

FCC 47 CFR § 2.1093

RF EVALUATION REPORT (Digitizer)

FOR

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

MODEL NUMBER: SM-F946U, SM-F946U1

FCC ID: A3LSMF946U

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Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	5/15/2023	Initial Issue	--
V2	5/24/2023	Revised model name in report. Revised SAR room and system date in Sec.8 Revised extremity SAR value due to Revised SAR report part.1.	Sunghoon.Kim

Table of Contents

1.	Attestation of SAR Characterization	4
2.	Test Specification, Methods and Procedures.....	5
3.	Facilities and Accreditation	5
4.	H-field Measurement System & Test Equipment.....	6
4.1.	H-field Measurement System.....	6
4.2.	H-field measurement & extrapolation using MAGpy probe.....	7
4.3.	Test Equipment	8
5.	Measurement Uncertainty.....	8
6.	DUT Informations	8
7.	RF Exposure Conditions (Test Configurations)	8
8.	System verification	9
9.	Test results	10
10.	TER analysis results	10
Appendixes	11	
	<i>4790748041-S7 FCC Report Digitizer evaluation _App A_ Test setup photos.....</i>	<i>11</i>
	<i>4790748041-S7 FCC Report Digitizer evaluation _App B_ Highest Magnetic field strength Test Plots</i>	<i>11</i>
	<i>4790748041-S7 FCC Report Digitizer evaluation _App C_ System verification Plots</i>	<i>11</i>
	<i>4790748041-S7 FCC Report Digitizer evaluation _App D_ Probe Cal. Certificates</i>	<i>11</i>
	<i>4790748041-S7 FCC Report Digitizer evaluation _App E_ Verification Source Cal. Certificates</i>	<i>11</i>

1. Attestation of SAR Characterization

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.
FCC ID	A3LSMF946U
Model Number	SM-F946U, SM-F946U1
Applicable Standards	FCC 47 CFR § 2.1093
Exposure Category	Magnetic field strength limit (A/m)
General population / Uncontrolled exposure	1.63
RF Exposure Conditions	The Highest Magnetic field strength (A/m)
	0.322
TER (Total Exposure Ratio)	0.967
Date Tested	3/28/2023, 4/5/2023
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:
	
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2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093.

- 447498 D04 Interim General RF Exposure Guidance v01

In addition to the above, the following information was used:

- [TCB workshop](#) April, 2022; Part18 and Wireless Power Transfer Updates (Part I)
- DASY8 Module WPT System Handbook (Manual)

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

Suwon
SAR 1 Room

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. H-field Measurement System & Test Equipment

4.1. H-field Measurement System

DASYsystem Module WPT - MAGPy is optimized for evaluation of compliance for wireless power transfer (WPT) systems and any other sources operating in the 3kHz - 10MHz frequency range. Module WPT V1.2 is compatible with the DASY 6 & 8 systems and in addition has been extended for easy evaluations of pulsed sources.



Figure 1.2.1: DASY8 Module WPT system

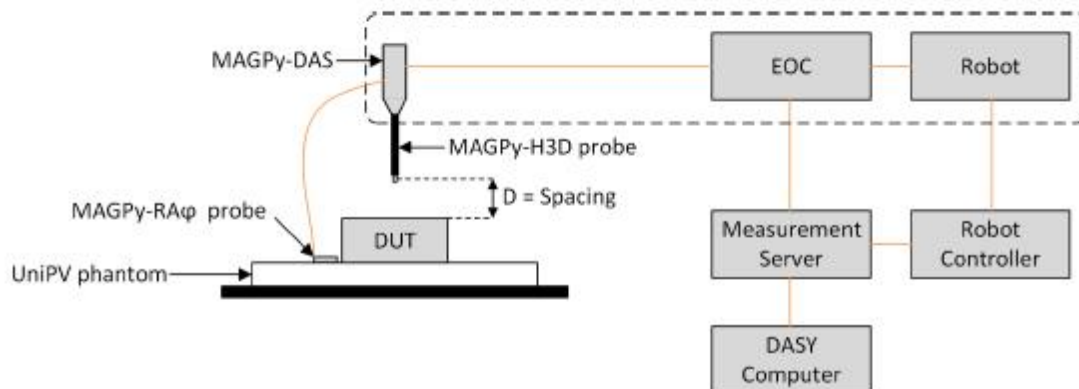


Figure : Typical measurement setup with DASY system Module WPT-MAGPy

DASYsystem Module WPT – MAGPy's Specifications

System	DASY8 Module WPT is composed of the isotropic probe MAGPy-H3D, the reference amplitude and phase probe (MAGPy-RAφ), and the data acquisition system (MAGPy-DAS) mounted to the DASY8 robot via the emergency stop (MAGPy-ES). The induced electric (E-) fields and specific absorption rate (SAR) are assessed with Sim4Life's Quasi-Static EM Solver (P-EM-QS) using only the measured data. The dedicated graphical user interface (GUI) fully automates the testing workflow.
MAGPy-H3D	The MAGPy-H3D probe consists of an isotropic H-field sensor (three concentric orthogonal loops): • Frequency range: 3 kHz – 10 MHz • Dynamic range: 0.1 A/m – 3200 A/m (0.12 μT – 4 mT) • Sensor size (loop): 1 cm² / Probe length: 335 mm • Probe tip diameter: 25 mm / Sensor center to tip: 6.6 mm
Software	Software components: • DASY8 Module WPT application programming interface (API) • MAGPy-DAS / Graphic library / Report generator • Sim4Life WPT (vector potential reconstruction, P-EM-QS solver)

4.2. H-field measurement & extrapolation using MAGpy probe.

MAGPy probe can measured H-field strength at 7mm distance from DUT's surface. And it is possible to Extrapolated the H-field strength of 0mm using Sim4Life WPT software.

So we can use this function for MAGPy probe to measure H-field strength radiating of digitizer's coil and check the 0mm H-field strength. In order to additionally verify the H-field strength Extrapolated method, we progress to test using Reference source(V-coil50/400) as follows and compared Measured H-field strength and Extrapolated H-field strength at 7mm separation distance from reference source.

(Test A is Measured H-field at 7mm & Extrapolated H-field at 0mm.

Test B is Measured H-field at 14mm & Extrapolated H-field at 7mm.

Test distance	Test A (at 7mm)	Test B (at 14mm)	Diviation(%)	Plot
Measured H-field	153.22	84.68	2%	1
Extrapolated H-field	286.00	156.00		2

Depending on the test results, the deviation between Measured H-field at 7mm and Extrapolated H-field at 7mm is 2 %. Therefore, DUT measurement proceeds using the function of that extrapolation method.

4.3. Test Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal Date	Cal. Due Date
Probe	SPEAG	MAGPy-H3D	2050	9-23-2022	9-23-2023
	SPEAG	MAGPy-DAS	2050	9-23-2022	9-23-2023
System verification Source	SPEAG	V-Coil50/400	1014	10-6-2022	10-6-2023

5. Measurement Uncertainty

Measurement uncertainty of the MAGPy-H3D Probe (3 kHz to 10 MHz)
(According to IEC/IEEE 63184)

Error Description	Unc. Value (± dB)	Prob. Distr.	Div.	<i>c_i</i>	Std. Unc. (± dB)
Probe uncertainty					
Amplitude calibration uncertainty	0.47	Normal	1	1	0.47
Probe anisotropy	0.50	Rectangular	1.732	1	0.29
Probe dynamic linearity	0.15	Rectangular	1.732	1	0.09
Probe frequency domain response	0.25	Rectangular	1.732	1	0.14
Gradient uncertainty	0.10	Rectangular	1.732	1	0.06
Parasitic E-field sensitivity	0.10	Rectangular	1.732	1	0.06
Detection limit	0.15	Rectangular	1.732	1	0.09
Readout electronics	0.00	Normal	1	1	0.00
Probe positioning	0.19	Normal	1	1	0.19
Repeatability	0.10	Normal	1	1	0.10
Combined Standard Uncertainty (k = 1)					0.63
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =					1.24

6. DUT Informations

Tech	Frequency bands	Mode (Scanning)	Description
Digitizer	531 kHz - 593 kHz	Global Scan	Digitizer scans display area around for finding Spen.
		Local Scan	When Digitizer find Spen's location during Global Scan, then Digitizer scans small area around Spen.

7. RF Exposure Conditions (Test Configurations)

RF Exposure Conditions	Mode (Scanning)	Separation distance of DUT's surface-to-Probe's element	Test Position
Product Specific 10-g	Global Scan	7 mm	Front
	Local Scan	7 mm	Front

Notes:

- Digitizer is generally not expected to be used in head & body-worn exposure conditions. It is considered in the Hand exposure condition because it is mainly used by holding it in the hand. And Digitizer's coils operates to radiated to display of DUT. So other surface or edges are not considered.
- Test distance 7mm means that distance between DUT's surface to Probe's element.
In fact, DUT's surface to Probe's tip are almost touched.

8. System verification



A set of four system verification sources (3kHz, 85kHz, 400kHz and 6.78 MHz) are available. According to the manufacturer's guide, the system verification was performed in the nearest frequency band with DUT's operate frequency. And The deviation of measured values from the target values of calibration report should be less than the expanded uncertainty (1.24 dB).

Reference Target SAR Values

The reference SAR values can be obtained from the calibration certificate of system validation dipoles.

Verification Source	Serial No.	Cal. Date	Cal.due date	Target Magnetic field strength (A/m)	
				Measured at 7mm	Extrapolated at 2mm
V-coil50/400	1014	10-6-2022	10-6-2023	158.56	245.00

System verification Results

SAR 1 Room

Date Tested	System Source		Measured at 7mm Results (A/m)		Delta (±dB)	Extrapolated at 2mm Results		Delta (±dB)	Plot No.
	Type	Serial #	Test results	Target		Test results	Target		
3-28-2023	V-coil50/400	1014	153.32	158.56	-0.15	247.00	245.00	0.04	1
4-5-2023	V-coil50/400	1014	150.84	158.56	-0.22	243.00	245.00	-0.04	2

Notes:

The deviation of measured values from the target values of calibration report should be less than the expanded uncertainty (1.24 dB).

9. Test results

Test mode	Test position	Magnetic field strength results (A/m)		Plot No.
		Measured at 7mm Results	Extrapolated at 0mm Results	
Global Scan	Front	0.041	0.052	1
Local Scan with Spen	Front	0.195	0.322	2

Notes:

1. In the case of Local scan, The Spen needs to be placed over the display of DUT, which limits the measurements as it will collide with the MAGPy probe during measuring surface. Therefore, in order to measure as closely as possible to the conditions of use, we proceeded with the measurement after fixing the Spen to the probe.
2. For Extrapolated Results, The result are estimated based on the measured Magnetic field strength at 7mm.

10. TER analysis results

SAR Simultaneous Transmission Analysis in Section 12.2.4 in SAR part.1 report

RF Exposure	Test Position	Highest SAR (W/kg)				Sum SAR (W/kg)
		AG0	AG1	ER (NFC)	ER (UWB)	AG0 + AG1 + ERs
Extremity (10-g SAR)	Rear	2.823	0.811	0.014	0.001	3.649
	Front	1.637	1.439	0.000	0.001	3.077
	Top	0.000	3.093		0.000	3.108
	Left	2.101	1.245	0.000		3.346
	Bottom	3.038	0.000	0.000		3.038
	Right	0.000	0.000			0.000

TER Analysis

RF Exposure	Test Position	SAR evaluation (AG0 + AG1 + ERs)		Magnetic field strength evaluation (Digitizer)		TER (Total Exposure Ratio)
		SAR (W/kg)	SAR's ER	Magnetic field strength (A/m)	Magnetic field strength's ER	
Extremity (10-g SAR)	Front	3.077	0.769	0.322	0.198	0.967

* SAR's ER = Meas SAR (W/kg) / SAR limit (4.0 W/kg) & Magnetic field strength's ER = Meas H-field (A/m) / H-field limit (1.63 A/m)

Notes:

For TER analysis, Simultaneous transmission SAR referred to Section 12.2.2 in SAR Part.1 report, and TER result should be less than 1.0.

Appendixes

Refer to separated files for the following appendixes.

4790748041-S7 FCC Report Digitizer evaluation _App A_Test setup photos

4790748041-S7 FCC Report Digitizer evaluation _App B_Highest Magnetic field strength Test Plots

4790748041-S7 FCC Report Digitizer evaluation _App C_System verification Plots

4790748041-S7 FCC Report Digitizer evaluation _App D_Probe Cal. Certificates

4790748041-S7 FCC Report Digitizer evaluation _App E_Verification Source Cal. Certificates

END OF REPORT