



74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea
TEL: +82-31-645-6300 FAX: +82-31-645-6401

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: Jul. 06, 2020

Test Report No.: HCT-SR-2006-FC014-R2

Test Site: HCT CO., LTD.

FCC ID:

A3LSMN981B

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-N981B/DS

Additional Model Name:

SM-N981B

Date of Test:

06/22/2020

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

Moon Pyung, Choi
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	Jun. 29, 2020	First Approval Report
R1	Jul. 03, 2020	Revised TYPO Page 5,6 and 8
R2	Jul. 06, 2020	Revised Sec.3.2

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1. Test Methodology

The DUT was assessed in accordance with FCC KDB 680106 D01 RF Exposure Wireless Charging App v03.

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 (Testing No. KT197)

3. DEVICE UNDER TEST DESCRIPTION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Model:	SM-N981B/DS
Additional Model Name:	SM-N981B
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 9.0 W in charging status.

SM-N981B/DS, SM-N981B were tested and the worst case results are reported.
(Worst case :SM-N981B/DS)

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
2. All test configurations are with s-Pen inserted for charging.

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 9.0 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 20 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 7.97 % 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
Travel Adapter	Solu-M	EP-TA800	-	
USB Data Cable	RF Tehck	EP-DG980BBE		

TEST SETUP

The following three modes are tested in test configuration;

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

For Simultaneous Charging

All Position of client device were investigated and the worst position results are reported.

For S-Pen, both fully charged and non-fully charged condition were investigated. Test wer performed non-fully charged condition as worst case. Please refer to S-Pen Test report

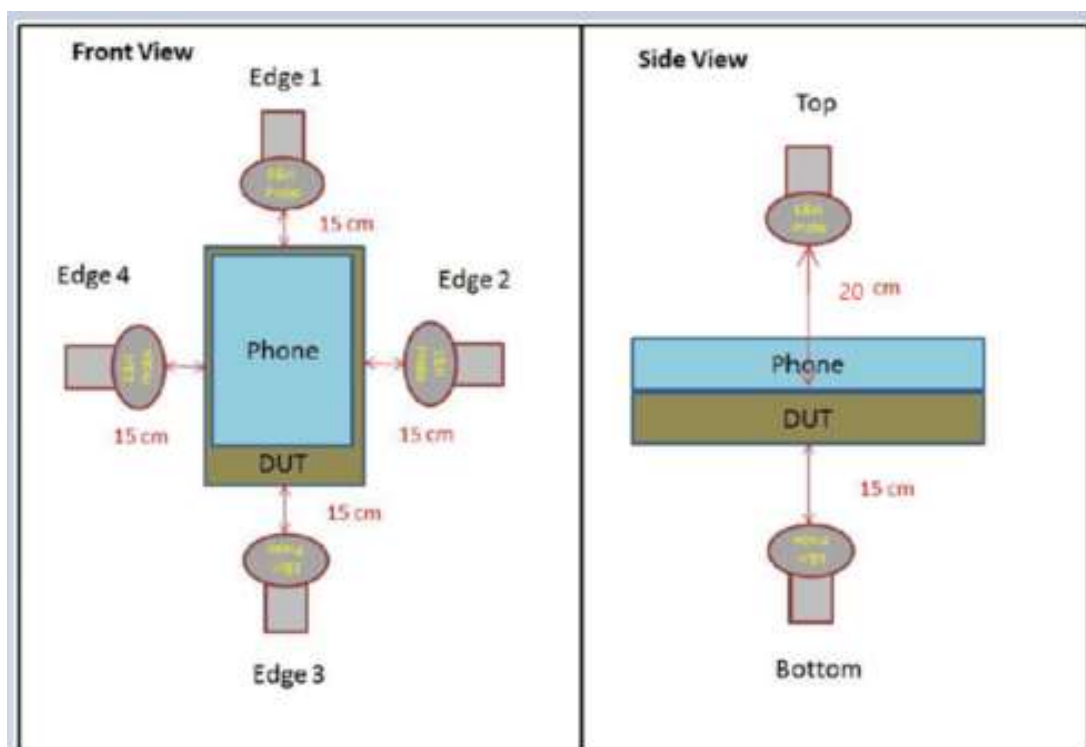
MEASUREMENT TEST SETUP

The measurement was taken using a probe place 15 cm from the edges of DUT or 20 cm above the DUT.

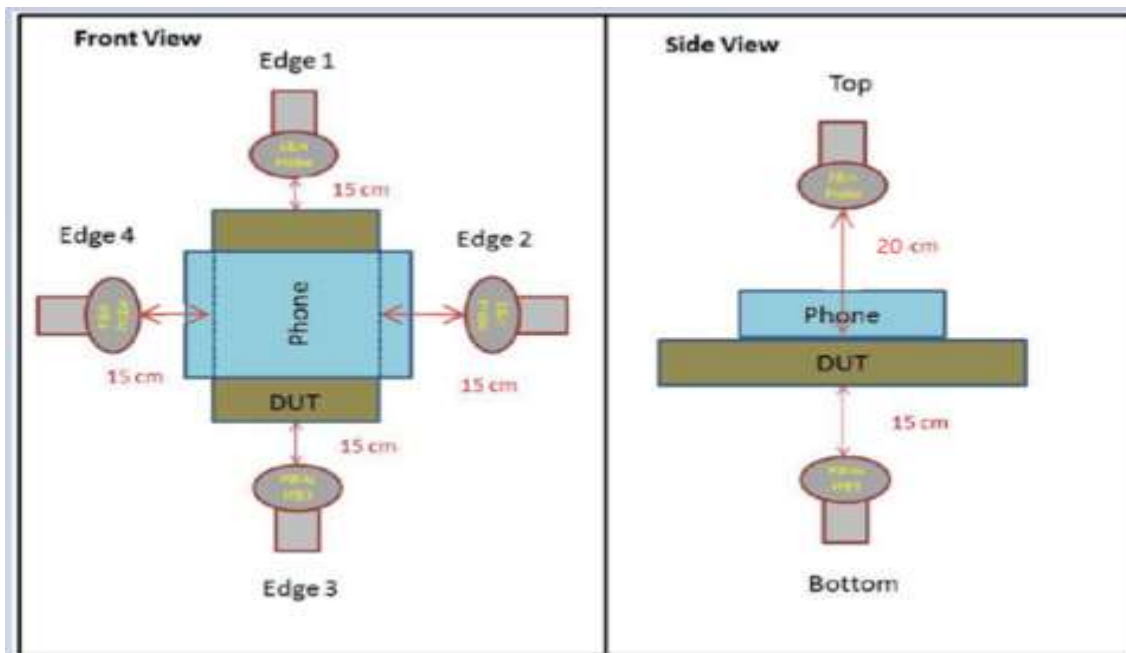
Measurement were from the top and all sides of the DUT per KDB680106 D01 v03. Additionally, as the DUT to phone configuration could result with the DUT place either above or below the phone, measurements were performed 'below' th DUT by flipping the DUT/phone so that the DUT was uppermost.

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.

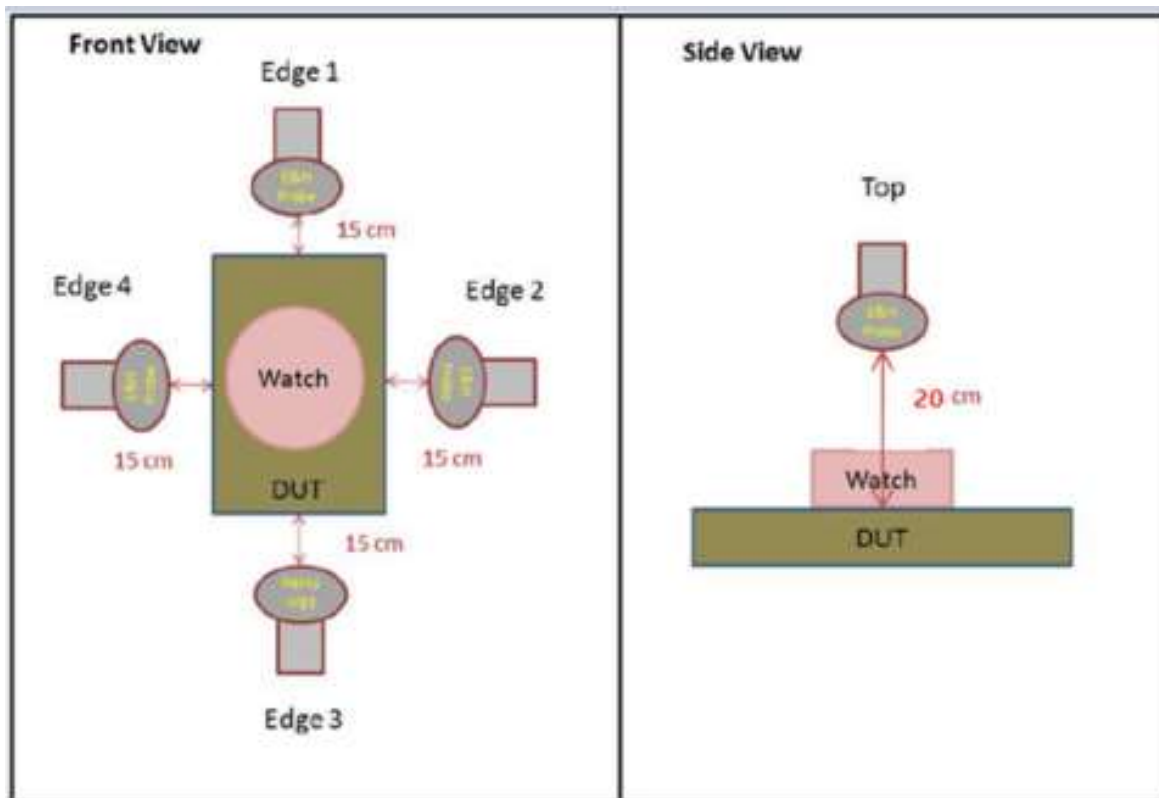
DUT to phone test Configuration 1 & 2



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	11/22/2020

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	0.0835
		15 cm	Bottom		0.1234
			Edge 1		0.1234
			Edge 2		0.1234
			Edge 3		0.1221
			Edge 4		0.1241
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0928
		15 cm	Bottom		0.1227
			Edge 1		0.1231
			Edge 2		0.1229
			Edge 3		0.1221
			Edge 4		0.1235
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0932
		15 cm	Bottom		0.1232
			Edge 1		0.1228
			Edge 2		0.1234
			Edge 3		0.1217
			Edge 4		0.1234
Configuration 2	Operation Real Product (Power <10% charging)	15 cm	Edge 4	1.63	0.1229

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	0.0924
		15 cm	Bottom		0.1226
			Edge 1		0.1207
			Edge 2		0.1223
			Edge 3		0.1239
			Edge 4		0.1245
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0935
		15 cm	Bottom		0.1226
			Edge 1		0.12
			Edge 2		0.1223
			Edge 3		0.1234
			Edge 4		0.1243
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0936
		15 cm	Bottom		0.1225
			Edge 1		0.1201
			Edge 2		0.1221
			Edge 3		0.1232
			Edge 4		0.1245
Configuration 4	Operation Real Product (Power <10% charging)	15 cm	Edge 4	1.63	0.1242

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	0.0924
		15 cm	Edge 1		0.1275
			Edge 2		0.1216
			Edge 3		0.1213
			Edge 4		0.1239
	Operation Real Product (Power 50~55% charging)	20 cm	Top	1.63	0.0923
		15 cm	Edge 1		0.1272
			Edge 2		0.121
			Edge 3		0.1208
			Edge 4		0.1238
	Operation Real Product (Power 90~95% charging)	20 cm	Top	1.63	0.0919
		15 cm	Edge 1		0.1272
			Edge 2		0.1216
			Edge 3		0.1212
			Edge 4		0.1233
Configuration 6	Operation Real Product (Power <10% charging)	15 cm	Edge 1	1.63	0.1253

6.2 FCC SUMMARYOF RESULTS

H-Field Limit		
FCC RF Exposure	Maximum meas data (A/m)	Percentage(%)
1.63	0.1275	7.97

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