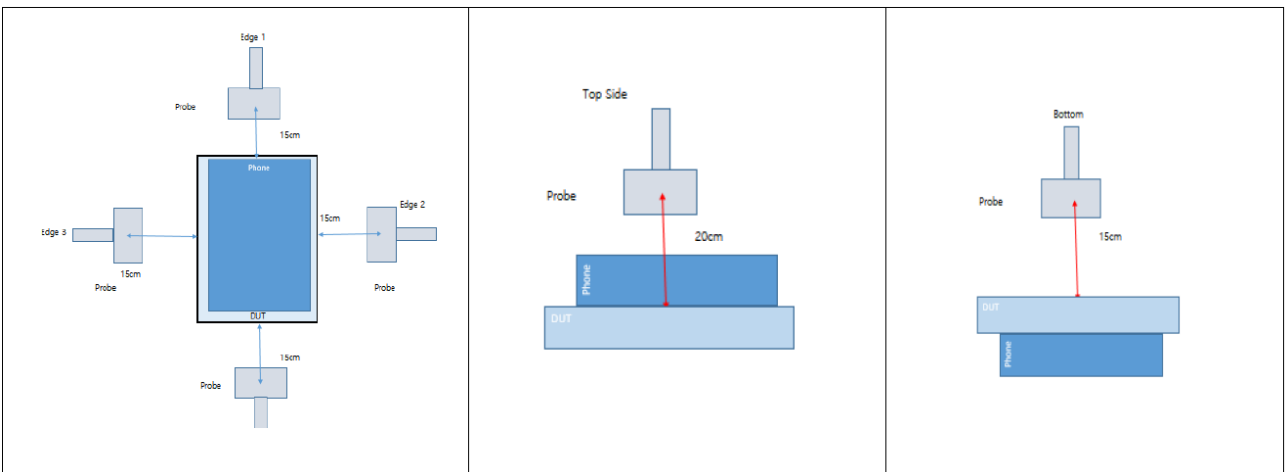
Mode
Operating (SUPPORT Equipment, <10% Power Charging)
Operating (SUPPORT Equipment, 50~55% Power Charging)
Operating (SUPPORT Equipment, 90~95% Power Charging)

MEASUREMENT TEST SETUP

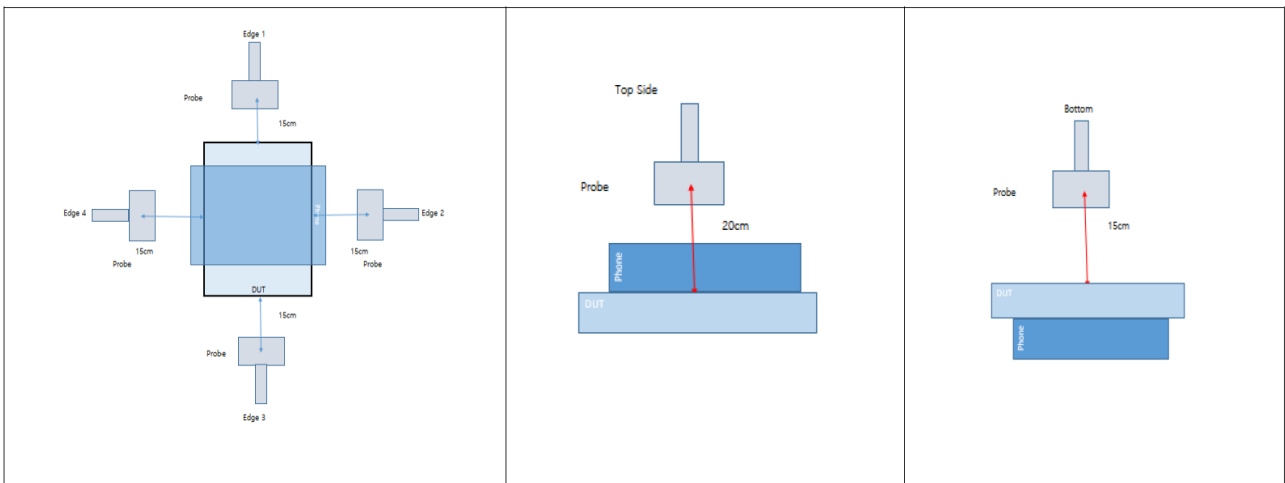
The measurement was taken using a probe place 15 cm from the edges of DUT or 20 cm above the DUT. Measurement were from the top and all sides of the DUT per KDB680106 D01 v03. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements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

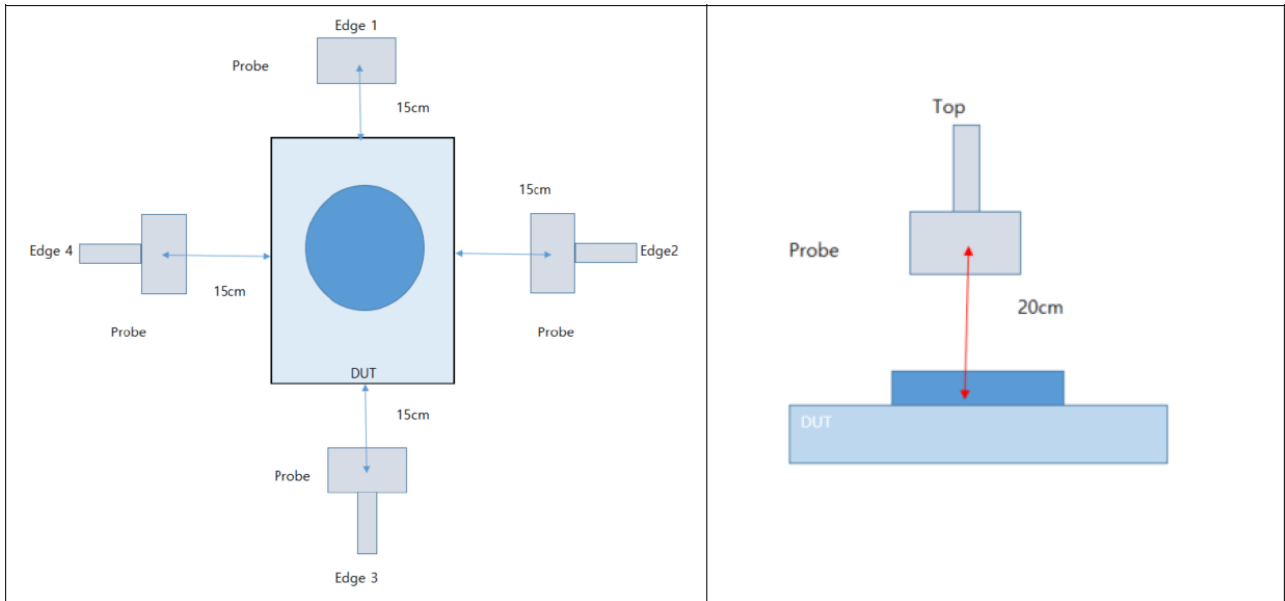
DUT to phone test Configuration 1 & 2



DUT to phone test Configuration 3 & 4



DUT to Watch(5 & 6)/EarBuds(7 & 8) test Configuration



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	ELT-400	Exposure Level Tester	N-0538	11/05/2021	11/05/2022
Narda	ELT-3 cm ² Probe	Magnetic (B) field	C-0171	04/18/2022	04/18/2023

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 * $\sqrt{\text{Duty Cycle}}$]

6.1.1 H field Measurement Results

H-Field TEST results of DUT to phone test Configuration 1 &2 [Phone to Phone]

FCC RF Exposure 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	0.137
		15 cm	Bottom		0.121
			Edge 1		0.126
			Edge 2		0.126
			Edge 3		0.129
			Edge 4		0.131
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.136
		15 cm	Bottom		0.121
			Edge 1		0.121
			Edge 2		0.126
			Edge 3		0.129
			Edge 4		0.131
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.136
		15 cm	Bottom		0.120
			Edge 1		0.125
Edge 2			0.124		
Edge 3			0.128		
Edge 4			0.130		
Configuration 2	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.135

H-Field TEST results of DUT to phone test Configuration 3 &4[Phone to phone]

FCC RF Exposure 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	0.151
		15 cm	Bottom		0.136
			Edge 1		0.129
			Edge 2		0.130
			Edge 3		0.129
			Edge 4		0.134
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.150
		15 cm	Bottom		0.134
			Edge 1		0.127
			Edge 2		0.130
			Edge 3		0.128
			Edge 4		0.134
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.149
		15 cm	Bottom		0.134
			Edge 1		0.126
Edge 2			0.129		
Edge 3			0.128		
Edge 4	0.133				
Configuration 4	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.150

H-Field TEST results of DUT to phone test Configuration 5 &6[Watch]

FCC RF Exposure 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	0.152
		15 cm	Edge 1		0.126
			Edge 2		0.128
			Edge 3		0.127
			Edge 4		0.132
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.134
		15 cm	Edge 1		0.125
			Edge 2		0.128
			Edge 3		0.126
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.132
		15 cm	Edge 1		0.124
			Edge 2		0.128
			Edge 3		0.125
Configuration 6	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.134
			Edge 1		0.124
			Edge 2		0.128
			Edge 3		0.125

H-Field TEST results of DUT to phone test Configuration 7 &8[EarBuds]

FCC RF Exposure Result					
Test Configuration	Test mode	Test distance	Test Position	H-Field Limit (A/m)	H-Field meas data (A/m)
Configuration 7	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.133
		15 cm	Edge 1		0.118
			Edge 2		0.123
			Edge 3		0.119
			Edge 4		0.126
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.132
		15 cm	Edge 1		0.118
			Edge 2		0.122
			Edge 3		0.119
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.132
		15 cm	Edge 1		0.117
			Edge 2		0.122
Edge 3			0.118		
Configuration 8	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.132
			Edge 1		0.117
			Edge 2		0.122
			Edge 3		0.118

H-Field TEST results of DUT to phone test Configuration 5

Results of H-Field Measurement (A/m) at the Worst case configuration	
The Distance from the device to the center of the measurement probe (cm)	H-Field Meas. (A/m)
0 (3 cm)	12.235
2 (5 cm)	3.690
4 (7 cm)	1.118
6 (9 cm)	0.464
8 (11 cm)	0.263
10 (13 cm)	0.204
12 (15 cm)	0.193
14 (17 cm)	0.185
16 (19 cm)	0.177
18 (21 cm)	0.165
20 (23 cm)	0.155

*The contact distance between the device and the probe is 3cm from the center of the probe.

7. Conclusion

	H-Field (A/m)
MPE Limit	1.63
Maximum Measurement Result	0.152
Percentage (%)	9.3

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