FCC 47 CFR § 2.1091

RF EVALUATION REPORT (MPE)

FOR

GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC,WPT and UWB

MODEL NUMBER: SM-S946U, SM-S946U1

FCC ID: A3LSMF946U

REPORT NUMBER: 4790748041-S6V2

ISSUE DATE: 5/18/2023

Prepared for
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Prepared by

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Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	5/15/2023	Initial Issue	--
V2	5/18/2023	Revised photos of measurement test setup in Sec.4.4. Added statement in measurement test setup in Sec.4.4. Revised titles in Section.6.2.1.	Sunghoon Kim

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1. Attestation of SAR Characterization

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.
FCC ID	A3LSMF946U
Model Number	SM-S946U, SM-S946U1
Applicable Standards	FCC 47 CFR § 2.1091 KDB 680106 D01 RF Exposure Wireless Charging Apps
Date Tested	5/12/2023 to 5/15/2023
Test Results	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government

Approved & Released By:	Prepared By:
	
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory	Sunghoon Kim Senior Laboratory Engineer UL Korea, Ltd. Suwon Laboratory

2. Test Methodology

All calculations were made in accordance with FCC OET Bulletin 65 Edition 97-01.

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☒ Shield Room 1

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. Equipment Under Test

4.1. Description of EUT

The EUT has WPT (Wireless Power Transfer) feature which has inductive charging coil to charge phone or watch. The charging frequency is between 110 kHz to 148 kHz, and the maximum power consumption is 9.0 W in charging status.

4.2. Worst-case configuration

Folder Closed 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 (Cross position)	Charging from Phone to DUT
DUT to Phone test configuration 4 (Cross position)	Charging from Phone to DUT (TA Charging from DUT)
DUT to Watch test configuration 5	Charging from Watch to DUT
DUT to Watch test configuration 6	Charging from Watch to DUT (TA Charging from DUT)

Note:

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

Folder Opened configuration

Test configuration	Description
DUT to Phone test configuration 7	Charging from Phone to DUT
DUT to Phone test configuration 8	Charging from Phone to DUT (TA Charging from DUT)
DUT to Phone test configuration 9 (Cross position)	Charging from Phone to DUT
DUT to Phone test configuration 10 (Cross position)	Charging from Phone to DUT (TA Charging from DUT)
DUT to Watch test configuration 11	Charging from Watch to DUT
DUT to Watch test configuration 12	Charging from Watch to DUT (TA Charging from DUT)

Note:

Configuration 8, 10 and 12 were tested with the worst case of configuration 7, 9 and 11.

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

Requirement	Device informations
(1) Power transfer frequency is less than 1 MHz.	Yes. Operating Frequency is between 110kHz 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 only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients 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 at 15 cm or 20cm from the device are 23.37 % of the FCC H field limit.

4.4. Description of Test setup

SUPPORT EQUIPMENT & PERIPHERALS

SUPPROT EQUIPMENT & PERIPHERALS LIST				
Description	Manufacturer	Model	Serial Numver	FCC ID
Phone	Samsung Electronics Co., Ltd.	SM-G986B/DS	R3CMB0C70XN	A3LSMG986B
Watch	Samsung Electronics Co., Ltd.	SM-R835F	RFAM90ZXFTF	A3LSMR835
Traver Adapter	Samsung Electronics Co., Ltd.	EP-TA800	R37N9BV0382HM3	DoC
USB Data Cable	Samsung Electronics Co., Ltd.	EP-DN980BBE	N/A	-

TEST SETUP

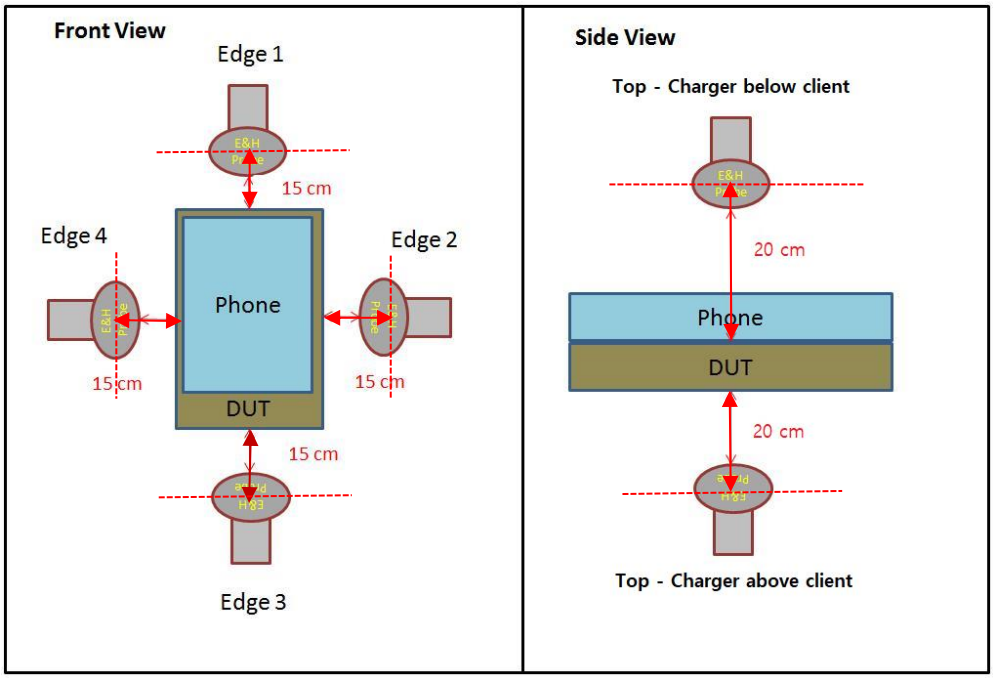
The following three modes are tested in test configurations

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 placed 15 cm surrounding the device and 20 cm above the top surface of the EUT. Measurements were taken the top (charger below/above client) and all sides of the EUT per KDB680106 D01.

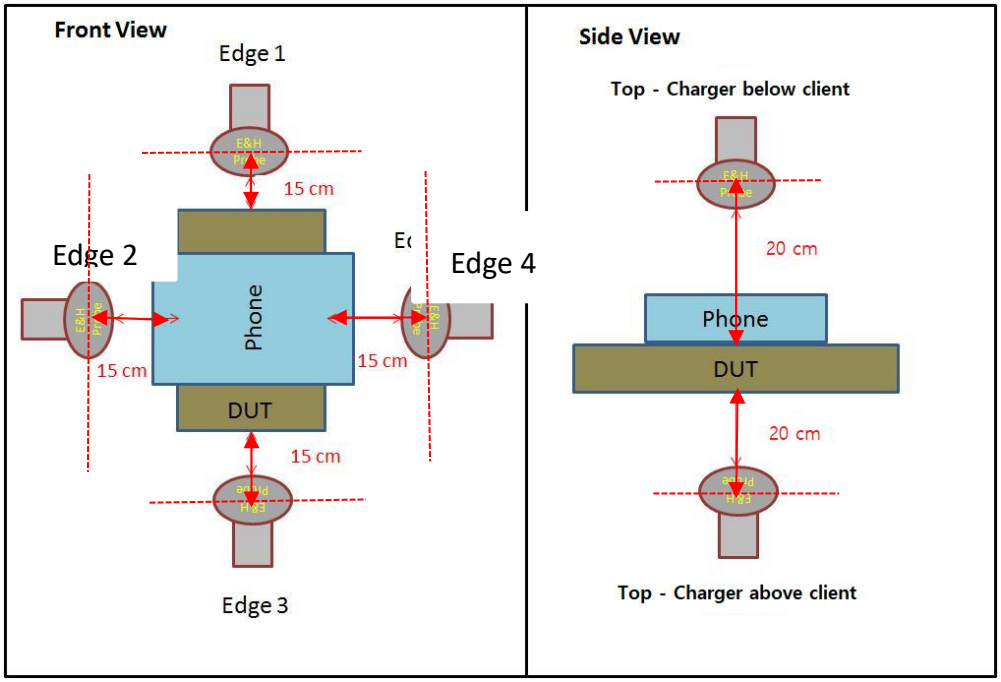
DUT to phone test Configuration 1 & 2 & 7 & 8



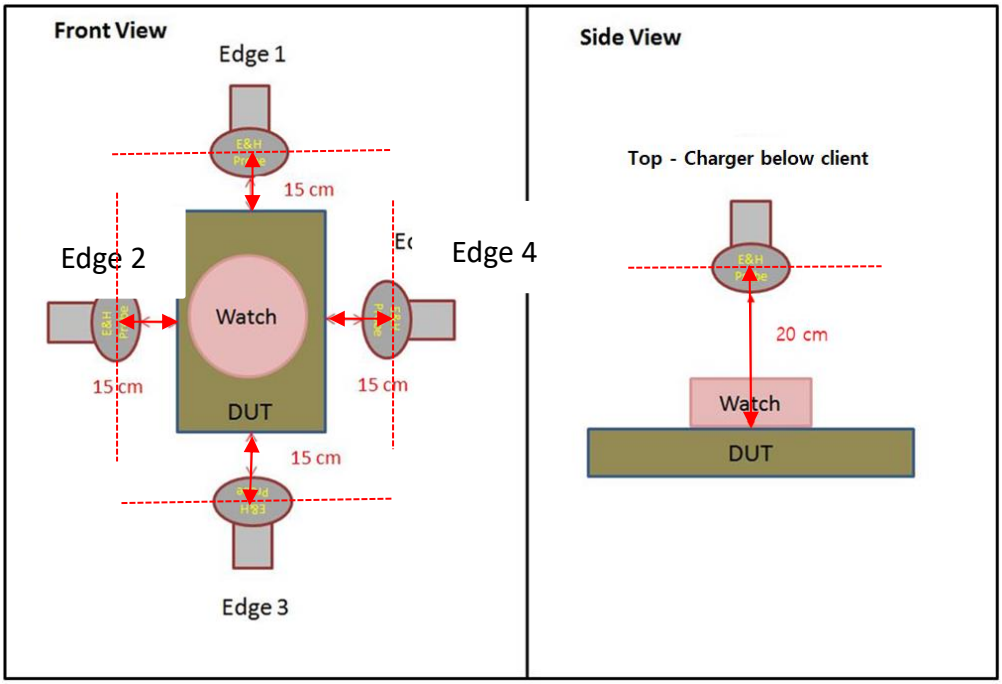
Note:

Test distance is the distance between DUT's surface to center of probe.

DUT to phone test Configuration 3 & 4 & 9 & 10



DUT to Watch test Configuration 5 & 6 & 11 & 12



Note:

Test distance is the distance between DUT's surface to center of probe.

5. Test and Measurement equipment

The following test and measurement equipment was used for the tests documented in this report;

Test equipment (Measurement probe)				
Description	**Manufacturer**	**Model**	**S/N**	**Cal due.**
E-H Field Analyzer	**Narda**	**EHP-200AC**	**170WX91008**	**8-23-2023**

6. Maximum Permissive RF exposure

6.1. FCC Limits and Summary

6.1.1. FCC Limits

§ 1.1310 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 to 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.

6.2. Test Results

6.2.1. FCC RF Exposure

H-FIELD MEASUREMENTS

Note: Peak measurement were performed. Additional test was performed in each Test mode by moving the probe surrounding the device to find the maximum exposure.

TEST results of DUT(Folder Closed) 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 meas. data (A/m)
Configuration 1	Operating Real Product (Power <10% charging)	15 cm probe to edges of EUT and 20 cm probe to top surface of the EUT	Top - charger above client	1.63	0.031
			Top - charger below client		0.031
			Edge 1		0.038
			Edge 2		0.032
			Edge 3		0.060
			Edge 4		0.035
			Max		0.060
	Operating Real Product (Power 50~55% charging)		Top - charger above client		0.029
			Top - charger below client		0.030
			Edge 1		0.034
			Edge 2		0.032
			Edge 3		0.056
			Edge 4		0.035
			Max		0.056
	Operating Real Product (Power 90~95% charging)		Top - charger above client		0.029
			Top - charger below client		0.031
			Edge 1		0.031
			Edge 2		0.031
			Edge 3		**0.068**
			Edge 4		0.038
			Max		0.068
Configuration 2	Operating Real Product (Power 90~95% charging)		Edge 3		0.071

TEST results of DUT(Folder Closed) to phone test Configuration 3 & 4

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	Operating Real Product (Power <10% charging)	15 cm probe to edges of EUT and 20 cm probe to top surface of the EUT	Top - charger above client	1.63	0.039
			Top - charger below client		0.058
			Edge 1		0.044
			Edge 2		0.059
			Edge 3		0.045
			Edge 4		0.126
			Max		0.126
	Operating Real Product (Power 50~55% charging)		Top - charger above client		0.036
			Top - charger below client		0.053
			Edge 1		0.051
			Edge 2		0.055
			Edge 3		0.048
			Edge 4		0.145
			Max		0.145
	Operating Real Product (Power 90~95% charging)		Top - charger above client		0.040
			Top - charger below client		0.054
			Edge 1		0.048
			Edge 2		0.054
			Edge 3		0.044
			Edge 4		**0.146**
			Max		0.146
Configuration 4	Operating Real Product (Power 90~95% charging)		Edge 4		0.144

TEST results of DUT(Folder Closed) to phone test Configuration 5 & 6

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	Operating Real Product (Power <10% charging)	15 cm probe to edges of EUT and 20 cm probe to top surface of the EUT	Top - charger below client	1.63	0.246
			Edge 1		0.265
			Edge 2		0.121
			Edge 3		0.368
			Edge 4		0.166
			Max		0.368
	Operating Real Product (Power 50~55% charging)		Top - charger below client		0.245
			Edge 1		0.225
			Edge 2		0.123
			Edge 3		0.375
			Edge 4		0.184
			Max		**0.375**
	Operating Real Product (Power 90~95% charging)		Top - charger below client		0.218
			Edge 1		0.221
			Edge 2		0.127
			Edge 3		0.381
			Edge 4		0.172
			Max		**0.381**
Configuration 6	Operating Real Product (Power 90~95% charging)		Edge 3		0.351

TEST results of DUT(Folder Opened) to phone test Configuration 7 & 8

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	Operating Real Product (Power <10% charging)	15 cm probe to edges of EUT and 20 cm probe to top surface of the EUT	Top - charger above client	1.63	0.031
			Top - charger below client		0.032
			Edge 1		0.030
			Edge 2		0.030
			Edge 3		0.051
			Edge 4		0.041
			Max		0.051
	Operating Real Product (Power 50~55% charging)		Top - charger above client		0.032
			Top - charger below client		0.029
			Edge 1		0.029
			Edge 2		0.031
			Edge 3		**0.058**
			Edge 4		0.036
			Max		0.058
	Operating Real Product (Power 90~95% charging)		Top - charger above client		0.030
			Top - charger below client		0.031
			Edge 1		0.030
			Edge 2		0.030
			Edge 3		0.054
			Edge 4		0.032
			Max		0.054
Configuration 8	Operating Real Product (Power 50~55% charging)		Edge 3		0.068

TEST results of DUT(Folder Opened) to phone test Configuration 9 & 10

FCC RF Exposure Result

Test Configuration	Test mode	Test distance	Test Position	H-Field Limit (A/m)	H-Field meas. data (A/m)
Configuration 9	Operating Real Product (Power <10% charging)	15 cm probe to edges of EUT and 20 cm probe to top surface of the EUT	Top - charger above client	1.63	0.030
			Top - charger below client		0.032
			Edge 1		0.030
			Edge 2		0.031
			Edge 3		0.058
			Edge 4		0.077
			Max		0.077
	Operating Real Product (Power 50~55% charging)		Top - charger above client		0.031
			Top - charger below client		0.034
			Edge 1		0.031
			Edge 2		0.032
			Edge 3		0.059
			Edge 4		0.079
			Max		0.079
	Operating Real Product (Power 90~95% charging)		Top - charger above client		0.030
			Top - charger below client		0.032
			Edge 1		0.030
			Edge 2		0.031
			Edge 3		0.062
			Edge 4		**0.083**
			Max		0.083
Configuration 10	Operating Real Product (Power 90~95% charging)		Edge 4		0.076

TEST results of DUT(Folder Opened) to phone test Configuration 11 & 12

FCC RF Exposure Result

Test Configuration	Test mode	Test distance	Test Position	H-Field Limit (A/m)	H-Field meas. data (A/m)
Configuration 11	Operating Real Product (Power <10% charging)	15 cm probe to edges of EUT and 20 cm probe to top surface of the EUT	Top - charger below client	1.63	0.195
			Edge 1		0.202
			Edge 2		0.053
			Edge 3		0.346
			Edge 4		0.224
			Max		0.346
	Operating Real Product (Power 50~55% charging)		Top - charger below client		0.197
			Edge 1		0.198
			Edge 2		0.056
			Edge 3		0.353
			Edge 4		0.241
			Max		0.353
	Operating Real Product (Power 90~95% charging)		Top - charger below client		0.208
			Edge 1		0.191
			Edge 2		0.064
			Edge 3		0.337
			Edge 4		0.219
			Max		0.337
Configuration 12	Operating Real Product (Power 50~55% charging)		Edge 3		0.320

6.2.2. FCC SUMMARY OF RESULTS

H-Field Limit		
FCC RF Exposure	Maximum meas data (A/m)	Percentage (%)
1.63	0.3810	**23.37**

Conclusion:

H-Field result is less than 50% of the MPE limit.

Appendixes

Refer to separated files for the following appendixes.

4790748041-S6 FCC Report MPE_App A_Test setup photos

END OF REPORT