

RF Exposure Lab

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CERTIFICATE OF COMPLIANCE RF EXPOSURE EVALUATION

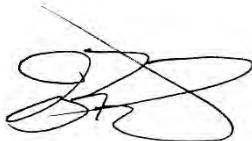
Intuitive Surgical, Inc.
1020 Kifer Road
Sunnyvale, CA 94086

Dates of Test: March 7-8, 2024
Test Report Number: SAR.20240303
Lab Designation Number: US1195

FCC ID:	2AAZF-SCWX01
Model(s):	SCWCX01
Serial Number:	FVN22280098
Equipment Type:	Wireless Power Transfer
Classification:	WPT Transmitter
TX Frequency Range:	120-148.5 kHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	120 kHz – -21.73 dBm EIRP
Signal Modulation:	FSK
Antenna Type:	Internal
Application Type:	Certification
Standard(s):	KDB680106 D01 v04
Maximum E-Field	61.53 V/m
Maximum H-Field	1.60 A/m
Distance to Probe:	0 mm

This wireless mobile device has been shown to meet the requirements for RF exposure testing for uncontrolled environment/general exposure limits specified in above listed standards. The device has also been shown to meet the simultaneous requirements of each standard as well (See test report).

I attest to the accuracy of the data. I assume full responsibility for the completeness of these calculations and vouch for the qualifications of all persons making them.



Jay M. Moulton
Vice President



Testing Certificate # 2387.01

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Comment/Revision	Date
Original Release	March 11, 2024

1. Introduction

This report shows the RF exposure evaluation of the Intuitive Surgical, Inc. Model SCWCX01 Wireless Power Transfer with KDB680106 D01 v04.

2. Radiation Sources

Radio	Description	
FSK	Frequency (MHz)	120-148.5 kHz
	Maximum Power (dBm)	-21.73 dBm (EIRP)
	Maximum Duty Cycle (%)	100%

3. SCWCX01

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4. RF Exposure Classifications

Device Types	
Fixed	A fixed device is defined as a device physically secured at one fixed location and cannot be easily re-located.
Mobile	A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.
Portable	A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

Exposure Categories	
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.
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 cannot exercise control over their exposure.

5. RF Exposure Limits

FCC Requirements

The RF exposure limits, as set forth in § 1.1310, do not cover the frequency range below 100 kHz for Specific Absorption Rate (SAR) and below 300 kHz for Maximum Permitted Exposure (MPE). In addition, present limitations of RF exposure evaluation systems prevent an accurate evaluation of SAR below 4 MHz. For these reasons, a specific MPE-based RF Exposure compliance procedure for devices operating in the aforementioned low-frequency ranges has been set in place. This procedure is applicable to Equipment Authorization of all RF devices, thus including, but not limited to, Part 18 and WPT devices.

Accordingly, for § 2.1091-Mobile devices, the MPE limits between 100 kHz to 300 kHz are to be considered the same as those at 300 kHz in Table 1 of § 1.1310, that is, 614 V/m and 1.63 A/m, for the electric field and magnetic field, respectively. For § 2.1093-Portable devices below 4 MHz and down to 100 kHz, the MPE limits in § 1.1310 (with the 300 kHz limit applicable all the way down to 100 kHz) can be used for the purpose of equipment authorization in lieu of SAR evaluations.

ECP CONTENT

Table 1 to § 1.1310(e)(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)
(i) Limits for Occupational/Controlled Exposure				
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
300–1,500			f/300	<6
1,500–100,000			5	<6
(ii) 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
30–300	27.5	0.073	0.2	<30
300–1,500			f/1500	<30
1,500–100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Note: For frequencies below 300 MHz, use the limits at 300 MHz.

6. General Conditions

- This report is only in reference to the item that has undergone the assessment.
- This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.

7. Environmental Conditions

The following limits were not exceeded during the test:

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative Humidity	Min. = 30%
	Max. = 60%

8. Test Equipment

	Serial Number	Last Cal. Date	Cal. Due Date
• Wavecontrol SMP2	19SN1179	04/13/2022	04/13/2024
• WP400-3	19WP120054	04/13/2022	04/13/2024
• Positioning Apparatus used is a plastic tripod to hold the meter and probe at a specified position with a horizontal mechanism for moving the probe away from the source at 10 mm increments			

9. EUT Description

The description of the antenna is listed below

- There is one antenna in the device
- The element is a 12 turn coil antenna with an impedance of 10 μ H
- The shielding or field shaping is not applicable
- The overall dimensions of the device is 78 cm x 12 cm x 2.3 cm
- The distance from the antenna to the outside of the enclosure is 2 cm
- The position of the antenna in the device is located on the left side of the armrest of the Surgeon Console
- The enclosure over the antenna is silicon and the enclosure over the PCB is metal

10. RF Exposure Evaluation Results

The load was kept 6 mm from the radiating antenna with a low loss dielectric plastic spacer. The measurements for the SCWCX01 was conducted at 20 mm distance from the device to the center of the probe diameter. A pre-scan of the around the antenna was conducted first by moving the probe around all areas of the device being tested. The movement was conducted at a very slow pace to find the peak value for the device. Once the peak position was determined for the device, the meter and probe were installed on the positioning apparatus for conducting the final measurements.

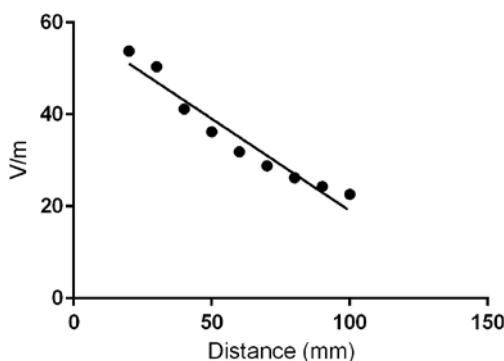
The highest value of the device was then tested every 10 mm moving away from the antenna. All the values were used to extrapolate to the 0 mm distance. The equation used to extrapolate the value to zero is $y = mx + b$, where x is the independent variable, y is the dependent variable, m is the estimated slope and b is the estimated intercept. Below are all the measured values for the e- and h-field.

E-Field		H-Field	
Distance	Meas. Value	Distance	Meas. Value
20 mm	53.78 V/m	20 mm	1.52 A/m
30 mm	50.37 V/m	30 mm	1.31 A/m
40 mm	41.19 V/m	40 mm	1.22 A/m
50 mm	36.23 V/m	50 mm	1.15 A/m
60 mm	31.89 V/m	60 mm	1.11 A/m
70 mm	28.83 V/m	70 mm	1.04 A/m
80 mm	26.24 V/m	80 mm	0.99 A/m
90 mm	24.31 V/m	90 mm	0.93 A/m
100 mm	22.63 V/m	100 mm	0.87 A/m

The slope for the E-Field calculates to be -0.4001 ± 0.03775 .

The Y-intercept for the E-Field calculates to be 59.06 ± 2.466 .

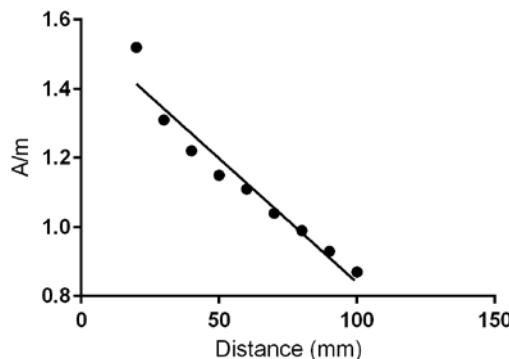
Below is the scatter plot for all the measurements.



The slope for the H-Field calculates to be -0.007183 ± 0.0006726 .

The Y-intercept for the H-Field calculates to be 1.558 ± 0.04393 .

Below is the scatter plot for all the measurements.



The following table shows the maximum value of the device in both the H-Field and E-Field requirement with the limit. The value is the extrapolated value at 0 mm listed in the tables including the tolerance.

Frequency	E-Field Measurement				Max [V/m]	Limit [V/m]	% Limit	Verdict
	Front	Back	Top	Bottom				
115-150 kHz	61.53	10.56	9.59	9.96	61.53	614	10.0	Pass

Frequency	H-Field Measurement				Max [A/m]	Limit [A/m]	% Limit	Verdict
	Front	Back	Top	Bottom				
115-150 kHz	1.60	0.326	0.492	0.411	1.60	1.63	98.2	Pass

Appendix A – Calibration Certificates



Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number 220411-085519-f52052



Model Number WP400-3; SMP2
Manufacturer Wavecontrol
Description Field Probe
Serial Number 19WP120054; 19SN1179
Customer Asset No. N/A

Customer
RF Exposure Lab, LLC
802 N. Twin Oaks Valley Rd
Suite 105
San Marcos, CA 92069
USA

Date of Calibration 04/13/2022
Temperature 23°C
Humidity 48% RH

Location of Calibration
Keysight Technologies Inc.
1346 Yellowwood Road
Kimballton, IA 51543
United States

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.

Calibration Standard(s)
IEEE Std 1309-2013

Calibration Method(s)
Substitution

Calibration Procedure(s)
909579

Calibration Software
Probe Comparison 1.4.1

As Received Conditions

The measured values of the equipment were observed in specification at the points tested.

Action Taken

No action was taken.

As Completed Conditions

The measured values of the equipment were observed in specification at the points tested.

Calibration Due

Based on the customer's request, the next calibration is due on 13 Apr 2024

Remarks or Special Requirements

This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

Keysight Technologies, Inc.
1346 Yellowwood Road
Kimballton, IA 51543
United States

Issue Date 14 Apr 2022


Brandt Langer Iowa Service Center Manager

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Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number 220411-085519-f52052



Traceability Information

Technician Name Dave Grabill

Measurements are traceable to the International System of Units (SI) via national metrology institutes (www.keysight.com/find/NMI) that are signatories to the CIPM Mutual Recognition Arrangement.

Calibration Equipment Used

Manufacturer	Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
Agilent Technologies, Inc.	33250A	Function/Arbitrary Waveform Generator	11101	06/03/2022	210602-130008-794ded
AR	350AH1	Amp	11453	NA	NA
Crown	5002VZ	Amp	11069	NA	NA
EMCO	5101	TEM Cell	10420	NA	2003121920
Hewlett-Packard	8564E	Spectrum Analyzer	10029	06/02/2022	210527-143459-612042
Combinova	FD1	Field Detector	10348	01/31/2023	220104-091355-ad0560
Combinova	FD2	Field Detector	10347	02/28/2023	220201-110452-66d607
Schwarzbeck Mess-Elektronik	FESP 5133-7/41	Loop	11285	10/31/2022	211018-135220-351697
Schwarzbeck Mess-Elektronik	HHS 5204-12	Helmholtz Coil	11091	NA	NA
Holaday	HI-3624	ELF Magnetic Field Meter	10569	09/30/2022	210901-094617-c4f116
Holaday	HI-3627	ELF Magnetic Field Meter	10570	03/31/2023	220309-140426-5aaae9

Compliance with Specification

Unless otherwise noted, the calibration results are reported without factoring in the effect of uncertainty on the assessment of compliance/specification.

In Specification/Out of Specification Explanation

The standard criteria to determine the "In Specification/Out of Specification" status is based on one or more of the following conditions, as requested by the client:

1. If the manufacturer has a specified specification for the item being calibrated, then the calibration values are compared to this specification, and the values must fall within the manufacturer's specification. The specification may be obtained from the manufacturer's web site, data sheets, equipment manuals, etc.
2. Where specifications are called out in a published standard, the calibration results are compared to this specification, and the measured values must fall within the standard's specification.
3. In cases where the manufacturer, standard, or client does not identify any relevant specifications, applicable calibration results are compared to historical data with a +/- 3 dB specification.

Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008(GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Parameter	Range	MU (+/-)
Magnetic Field Strength Meters - AC	0.20 mG to 20 G	0.33% + 1.2 mG

Customer Name: RF Exposure Lab, LLC

Probe Manufacturer: Wavecontrol

Probe Model: WP400-3; SMP2

Probe Serial No.: 19WP120054; 19SN1179

Notes:

CAL CERT #: 220411-085519-f52052

Electric Field

Linearity - 50Hz

E Field (V/m)	X axis CF	X axis dB	Y axis CF	Y axis dB	Z axis CF	Z axis dB	Mean
800	1.05	0.41	1.04	0.34	1.04	0.35	1.04
750	1.04	0.32	1.04	0.33	1.03	0.27	1.04
500	1.04	0.30	1.03	0.22	1.02	0.18	1.03
250	1.04	0.32	1.04	0.35	1.04	0.32	1.04
100	1.01	0.09	1.03	0.29	0.99	-0.05	1.01
50	1.03	0.22	1.03	0.30	1.03	0.23	1.03
20	1.01	0.05	1.04	0.32	1.04	0.31	1.03

Frequency Response

25Hz-100kHz: 750V/m / 10Hz, 200-400kHz: 300V/m

Freq Hz	X axis CF	X axis dB	Y axis CF	Y axis dB	Z axis CF	Z axis dB	Mean
10	1.31	2.37	1.30	2.31	1.31	2.37	1.31
25	1.14	1.16	1.16	1.26	1.15	1.23	1.15
50	1.06	0.54	1.07	0.56	1.07	0.61	1.07
100	1.09	0.77	1.09	0.77	1.10	0.83	1.10
500	1.10	0.82	1.09	0.72	1.10	0.81	1.09
1000	1.10	0.82	1.09	0.71	1.10	0.83	1.10
2000	1.18	1.44	1.17	1.33	1.17	1.39	1.17
10000	1.07	0.57	1.05	0.45	1.07	0.57	1.06
100000	1.07	0.56	1.06	0.50	1.06	0.48	1.06
200000	1.00	0.04	1.00	0.03	1.00	0.02	1.00
300000	1.05	0.44	1.05	0.46	1.05	0.43	1.05
400000	1.06	0.51	1.03	0.27	1.06	0.48	1.05

Customer Name: RF Exposure Lab, LLC

Probe Manufacturer: Wavecontrol

Probe Model: WP400-3; SMP2

Probe Serial No.: 19WP120054; 19SN1179

Notes:

CAL CERT #: 220411-085519-f52052

Magnetic Field

Linearity - 50Hz							
B Field (uT)	X axis CF	X axis dB	Y axis CF	Y axis dB	Z axis CF	Z axis dB	Mean
2000	1.00	0.02	1.00	0.00	1.00	0.00	1.00
1500	0.97	-0.26	0.96	-0.33	0.96	-0.36	0.96
1000	0.97	-0.26	0.97	-0.23	0.97	-0.28	0.97
750	0.96	-0.37	0.96	-0.35	0.95	-0.40	0.96
500	0.96	-0.35	0.96	-0.32	0.96	-0.37	0.96
250	0.97	-0.30	0.97	-0.24	0.97	-0.29	0.97
100	0.95	-0.41	0.96	-0.35	0.95	-0.41	0.96
50	0.97	-0.30	0.97	-0.23	0.97	-0.28	0.97
10	0.97	-0.25	0.98	-0.18	0.98	-0.22	0.98
5	0.98	-0.20	0.98	-0.15	0.98	-0.19	0.98

Frequency Response							
10Hz-2kHz: 100uT / 10-200kHz: 25uT							
Freq Hz	X axis CF	X axis dB	Y axis CF	Y axis dB	Z axis CF	Z axis dB	Mean
10	0.93	-0.67	0.93	-0.65	0.93	-0.63	0.93
30	1.02	0.15	1.02	0.17	1.02	0.19	1.02
50	0.95	-0.46	0.95	-0.44	0.95	-0.43	0.95
100	0.98	-0.17	0.98	-0.15	0.98	-0.14	0.98
500	1.01	0.08	1.01	0.12	1.02	0.13	1.01
1000	0.95	-0.43	0.96	-0.38	0.96	-0.38	0.96
2000	0.94	-0.52	0.95	-0.49	0.95	-0.49	0.94
10000	0.88	-1.09	0.88	-1.14	0.88	-1.12	0.88
100000	0.87	-1.16	0.87	-1.25	0.87	-1.26	0.87
200000	0.88	-1.16	0.86	-1.30	0.86	-1.28	0.87