FCC 47 CFR § 2.1093

RF EVALUATION REPORT (SAR-WPT)
FOR

Wireless Charger

MODEL NUMBER: AT2604

FCC ID : ACJ932AT2604

REPORT NUMBER: S-4791839285-S1V2

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Prepared for

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IAS ACCREDITED

Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	2025-07-09	Initial Issue	--
V2	2025-08-01	Revised table in Sec. 6.1.	Sunghoon Kim

Table of Contents

1. Attestation of SAR Characterization

Applicant Name	Panasonic Automotive Systems Co., Ltd.
FCC ID	ACJ932AT2604
Model Number	AT2604
Applicable Standards	FCC 47 CFR § 2.1093 KDB 680106 D01 RF Exposure Wireless Charging Apps
Exposure Category	SAR Limit – 1g SAR (W/kg)
General population / Uncontrolled exposure	1.6
RF exposure conditions	The Highest Simulated SAR (W/kg)
SAR (=at 0 cm test distance)	0.02
Date Tested	2025-06-24 to 2025-06-27
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 Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093. the following FCC Published RF exposure
KDB procedures:

- 447498 D04 Interim General RF Exposure Guidance v01
- 680106 D01 Wireless Power Transfer v04

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

- TCB workshop April 2024; Part 18 and Wireless Power Transfer Devices
- DASY8 Modules WPT System Handbook (SW Module WPT V2.6)
- DASY8/6 Module WPT and SAR Application note

3. Facilities and Accreditation

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

Suwon
SAR 1 Room

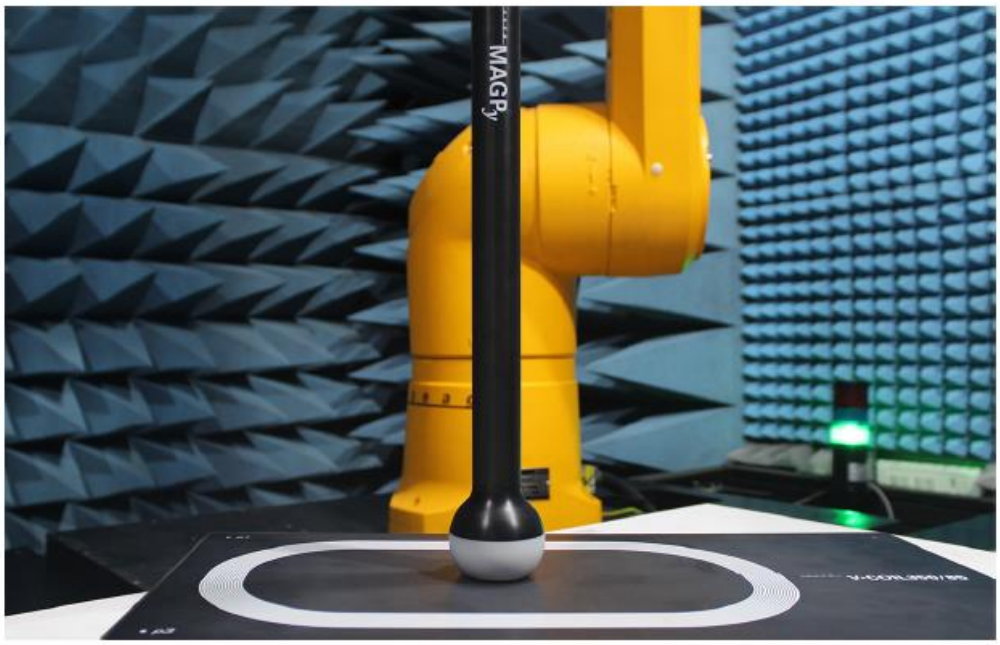
UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at;

https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. DASY module WPT Test System & Test equipment

4.1 E-field and H-field measurement System

DASY system 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 V2.6 is compatible with the DASY systems and in addition has been extended for easy evaluations of pulsed sources.



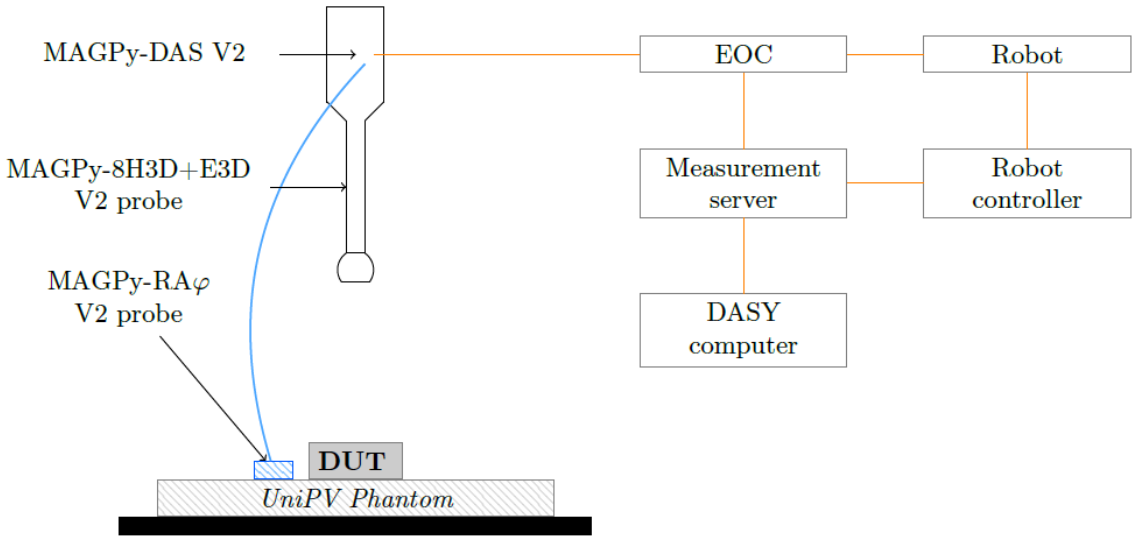


Figure : Typical measurement setup with DASY system Module WPT-MAGPy

DASYsystem Module WPT – MAGPy's Specifications

System	DASY8 Module WPT is composed of the isotropic probe MAGPy-8H3D+E3D Version 2, the reference probe (MAGPy-RAφ), and the data acquisition system (MAGPy-DAS) mounted to the DASY8 robot via the emergency stop (MAGPy-ES). It measures the incident electric and magnetic fields (E-Field, H-Field) in a volume from the surface of the DUT using advanced field reconstructions to obtain a high-resolution (mm range) field distribution. The induced electric (E-) field distributions and specific absorption rate (SAR) are assessed with Sim4Life's Quasi-Static EM Solver (P-EM-QS) using only the measured data. At each probe location, eight sets of isotropic H-field values and one set of isotropic E-field values are acquired in parallel. The dedicated graphical user interface (GUI) fully automates the testing workflow.
Applications	Laboratory evaluation of WPT systems and any other local electromagnetic source not requiring magnetic (H-) field volume scans exceeding 2000 mm × 1000 mm × 1500 mm: • Assessment of high-resolution H-field distribution (3 kHz – 10 MHz) • Assessment of high-resolution E-field distribution (3 kHz – 10 MHz) • Determination of the induced field and SAR distribution in the standard phantom (3 kHz – 4 MHz) • Demonstration of compliance (3 kHz – 4 MHz) with international standards and national regulations, e.g., IEC PAS 63184, FCC KDB 680106 D01, ISED Canada SPR-002
Basic Components	The basic components of DASY8/6 Module WPT are: Platform and DASY8 TX2-90XL Robot • DASY8 Measurement Server • EOC8 • Light-Beam Unit • Quick Adapter Change System (QACSV1) • DASY8 PC
MAGPy-DAS	The MAGPy-DAS includes: • 27 14-bit ADC channels with 25 MSPs • Peak detection stage • Hardware supervising unit • Data transfer to the backend • 22 tap FIR filter
MAGPy-RAφV2	Specifications of the MAGPy-RAφ reference amplitude and phase probe: • Frequency range: 3 kHz – 10 MHz • Dynamic range: 0.1 A/m – 3200 A/m (0.12 µT – 4 mT) • Loop coil area: 18.9 cm^2 • Sensor size: 51 mm x 51 mm x 0.2 mm

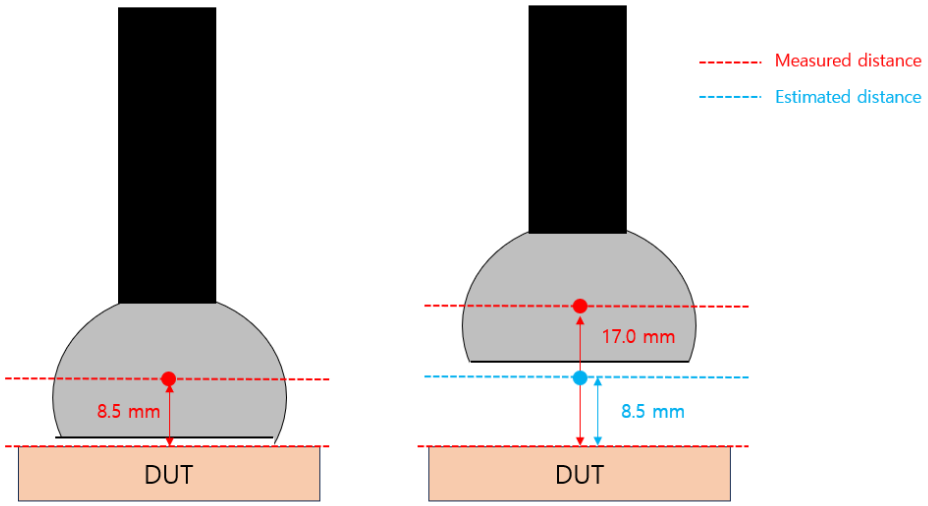
MAGPy-8H3D+E3D V2	The MAGPy-8H3D+E3D probe consists of eight isotropic H-field sensors and one isotropic E-field sensor: Probe design: • Probe length: 335 mm • Probe tip diameter: 60 mm • 8H3D: eight isotropic 1 cm^2-H-field sensors, arranged at the corners of a 22 mm cube • First H-field sensor plane: 7.5 mm from the probe tip • E3D: one isotropic E-field sensor (dipole / monopole) (arm length: 50mm) Sensor specifications: • Frequency range: 3 kHz – 10 MHz • H-field dynamic range: 0.1 A/m – 3200 A/m (0.12 µT – 4 mT) • H-field extrapolation uncertainty: 0.6 dB (k = 2) • E-field dynamic range: 0.08 V/m – 2000 V/m
Software	Software components: • DASY8 Module WPT application programming interface (API) • WPT /6backend • Jupyter Notebook GUI • Sim4Life plugin (vector potential reconstruction, P-EM-QS solver)

4.1.1 Incident E-field and H-field measurement & extrapolation using MAGPy probe.

MAGPy probe v2.6 can measured H-field strength at 8.5 mm distance from Probe sensor to DUT's surface. And it is possible to Extrapolated the H-field strength of 0.0 mm using Sim4Life WPT software.

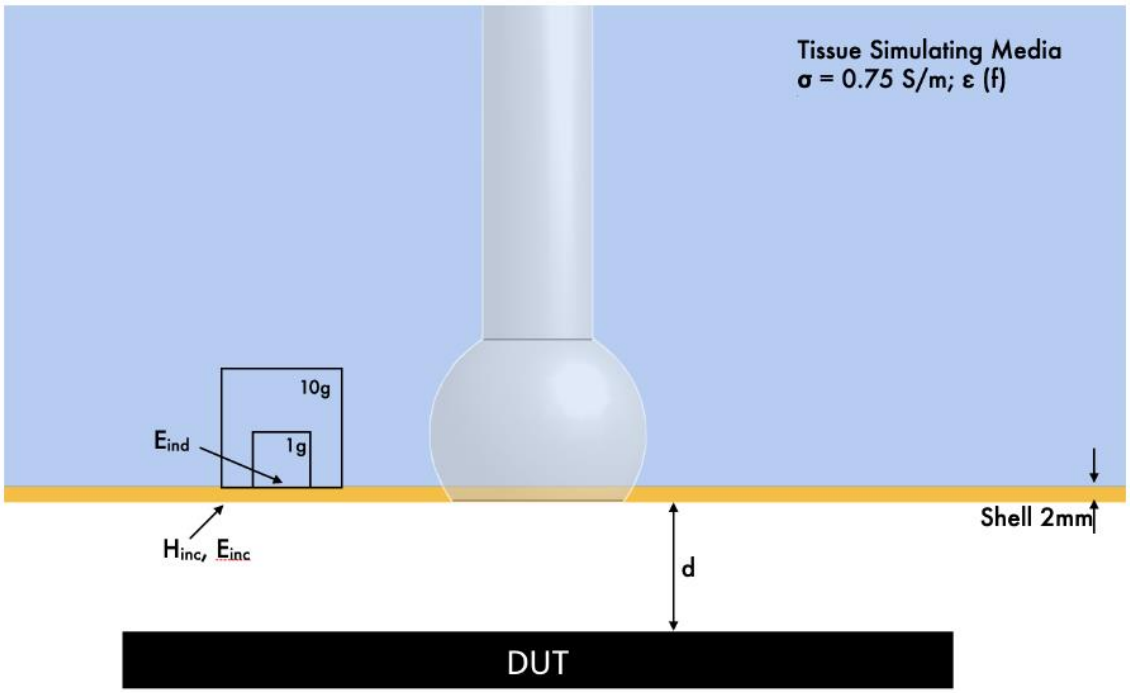
So we can use this function for MAGPy probe to measure H-field strength radiating of wireless charger's coil and check the 0mm H-field strength.

In order to additionally apply to estimated 0mm test data, we referred to Section 3.3 of KDB 680106 D01 v04 and compared to both measured data and estimated data at 8.5mm.



Both results should be within 30% at 8.5 mm distance according to KDB 680106 D01v04 guide.

4.2 Simulated SAR based on DASY module WPT S/W



Distance used in the tables for simulation and compliance evaluation results is defined as the spacing between the top surface of the DUT and the bottom surface of the fictive phantom shell (with a thickness of 2 mm). In this case, the evaluation is made at distance d. Typically d = 0, i.e., at the DUT surface. The evaluation locations of the incident E-/H-fields as well as the SAR are also illustrated.
Finally, SAR is simulated through incident E-/H-field.

4.3 Test Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal Date	Cal. Due Date
Probe	SPEAG	MAGPy-8H3D+E3D	3071	2024-07-04	2025-07-04
	SPEAG	MAGPy-DAS	2050	2024-07-04	2025-07-04
System verification Source	SPEAG	V-Coil350/85	1019	2024-10-18	2025-10-18

5. Measurement & Simulation Uncertainty

5.1 Incident E-/H-field Measurement Uncertainty

DASY8 Uncertainty Budget for Peak Incident H-field
according to IEC/IEEE 63184

Item	Error Description	Unc. Value (±dB)	Probab. Distr.	Div.	(c_i)	Std. Unc. (±dB)
Measurement system						
1	Amplitude calibration uncertainty	0.35	N	1	1	0.35
2	Probe anisotropy	0.6	R	$\sqrt{3}$	1	0.35
3	Probe dynamic linearity	0.2	R	$\sqrt{3}$	1	0.12
4	Probe frequency domain response	0.3	R	$\sqrt{3}$	1	0.17
5	Probe frequency linear interp. fit	0.15	R	$\sqrt{3}$	1	0.09
6	Spatial averaging	0.1	R	$\sqrt{3}$	1	0.06
7	Parasitic E-field sensitivity	0.1	R	$\sqrt{3}$	1	0.06
8	Detection limit	0.15	R	$\sqrt{3}$	1	0.09
9	Readout electronics	0	N	1	1	0
10	Probe positioning	0.19	N	1	1	0.19
11	Repeatability	0.1	N	1	1	0.10
12	Surface field reconstruction	0.3	N	1	1	0.3
Combined uncertainty ($k = 1$)						0.67
Expanded uncertainty ($k = 2$)						**1.33 (16.6%)**

DASY8 Uncertainty Budget for Incident E-field
according to IEC/IEEE 63184

Item	Error Description	Unc. Value (±dB)	Probab. Distr.	Div.	(c_i)	Std. Unc. (±dB)
Measurement system						
1	Amplitude calibration uncertainty	0.53	N	1	1	0.53
2	Probe anisotropy	0.8	R	$\sqrt{3}$	1	0.46
3	Probe dynamic linearity	1	R	$\sqrt{3}$	1	0.58
4	Probe frequency domain response	0.3	R	$\sqrt{3}$	1	0.17
5	Probe frequency linear interp. fit	0.15	R	$\sqrt{3}$	1	0.09
6	Parasitic H-field sensitivity	0.2	R	$\sqrt{3}$	1	0.12
7	Detection limit	0.15	R	$\sqrt{3}$	1	0.09
8	Readout electronics	0	N	1	1	0
9	Repeatability	0.1	N	1	1	0.10
Combined uncertainty ($k = 1$)						0.95
Expanded uncertainty ($k = 2$)						**1.89 (24.4%)**

Notes:

The uncertainties of Incident E/H field used the data provided by Equipment manufacturer.

5.2 1g SAR Simulation Uncertainty

DASY8 Uncertainty Budget for psSAR1 g
according to IEC/IEEE 63184

Item	Error Description	Unc. Value (±dB)	Probab. Distr.	Div.	(c_i)	Std. Unc. (±dB)
Measurement system						
1	Amplitude calibration uncertainty	0.35	N	1	1	0.35
2	Probe anisotropy	0.6	R	$\sqrt{3}$	1	0.35
3	Probe dynamic linearity	0.2	R	$\sqrt{3}$	1	0.12
4	Probe frequency domain response	0.3	R	$\sqrt{3}$	1	0.17
5	Probe frequency linear interp. fit	0.15	R	$\sqrt{3}$	1	0.09
6	Spatial averaging	0.1	R	$\sqrt{3}$	1	0.06
7	Parasitic E-field sensitivity	0.1	R	$\sqrt{3}$	1	0.06
8	Detection limit	0.15	R	$\sqrt{3}$	1	0.09
9	Readout electronics	0	N	1	1	0
10	Probe positioning	0.19	N	1	1	0.19
11	Repeatability	0.1	N	1	1	0.1
12	Surface field reconstruction	0.2	N	1	1	0.2
Numerical simulations						
13	Grid resolution	0.02	R	$\sqrt{3}$	1	0.01
14	Tissue parameters	0	R	$\sqrt{3}$	1	0
15	Exposure position	0	R	$\sqrt{3}$	1	0
16	Source representation	0.09	N	1	1	0.09
17	Convergence and power budget	0	R	$\sqrt{3}$	1	0
18	Boundary conditions	0.1	R	$\sqrt{3}$	1	0.06
19	Phantom loading/backscattering	0.1	R	$\sqrt{3}$	1	0.06
Combined uncertainty ($k = 1$)						0.63
Expanded uncertainty ($k = 2$)						**1.27 (33.9%)**

Notes:

The uncertainties of 1g SAR used the data provided by Equipment manufacturer.

6. DUT Information

This devices has WPT (Wireless Power Transfer) feature which has inductive charging coil to charge Phone within a vehicle. The charging frequencies are 120.3 kHz, 127.0 kHz and 127.5 kHz, and the maximum power consumption is 15.0 W in charging status. The test configuration is listed at Section 7.

SUPPORT EQUIPMENTS & PERIPHERALS

SUPPROT EQUIPMENT & PERIPHERALS LIST				
Depscription	Manufacturer	Charging Frequency (kHz)	Model	Serial Number
Oppo Find X3 pro (WPT client)	Guangdong OPPO Mobile Telecommunications Corp., Ltd.	110-148 kHz	CPH2173	A3755e09

6.1 KDB 680106 D01 General Considerations

Requirement	Device informations
(1) Power transfer frequency is less than 1 MHz	Yes. Operating Frequencies are 120.3 kHz,127.0 kHz and 127.5 kHz
(2) Output power from each primary coil is less than or equal to 15 Watts.	Yes. Maximum power is 15.0 Watts.
(3) Client device is placed directly in contact with the transmitter.	Yes.
(4) Mobile exposure(2.1091) condition or Portable exposure(2.1093) condition	Portable exposure condition (2.1093)
(5) E/H field measurement test distance.	0cm (using extrapolation).
(6) SAR simulation requirement (NUMSIM)	Yes. SAR simulation is required. (If MPE limit is not satisfy, then SAR simulation is alternative according to KDB 680106 D01.)

7. RF Exposure Conditions (Test Configurations)

RF Exposure Conditions	Test categories	Mode (Scanning)	Test Configurations	Internal E-field and SAR evaluation distance	DUT test Position	Note
SAR	Exposure from the WPT system during power transfer	Charging mode	WPT Source & WPT Client	0 cm	Above DUT / All edges	1
	Direct exposure from the WPT source	Charging mode	Only WPT Source	0 cm	Above DUT	2

Notes:

1. Charging mode with WPT client SAR tests performed at above DUT and all edges for users
2. For test of Direct exposure from the WPT source, Only charging mode without WPT client measured because this DUT does not support standby mode.

8. System verification

System check performed using 85/400kHz verification source according to test system and procedure Manufacturer guide(DASY8 Modules WPT System Handbook (SW Module WPT V2.6)). And The deviation of measured values from the target values of calibration report should be less than the expanded uncertainty.

Reference Values

The reference values can be obtained from the calibration certificate of system verification source.

Verification Source	Serial No.	Cal. Date	Cal.due date	Target values at 0mm distance		
				Measured/Extrapolated	Simulated (Local)	
				H-field (A/m)	Interanl E field (V/m)	1g SAR (W/kg)
V-coil350/85	1019	2024-10-18	2025-10-18	217.00	3.56	0.00711

System Verification Results

SAR 1 Room

Date Tested	System Source		H-field (A/m)		Deviation (±16.6%)	Internal E field (V/m)		Deviation (±18.2%)	1g SAR (W/kg)		Deviation (±33.9%)	Plot No.
	Type	Serial #	Test results	Target		Test results	Target		Test results	Target		
2025-06-24	V-coil350/85	1019	211.00	217.00	-2.76	3.57	3.56	0.28	0.00722	0.00711	1.55	
2025-06-27	V-coil350/85	1019	206.00	217.00	-5.07	3.41	3.56	-4.21	0.00660	0.00711	-7.17	1

Notes:

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

9. E/H Field Strength and 1-g SAR Results

Test mode	Charging Frequency (kHz)	Test configurations	Simulated Distance (cm)	Measured E_{inc} (V/m)	E_{inc} field Limit	Measured H_{inc} (A/m)	H_{inc} field Limit	1g SAR results (mW/kg)	1g SAR results (W/kg)	FCC SAR Limit (W/kg)	Plot No.
Charging Mode with Client	120.3	Above DUT	0.0	34.60	614	8.06	1.63	0.001	0.000001	1.6	
		Left edge	**0.0**	**4.02**	614	**11.60**	1.63	**0.002**	**0.000002**		1
		Right edge	0.0	3.53	614	6.88	1.63	0.001	0.000001		
		Top edge	0.0	4.76	614	0.32	1.63	0.000	0.000000		
		Bottom edge	0.0	2.70	614	0.72	1.63	0.000	0.000000		
	127.0	Above DUT	0.0	23.80	614	7.51	1.63	0.001	0.000001		
		Left edge	0.0	4.37	614	7.77	1.63	0.001	0.000001		
		Right edge	**0.0**	**4.28**	614	**12.10**	1.63	**0.003**	**0.000003**		2
		Top edge	0.0	4.84	614	0.59	1.63	0.000	0.000000		
		Bottom edge	0.0	7.51	614	2.70	1.63	0.000	0.000000		
	127.5	Above DUT	0.0	34.30	614	8.58	1.63	0.001	0.000001		
		Left edge	0.0	4.84	614	11.40	1.63	0.002	0.000002		
		Right edge	**0.0**	**3.37**	614	**15.40**	1.63	**0.005**	**0.000005**		3
		Top edge	0.0	2.46	614	0.70	1.63	0.000	0.000000		
		Bottom edge	0.0	1.65	614	0.20	1.63	0.000	0.000000		
Charging Mode without Client	120.3	**Above DUT**	**0.0**	**118.00**	**614**	**1559.00**	1.63	**23.8**	**0.023800**	1.6	4
	127.0	Above DUT	0.0	95.80	614	1250.00	1.63	16.5	0.016500		
	127.5	Above DUT	0.0	104.00	614	1273.00	1.63	17.2	0.017200		

Additional test for Extrapolation method verification

Test mode	Charging Frequemcy (kHz)	Test positon	Test distance	Magnetic field strength results (A/m)		Deviation (%)	Note	Plot No.
				Measured Result at 8.5 mm	Extrapolated Result at 8.5 mm			
Charging Mode with Client	120.3	Left edge	8.5 mm	6.01		14.3	2	1
		Left edge	17.0 mm		6.87			5
	127.0	Right edge	8.5 mm	6.02		-1.0		2
		Right edge	17.0 mm		5.96			6
	127.5	Right edge	8.5 mm	8.13		-5.4		3
		Right edge	17.0 mm		7.69			7
Charging Mode without Client	120.3	Above DUT	8.5 mm	787.11		-18.1		4
		Above DUT	17.0 mm		645.00			8

Notes:

1. Simulated SAR Results at 0mm are satisfied within FCC SAR limit
2. For Additional test Guidance, It was confirmed that the deviation between Measured H-field and Estimated H-field was within 30% at 8.5mm test distance according to KDB 680106 D01v04 guide.

Appendixes

Refer to separated files for the following appendixes.

S-4791839285-S1 FCC SAR App A Test photos

S-4791839285-S1 FCC SAR App B Test Plots

S-4791839285-S1 FCC SAR App C System Plots

S-4791839285-S1 FCC SAR App D Probe Certi

S-4791839285-S1 FCC SAR App E Source Certi

END OF REPORT