

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. 17, 2022 Test Report No.: HCT-SR-2206-FC002 Test Site: HCT CO., LTD.
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FCC ID:

A3LSMG990B2

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-G990B2/DS

Additional Model Name:

SM-G990B2

Date of Test:

Jun.14, 2022

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



Chanmin, Ko
Test Engineer
SAR Team
Certification Division

Reviewed By



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DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
0	Jun. 17, 2022	First Approval Report

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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-G990B2/DS
Additional Model Name:	SM-G990B2
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 or EarBuds. The charging frequency is between 110 kHz to 148 kHz, and the maximum transfer power consumption is 9 W in charging status.

SM-G990B2/DS, SM-G990B2 were tested and the worst case results were reported.
(Worst case : SM-G990B2/DS)

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 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 20 cm from the device are 19.51 % 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.

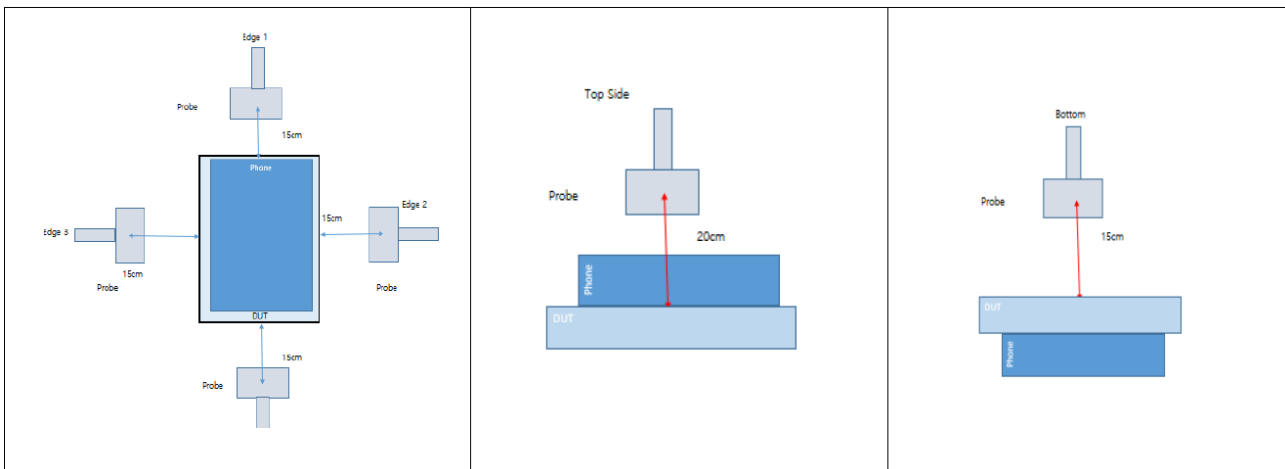
Mode
Operating (SUPPORT Equipment, <10% Power Charging)
Operating (SUPPORT Equipment, 50~55% Power Charging)
Operating (SUPPORT Equipment, 90~95% Power Charging)

MEASUREMENT TEST SETUP

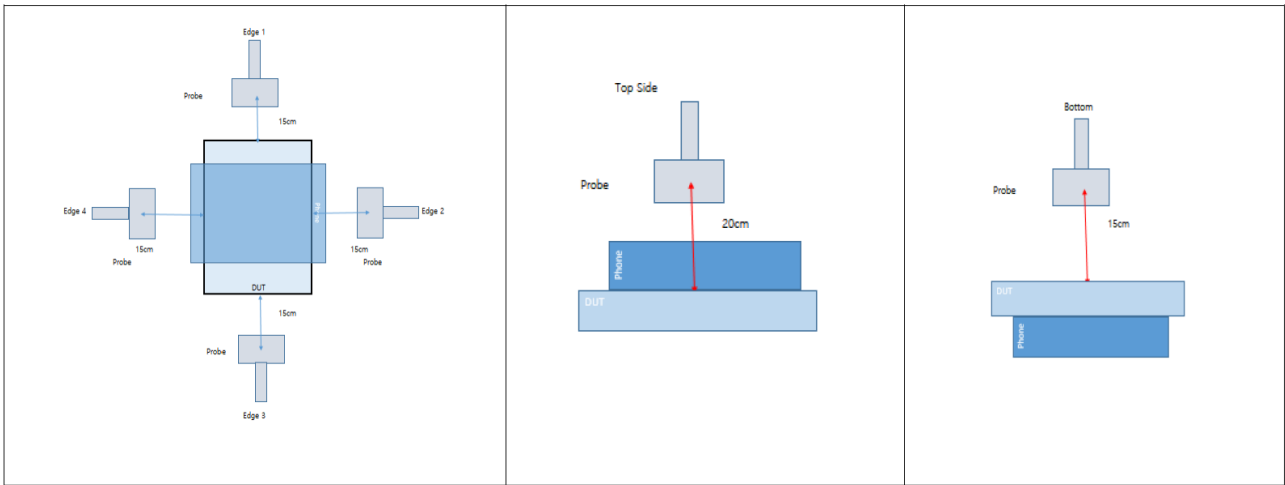
The measurement was taken using a probe place 15 cm from the edges of DUT or 20 cm above the DUT. Measurement were from the top and all sides of the DUT per KDB680106 D01 v03. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements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

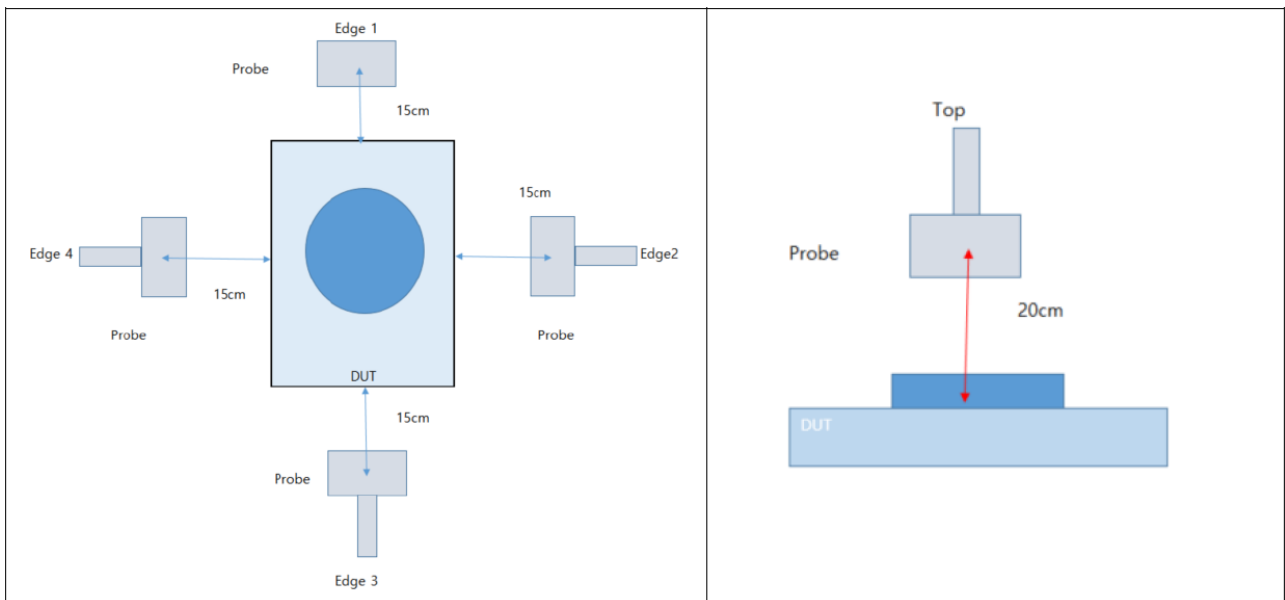
DUT to phone test Configuration 1 & 2



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 environmental impact of human exposure to radio-frequency(RF) radiation as specified in 1.1307(b), except in the case of portable devices which shall be evaluated according 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 Configuration 1 &2

FCC RF Exposure Result					
Test Configuration	Test mode	Test distance	Test Position	H-Field Limit (A/m)	H-Field Measured Results (A/m)
Configuration 1	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.310
		15 cm	Bottom		0.301
			Edge 1		0.296
			Edge 2		0.301
			Edge 3		0.300
			Edge 4		0.302
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.309
		15 cm	Bottom		0.300
			Edge 1		0.289
			Edge 2		0.296
			Edge 3		0.293
			Edge 4		0.300
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.306
		15 cm	Bottom		0.297
			Edge 1		0.296
			Edge 2		0.301
			Edge 3		0.299
			Edge 4		0.292
Configuration 2	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.309

TEST results of DUT to phone test Configuration 3 &4

FCC RF Exposurs Result					
Test Configuration	Test mode	Test distance	Test Position	H-Field Limit (A/m)	H-Field Measured Results (A/m)
Configuration 3	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.311
		15 cm	Bottom		0.309
			Edge 1		0.304
			Edge 2		0.298
			Edge 3		0.299
			Edge 4		0.310
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.308
		15 cm	Bottom		0.307
			Edge 1		0.297
			Edge 2		0.299
			Edge 3		0.293
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.301
		15 cm	Bottom		0.306
			Edge 1		0.297
			Edge 2		0.294
Edge 3			0.291		
Configuration 4	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.308
		15 cm	Bottom		0.306
			Edge 1		0.297
			Edge 2		0.294
			Edge 3		0.291

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 Measured Results (A/m)
Configuration 5	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.318
		15 cm	Edge 1		0.295
			Edge 2		0.300
			Edge 3		0.302
			Edge 4		0.306
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.309
		15 cm	Edge 1		0.295
			Edge 2		0.294
			Edge 3		0.297
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.314
		15 cm	Edge 1		0.288
			Edge 2		0.301
Edge 3			0.296		
Configuration 6	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.315
			Edge 1		0.288
			Edge 2		0.301
			Edge 3		0.296

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 Measured Results (A/m)	
Configuration 7	Operation Real Product (Power <10% charging)	20 cm	Top	1.63	0.309	
		15 cm	Edge 1		0.298	
			Edge 2		0.308	
			Edge 3		0.294	
			Edge 4		0.303	
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.308	
		15 cm	Edge 1		0.289	
			Edge 2		0.303	
			Edge 3		0.288	
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.307	
		15 cm	Edge 1		0.292	
			Edge 2		0.298	
			Edge 3		0.286	
	Configuration 8	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.308
			15 cm	Edge 1		0.292
Edge 2				0.298		
Edge 3				0.286		

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)	4.843
2 (5 cm)	3.987
4 (7 cm)	1.930
6 (9 cm)	0.737
8 (11 cm)	0.433
10 (13 cm)	0.324
12 (15 cm)	0.317
14 (17 cm)	0.317
16 (19 cm)	0.316
18 (21 cm)	0.316
20 (23 cm)	0.317

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

6.2 SUMMARY OF RESULTS

H-Field Limit		
FCC RF Exposure (A/m)	Maximum meas data (A/m)	Percentage (%)
1.63	0.318	19.51

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