FCC Part 1 Subpart I
FCC Part 2 Subpart J

TEST REPORT

FOR

WIRELESS CHARGER PAD MODULE

MODEL NO: 52192780

REPORT NUMBER: R13640973-S1

ISSUE DATE: 2021-07-30

Prepared for
FLEX AUTOMOTIVE
27755 STANSBURY BLVD STE 300
FARMINGTON HILLS, MI, 48334

Prepared by
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ACCREDITED
CERT #0751.06

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2021-07-30	Initial Issue	---

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Flex Automotive
27755 Stansbury Blvd Ste 300
Farmington Hills, MI, 48334

EUT DESCRIPTION: Wireless Charger Pad Module

MODEL NUMBER: 52192780

SERIAL NUMBER: 00043

DATE TESTED: 2021-06-22 – 2021-06-28

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For
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2. TEST METHODOLOGY

All testing / calculations were made in accordance with FCC KDB 447498 D01, KDB 447498 D03, KDB 680106 D01 v03r01 and FCC OET Bulletin 65 Edition 97-01.

3. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Laboratory Cert #0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
☒	Building: 2800 Perimeter Park Dr, Suite B Morrisville, NC 27560, U.S.A		27265	

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. DECISION RULES

For all tests where the applicable U_{LAB} <= U_{MAX} the Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2, where U_{MAX} = 30% (0.3) for RF Exposure evaluations. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

For all tests where the applicable U_{LAB} > U_{MAX} the Decision Rule is based on Guarded Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.3.2, with a guard band equal to (U_{LAB} – U_{MAX}), where U_{MAX} = 30% (0.3) for RF Exposure evaluations. (Test results are adjusted by the value of the guard band to determine conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{Lab}	U_{MAX}
Magnetic Field Measurement	+/- 0.8 dB (20.2%)	30%
Electric Field Measurement	+/- 0.91 dB (23.3%)	30%

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a wireless charging pad module. The WPT frequency of operation is 127.66 kHz. The EUT includes 3 charging coils, however only a single coil is active at a given time. The coil activated is based on the alignment with the load's coil.

5.2. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	T450	PC-0A2UQS	PD97265NGU
Charger	Lenovo	ADLX45NDC2A	8SSA10E75790D1SG68B054C	NA
APG LIN Serial Analyzer	Microchip	NA	BUR203812178	NA
DC Power Supply	Keysight	E3633A	MY58426145	NA

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	1	1	USB	Shielded	<3m	Control of test sample

TEST SETUP

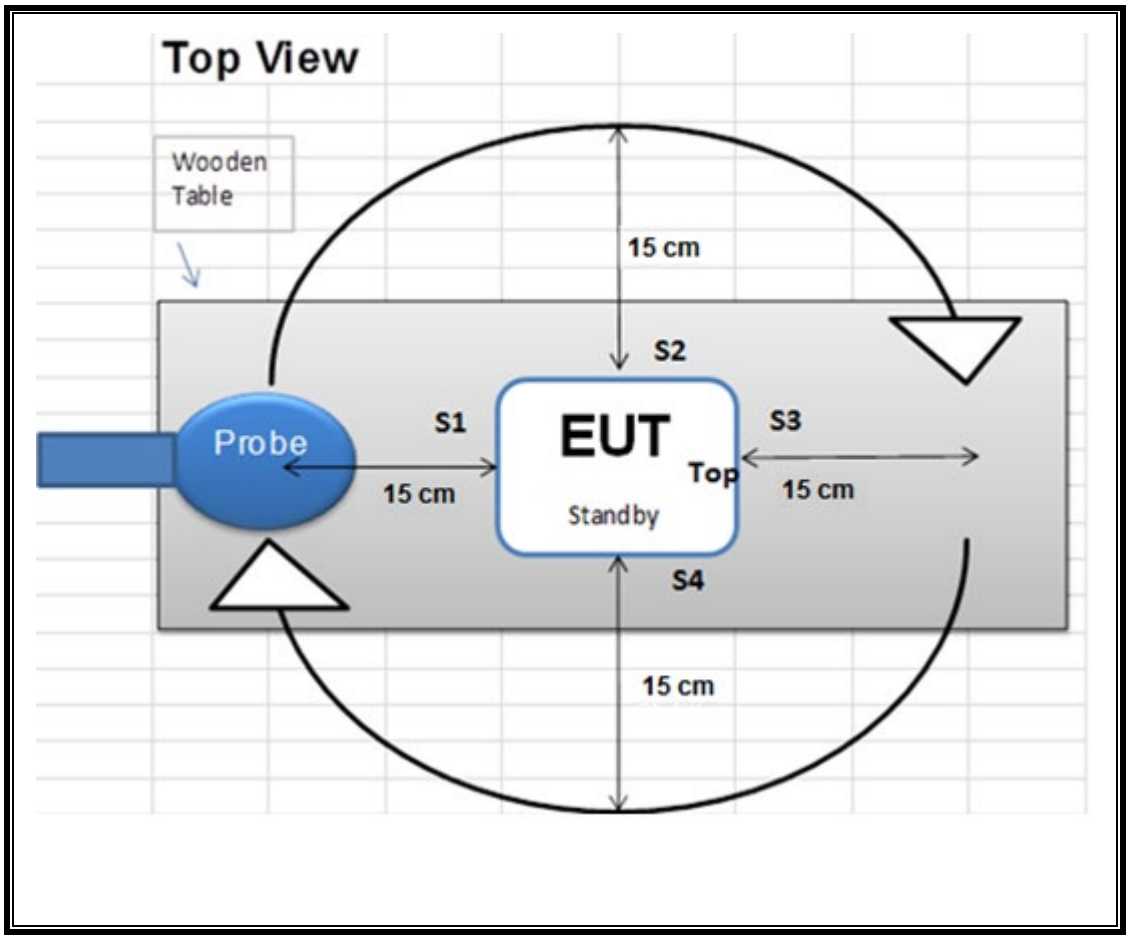
The following configurations are tested. The EUT is normally powered by vehicle battery supply; a laboratory DC supply was used for testing.

Configuration	Mode	Descriptions
1	Standby (< 10% Power Detecting)	EUT alone powered by DC supply
2	Operating on Coil 0 (With load) Note: Measurements were made when the load was set to a state of 0.5 W, 5W and 15W	EUT powered by DC supply
3	Operating on Coil 1 (With load) Note: Measurements were made when the load was set to a state of 0.5 W, 5W and 15W	EUT powered by DC supply
4	Operating on Coil 2 (With load) Note: Measurements were made when the load was set to a state of 0.5 W, 5W and 15W	EUT powered by DC supply

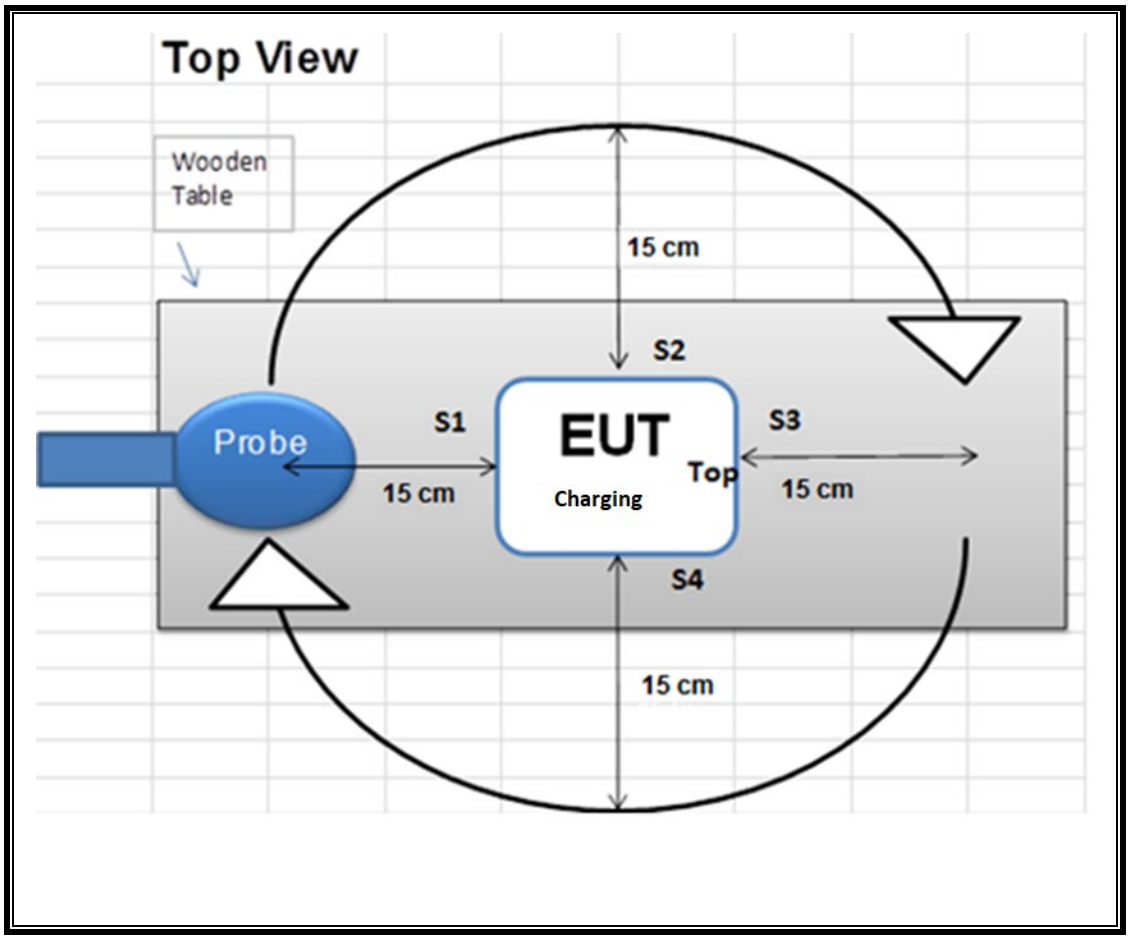
MEASUREMENT SETUP

The measurement was taken using a probe placed 15cm surrounding the device and 20cm above the top surface of the EUT. Measurements were taken from the top and all sides of the EUT per KDB 680106 D01 v04.

CONFIGURATION 1



CONFIGURATIONS 2-4



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment were used for the tests documented in this report:

Test Equipment List					
Description	**Manufacturer**	**Model**	**Equip. ID**	**Cal Date**	**Cal Due**
Electric and Magnetic Field Probe	Narda	EHP-200AC	FA0001	2020-07-14	2021-07-14
Spectrum Analyzer	Agilent	E4446A	T177	2021-05-19	2022-05-19

7. DUTY CYCLE

LIMITS

None; for reporting purposes only.

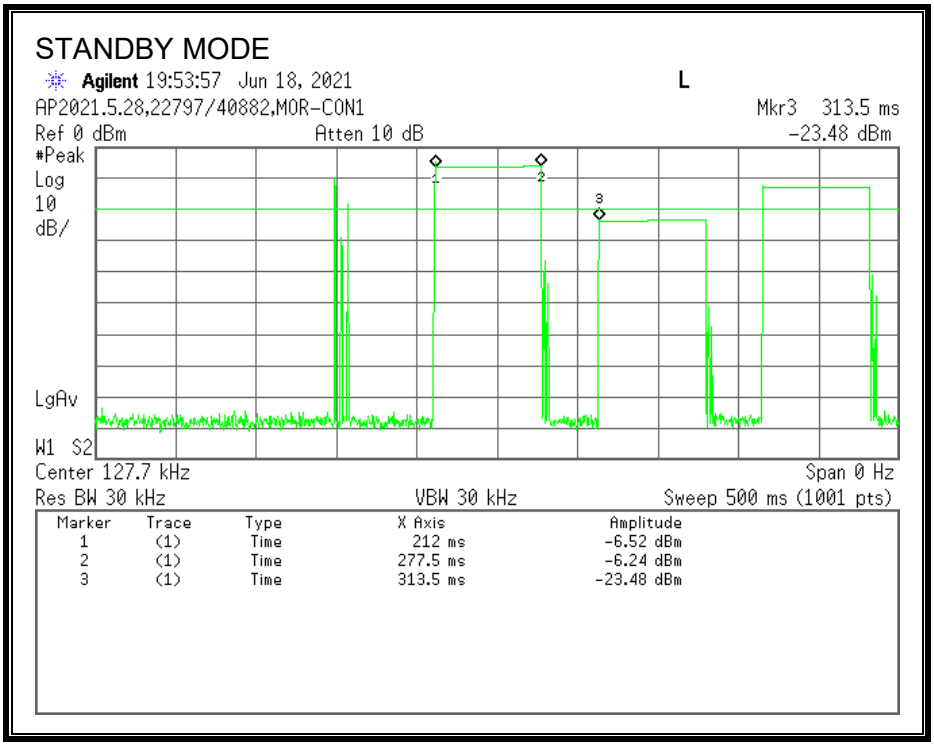
PROCEDURE

Zero-Span Spectrum Analyzer Method.

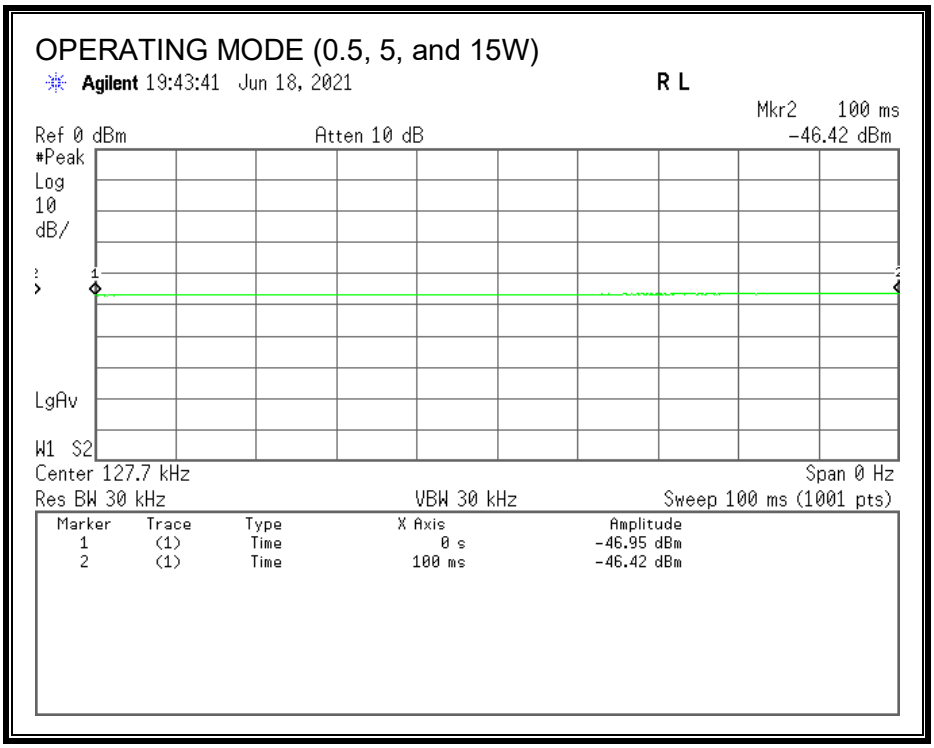
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)
Standby (Config 1)	65.50	101.50	0.6453	64.53%
Operating(Config 2)	100.00	100.00	1.00	100.00%

STANDBY MODE



OPERATING MODE (0.5, 5, and 15W)



8. MAXIMUM PERMISSIBLE RF EXPOSURE TEST RESULTS

8.1. 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.

8.2. SUMMARY OF TEST RESULTS

RESULTS

ID:	84740 / 21193	Date:	2021-06-22 – 2021-06-28

Note: Both magnetic and electric field strengths have been investigated from 9 kHz to 30 MHz at 15cm surrounding the device and 20cm above the top surface of the EUT operation frequency at 127.66 kHz.

The inductive wireless power transfer device meets all of the following requirements:

☒ Power transfer frequency is less than 1 MHz
☒ Output power from each primary coil is less than or equal to 15 watts.
☒ 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.
☒ Client device is placed directly in contact with the transmitter.
☒ Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).
☐ 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.

FCC RF Exposure Summary of Results

Electric Field			Magnetic Field		
FCC Limit (V/m)	Maximum Average Reading (V/m)	Percentage (%)	FCC Limit (A/m)	Maximum Average Reading (A/m)	Percentage (%)
614	18.220	2.97%	1.63	1.618	99.26%

Note: since the H field is higher than the limit by more than 50% of the limit, a PAG is required.

8.3. DETAILED TEST RESULTS

E- FIELD AND 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 values: [Field Strength x √Duty Cycle].

Config	Test Mode	Meas Dist (cm)	E field Limit (V/m)	Electric Field Reading (V/m)				Magnetic Field Limit (A/m)	Magnetic Field Reading (A/m)			
			FCC	Location	Peak	Duty Cycle %	FCC Average	FCC	Location	Peak	Duty Cycle %	FCC Average
1	Standby	15 cm surrounding the device (S1 - S4) and 20 cm above the top surface of the EUT	614	S1	4.536	64.53	3.644	1.63	S1	0.298	64.53	0.240
				S2	3.375		2.711		S2	0.777		0.624
				S3	4.869		3.911		S3	0.299		0.240
				S4	2.820		2.266		S4	0.740		0.594
				Top	5.984		4.807		Top	0.962		**0.773**
				Max	5.984		4.807		Max	0.962		**0.773**
2 - Coil 0	Operating Power 0.5W			S1	14.448	100.00	14.448		S1	0.157	100	0.157
				S2	6.798		6.798		S2	0.197		0.197
				S3	10.582		10.582		S3	0.195		0.195
				S4	5.850		5.850		S4	0.015		0.015
				Top	16.665		16.665		Top	0.052		0.052
				Max	16.665		16.665		Max	0.197		0.197
	Operating Power 5W			S1	15.705	100.00	15.705		S1	0.200	100	0.200
				S2	7.849		7.849		S2	0.208		0.208
				S3	10.544		10.544		S3	0.201		0.201
				S4	5.858		5.858		S4	0.015		0.015
				Top	16.651		16.651		Top	0.051		0.051
				Max	16.651		16.651		Max	0.208		0.208
	Operating Power 15W			S1	18.220	100.00	**18.220**		S1	0.191	100	0.191
				S2	9.013		9.013		S2	0.209		0.209
				S3	10.587		10.587		S3	0.194		0.194
				S4	5.875		5.875		S4	0.023		0.023
				Top	16.591		16.591		Top	0.048		0.048
				Max	18.220		**18.220**		Max	0.209		0.209

Config	Test Mode	Meas Dist (cm)	E field Limit (V/m)	Electric Field Reading (V/m)				Magnetic Field Limit (A/m)	Magnetic Field Reading (A/m)			
			FCC	Location	Peak	Duty Cycle %	FCC Average	FCC	Location	Peak	Duty Cycle %	FCC Average
3 - Coil 1	Operating Power 0.5W Charging	15 cm surrounding the device (S1 - S4) and 20 cm above the top surface of the EUT	614	S1	9.771	100.00	9.771	1.63	S1	0.358	100	0.358
				S2	4.583		4.583		S2	0.663		0.663
				S3	9.873		9.873		S3	0.444		0.444
				S4	8.147		8.147		S4	1.091		1.091
				Top	15.734		15.734		Top	0.197		0.197
				Max	15.734		15.734		Max	1.091		1.091
	Operating Power 5W Charging			S1	10.327	100.00	10.327		S1	0.431	100	0.431
				S2	4.812		4.812		S2	0.652		0.652
				S3	9.860		9.860		S3	0.445		0.445
				S4	8.101		8.101		S4	1.092		1.092
				Top	15.825		15.825		Top	0.198		0.198
				Max	15.825		15.825		Max	1.092		1.092
	Operating Power 15W Charged			S1	11.278	100.00	11.278		S1	0.557	100	0.557
				S2	5.230		5.230		S2	0.638		0.638
				S3	9.938		9.938		S3	0.454		0.454
				S4	8.238		8.238		S4	1.093		**1.093**
				Top	15.853		**15.853**		Top	0.197		0.197
				Max	15.853		**15.853**		Max	1.093		**1.093**
4 - Coil 2	Operating Power 0.5W Charging	15 cm surrounding the device (S1 - S4) and 20 cm above the top surface of the EUT	614	S1	12.356	100.00	12.356	1.63	S1	0.410	100	0.410
				S2	9.185		9.185		S2	1.149		1.149
				S3	9.934		9.934		S3	0.344		0.344
				S4	4.447		4.447		S4	0.717		0.717
				Top	17.474		17.474		Top	0.313		0.313
				Max	17.474		17.474		Max	1.149		1.149
	Operating Power 5W Charging			S1	16.669	100.00	16.669		S1	0.394	100	0.394
				S2	10.149		10.149		S2	1.198		1.198
				S3	9.943		9.943		S3	0.347		0.347
				S4	4.427		4.427		S4	0.716		0.716
				Top	17.455		17.455		Top	0.226		0.226
				Max	17.455		17.455		Max	1.198		1.198
	Operating Power 15W Charged			S1	17.860	100.00	**17.860**		S1	0.379	100	0.379
				S2	16.576		16.576		S2	1.618		**1.618**
				S3	9.963		9.963		S3	0.358		0.358
				S4	4.430		4.430		S4	0.721		0.721
				Top	17.476		17.476		Top	0.226		0.226
				Max	17.860		**17.860**		Max	1.618		**1.618**