Test Report Serial Number:	45461435 R2.0
Test Report Date:	17 July 2018
Project Number:	1404

SAR Test Report - New Certification

Applicant:

Garmin International Inc.
1200 East 151 St.
Olathe, KS, 66062
USA

Maximum Reported 1g SAR			
FCC	Body	1.19	W/kg
ISED	Body	1.19	
General Pop. Limit:		1.60	

FCC ID:	ISED Registration Number
IPH-03298	1792A-03298
Product Model Number / HVIN	Product Name / PMN
A03298	A03298

In Accordance With:

FCC 47 CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

IC RSS-102 Issue 5
Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Approved By:

Ben Hewson, President
Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
Canada

Test Lab Certificate: 2470.01 **IC Registration 3874A-1** **FCC Registration: 714830**

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1.0 DOCUMENT CONTROL

Samples Tested By:	**Trevor Whillock**
Report Prepared By:	**Art Voss**
Report Reviewed By:	**Ben Hewson**

Report Issue Number	Description	By	Report Issue Date
R0.0	Draft	Art Voss	20 April 2018
R1.0	Initial Release Section 2.0 - Removed NFC Transmitter and Frequency Range	Art Voss	23 April 2018
R2.0	Section 18.0 - Updated Test Equipment and Calibration Table to Include all passive components.	Art Voss	23 April 2018
	Section 4.0,12.0,12.3-Revised test dates. Note pertaining to SAR test evaluation and reporting.	Trevor Whillock	17 July 2018

2.0 CLIENT AND DEVICE INFORMATION

Client Information		
Applicant Name	**Garmin International Inc.**	
Applicant Address	1200 East 151 St.	
	Olathe, KS,66062	
	USA	
DUT Information		
Device Identifier(s):	**FCC ID:**	**IPH-03298**
	IC:	**1792A-03298**
Type of Equipment:	Digital Transmission System (DTS) FCC Part 15, RSS 247	
	Low Power Communication Device Transmitter(DXX) Part 15	
Device Model(s) / HVIN:	A03298	
Device Marketing Name / PMN:	A03298	
Test Sample Serial No.:	T/A Sample - Identical Prototype	
Transmit Frequency Range:	WiFi: 2412 - 2462 MHz	
	BT: 2402 - 2480 MHz	
Number of Channels:	See Section 7.0	
Manuf. Max. Rated Output Power:	Avg Power: WiFi: 802.11b/14.47 dBm, 802.11g/13.4 dBm, 802.11n/12.3 dBm	
	BT/BLE/ANT: 4.77dBm	
Modulation:	WiFi 802.11g/b/n: DSSS, OFDM, MCS0-7	
	BT: ANT(GFSK), BT(BR-GFSK), BLE(GMSK)	
Duty Cycle:	100.0%	
DUT Power Source:	See Section 8.0	
Deviation(s) from standard/procedure:	None	
Modification of DUT:	None	

3.0 NORMATIVE REFERENCES

Normative References*	
ANSI / ISO 17025:2005	General Requirements for competence of testing and calibration laboratories
FCC CFR Title 47 Part 2 Title 47: Part 2.1093:	Code of Federal Regulations Telecommunication Radiofrequency Radiation Exposure Evaluation: Portable Devices
Health Canada Safety Code 6 (2015)	Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3kHz to 300GHz
Industry Canada Spectrum Management & Telecommunications Policy RSS-102 Issue 5:	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
IEEE International Committee on Electromagnetic Safety IEEE 1528-2013:	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEC International Standard IEC 62209-2 2010	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 2
FCC KDB KDB 865664 D01v01r04	SAR Measurement Requirements for 100MHz to 6GHz
FCC KDB KDB 447498 D01v06	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
FCC KDB KDB 248227 D01v02r02	SAR Test Guidane for IEEE 802.11 (WiFI) Transmitters
* When the issue number or issue date is omitted, the latest version is assumed.	

4.0 STATEMENT OF COMPLIANCE

This measurement report demonstrates that samples of the product model(s) were evaluated for Specific Absorption Rate (SAR) on the date(s) shown, in accordance with the Measurement Procedures cited and were found to comply with the Standard(s) Applied based on the Exposure Limits of the Use Group indicated for which the product is intended to be used.

Applicant:	Model / HVIN:	
Garmin International Inc.	A03298	
Standard(s) Applied:	**Measurement Procedure(s):**	
FCC 47 CFR §2.1093 Health Canada's Safety Code 6	FCC KDB 865664, FCC KDB 447498, FCC KDB 248227 Industry Canada RSS-102 Issue 5 IEEE Standard 1528-2013, IEC 62209-2	
Reason For Issue:	**Use Group:**	**Limits Applied:**
[x] New Certification	[x] General Population / Uncontrolled	[x] 1.6W/kg - 1g Volume
[ ] Class I Permissive Change		[ ] 8.0W/kg - 1g Volume
[ ] Class II Permissive Change	[ ] Occupational / Controlled	[ ] 4.0W/kg - 10g Volume
Reason for Change:		**Date(s) Evaluated:**
Original Filing		April 7,9 & 10, 2018

The results of this investigation are based solely on the test sample(s) provided by the applicant which was not adjusted, modified or altered in any manner whatsoever except as required to carry out specific tests or measurements. A description of the device, operating configuration, detailed summary of the test results, methodologies and procedures used during this evaluation, the equipment used and the various provisions of the rules are included in this test report.

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.

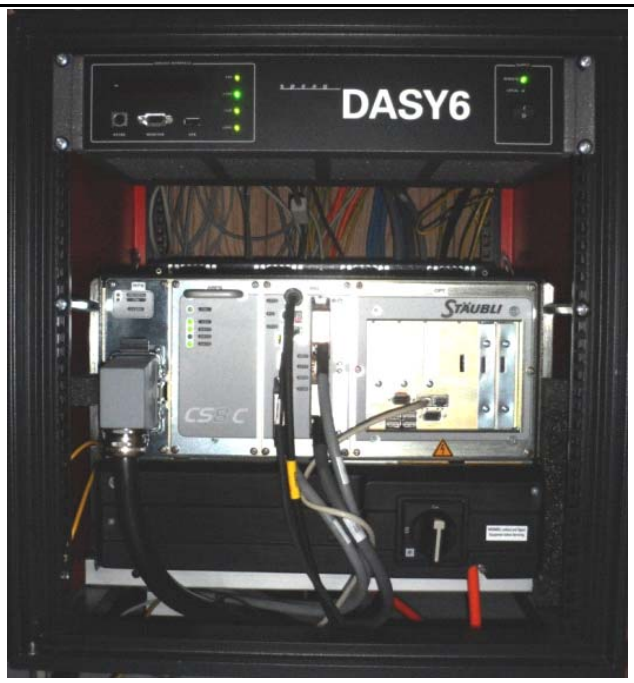
Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.
20 April 2018
Date

5.0 SAR MEASUREMENT SYSTEM

SAR Measurement System

Celltech Labs Inc. SAR measurement facility employs a Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY6 measurement system is comprised of the measurement server, a robot controller, a computer, a near-field probe, a probe alignment sensor, an Elliptical Planar Phantom (ELI) phantom and a specific anthropomorphic mannequin (SAM) phantom for Head and/or Body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller and a teach pendant (Joystick) to control the robot's servo motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical form the DAE to digital electronic signal and transfers data to the DASY6 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter, a command decoder and a control logic unit. Transmission to the DASY6 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot utilizes a controller with built in VME-bus computer.

DASY 6 SAR System with SAM Phantom



DASY 6 Measurement Controller

6.0 RF CONDUCTED POWER MEASUREMENT

Table 6.0 Conducted Power Measurements

Conducted Power Measurements									
Channel	**Frequency** *(MHz)*	**Measured Avg Power** *(dBm)*	**Rated Power** *(dBm)*	**Rated Power** *(W)*	**Delta** *(dB)*	**SAR Test Channel** *(Y/N)*	**Mode**	**Modulation**	**Battery Type**
1	2412	14.29	14.47	0.028	-0.18	–	WIFI-802.11b	DSS-1Mbps	Lithium ION AA
2	2417	14.45	14.47	0.028	-0.02	Y			
3	2422	14.23	14.47	0.028	-0.24	–			
4	2427	13.92	14.47	0.028	-0.55	–			
5	2432	13.94	14.47	0.028	-0.53	–			
6	2437	13.41	14.47	0.028	-1.06	Y			
7	2442	13.64	14.47	0.028	-0.83	–			
8	2447	13.46	14.47	0.028	-1.01	–			
9	2452	13.49	14.47	0.028	-0.98	–			
10	2457	13.59	14.47	0.028	-0.88	Y			
11	2462	13.55	14.47	0.028	-0.92	–			
12	2467	13.55	14.47	0.028	-0.92	–			
13	2472	13.76	14.47	0.028	-0.71	–			
2	2417	14.18	14.47	0.028	-0.29	–		DSS-2Mbps	
2	2417	13.41	14.47	0.028	-1.06	–		DSS-5.5Mbps	
2	2417	14.12	14.47	0.028	-0.35	–		DSS-11Mbps	
1	2412	10.22	13.4	0.022	-3.18	–	WIFI-802.11g	OFDM-6Mbps	
2	2417	12.48	13.4	0.022	-0.92	–			
3	2422	12.57	13.4	0.022	-0.83	–			
4	2427	12.58	13.4	0.022	-0.82	–			
5	2432	12.61	13.4	0.022	-0.79	–			
6	2437	12.77	13.4	0.022	-0.63	–			
7	2442	12.78	13.4	0.022	-0.62	–			
8	2447	12.81	13.4	0.022	-0.59	–			
9	2452	12.86	13.4	0.022	-0.54	–			
10	2457	12.91	13.4	0.022	-0.49	–			
11	2462	11.4	13.4	0.022	-2	–			
12	2467	13	13.4	0.022	-0.4	–			
13	2472	13.09	13.4	0.022	-0.31	–			

10	2457	12.68	13.4	0.022	-0.72	–	WIFI-802.11g	OFDM-9Mbps	Lithium ION AA
10	2457	11.95	13.4	0.022	-1.45	–		OFDM-12Mbps	
10	2457	11.48	13.4	0.022	-1.92	–		OFDM-18Mbps	
10	2457	11.08	13.4	0.022	-2.32	–		OFDM- 24Mbps	
10	2457	10.59	13.4	0.022	-2.81	–		OFDM-36 Mbps	
10	2457	9.97	13.4	0.022	-3.43	–		OFDM-48 Mbps	
10	2457	9.67	13.4	0.022	-3.73	–		OFDM-54 Mbps	

1	2412	7.01	12.3	0.017	-5.29	–	WIFI 802.11n	MCS-6.5 Mbps	Lithium ION AA
2	2417	9.37	12.3	0.017	-2.93	–			
3	2422	9.22	12.3	0.017	-3.08	–			
4	2427	9.25	12.3	0.017	-3.05	–			
5	2432	9.43	12.3	0.017	-2.87	–			
6	2437	9.29	12.3	0.017	-3.01	–			
7	2442	9.61	12.3	0.017	-2.69	–			
8	2447	9.59	12.3	0.017	-2.71	–			
9	2452	9.63	12.3	0.017	-2.67	–			
10	2457	9.74	12.3	0.017	-2.56	–			
11	2462	6.87	12.3	0.017	-5.43	–			
12	2467	9.87	12.3	0.017	-2.43	–			
13	2472	9.85	12.3	0.017	-2.45	–			
10	2457	11.85	12.3	0.017	-0.45	–		MCS-13Mbps	
10	2457	10.97	12.3	0.017	-1.33	–		MCS-19.5Mbps	
10	2457	10.15	12.3	0.017	-2.15	–		MCS-26 Mbps	
10	2457	9.58	12.3	0.017	-2.72	–		MCS-39 Mbps	
10	2457	8.7	12.3	0.017	-3.6	–		MCS-52 Mbps	
10	2457	8.34	12.3	0.017	-3.96	–		MCS-58 Mbps	
10	2457	8.09	12.3	0.017	-4.21	–		MCS-65 Mbps	
10	2457	7.77	12.3	0.017	-4.53	–		MCS-72Mbps	

2	2417	14.16	14.47	0.028	-0.31	–	802.11b	DSS-1Mbps	NiMH Pack
6	2437	13.38	14.47	0.028	-1.09	–			
10	2457	13.51	14.47	0.028	-0.96	Y			
13	2472	13.72	14.47	0.028	-0.75	–			
2	2417	13.96	14.47	0.028	-0.51	–			Alkaline AA
6	2437	13.5	14.47	0.028	-0.97	–			
10	2457	13.18	14.47	0.028	-1.29	Y			
13	2472	13.29	14.47	0.028	-1.18	–			
2	2417	13.77	14.47	0.028	-0.7	–			NiMH AA
6	2437	13.49	14.47	0.028	-0.98	–			
10	2457	13.23	14.47	0.028	-1.24	Y			
13	2472	13.37	14.47	0.028	-1.1	–			

2480	3.85	4.77	0.003	-0.92	–	BT	BR-GFSK	Lithium ION AA
	3.63	4.77	0.003	-1.14	–		LE-BLE,GMSK	
	3.64	4.77	0.003	-1.13	–		ANT-GFSK	
2441	1.7	4.77	0.002	-3.07	–		BR-GFSK	
2402	-0.48	4.77	0.001	-5.0	–		BR-GFSK	

The rated power and tolerance are stated for typical transmission modes and data rates. Some modes and data rates may produce lower than rated conducted power levels. Power measurements taken with the 4 battery types across the various channels, modes and data rates did not produce levels in excess of the Rated Average Power plus Tolerance. Power measurements were found to be the highest on DSS mode at 1Mbps than any other mode or data-rate. SAR was evaluated using WIFI DSS mode at 1Mbps data rate with the worst case battery type at the level specified by the manufacture to be the max output power and produce the most conservative SAR. SAR was evaluated at the *maximum average* tune up tolerance. See section 2.0 Client and Device Information for details. The *reported* SAR was not scaled down.

Due to the nature of the BT and ANT transmitter SAR evaluation was not required. See Section 10.0 for details.

7.0 NUMBER OF TEST CHANNELS (N_C) AND CONFIGURATIONS

As per FCC KDB 24827, the required 802.11 test channels are Ch1, Ch6 and Ch 11, provided a higher maximum output power is not specified for the other channels. When applicable, SAR test reduction methods may be utilized.

802.11b DSSS SAR test reduction is determined according to the following:

a) When the *reported* SAR of the highest measured maximum output power channel is ≤ to 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

b) When the *reported* SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest output power channel. When any *reported* SAR is > 1.2 W/Kg, SAR is required for the third channel.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

a) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.

b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Since the Overall dimensions of the device were less than 20cm.The DUT was evaluated for body SAR in accordance with the test positions required by FCC KDB 941225 D07. Based on this; 3 sides of the device required testing, front, back and Left side, at a distance of ≤5mm to the phantom surface.

See 12.1 for details

8.0 ACCESSORIES EVALUATED

Table 8.0 Accessories Evaluated

Manufacturer's Accessory List						
Test Report ID Number	**Manufacturer's Part Number**	**Description**	**UDC Group(1)**	**Type II Group(2)**	**SAR(3) Evaluated**	**SAR(4) Tested**
B1	010-11022-10	Belt-Clip, Swivel	**n/a**	**n/a**	**Y**	**Y**
B2	010-11022-20	Carabiner Mount	**n/a**	**n/a**	**Y**	**Y**
B3	010-10888-00	Retractable Tether	**n/a**	**n/a**	**Y**	**N**
P1*	-	Lithium ION AA(x2) 1.5V	**n/a**	**n/a**	**Y**	**Y**
P2*	-	NiMH AA(x2) 1.2V, 2300mAh	**n/a**	**n/a**	**Y**	**Y**
P3	010-11874-00	NiMH Battery Pack 1.2V, 2000mAh	**n/a**	**n/a**	**Y**	**Y**
P4*	-	Alkaline Batteries AA(x2) 1.5V	**n/a**	**n/a**	**Y**	**Y**
P5	362-00087-00	AC Adapter, 5.0V, 1.0A, USB-A Recpt	**n/a**	**n/a**	**n/a**	**n/a**
P6	320-00559-01	CA Assy, Micro B to A Style USB	**n/a**	**n/a**	**n/a**	**n/a**

* This device is capable of using off-the-shelf batteries. The battery selection used for SAR evaluation was chosen under the guidance of the manufacturer.

9.0 SAR MEASUREMENT SUMMARY

Table 9.0: Measured Results

Measured SAR Results (1g) - BODY(FCC/ISEDC)														
Date	Plot ID #	DUT Model	Test Type	Test Freq. (MHz)	Modulation	Accessories				DUT Spacing		Meas. Cond. Power (dBm)	Measured SAR 1g (W/kg)	SAR Drift (dB)
						Antenna ID	Battery ID	Body ID	Audio ID	DUT (mm)	Antenna (mm)			
BODY SAR														
09 Apr 2018	B1*	A03298	Body/Touch - Back	2417	DSSS-1Mbps	Default	P1 - Lithium	n/a	n/a	0	0	14.45	0.199	0.770
09 Apr 2018	B2	A03298	Body/Touch - Back	2417	DSSS-1Mbps	Default	P1 - Lithium	B1	n/a	0	35	14.45	0.047	-1.880
09 Apr 2018	B3	A03298	Body/Touch - Back	2417	DSSS-1Mbps	Default	P1 - Lithium	B2	n/a	0	20	14.45	0.044	-0.610
09 Apr 2018	B4	A03298	Body/Touch - Front	2417	DSSS-1Mbps	Default	P1 - Lithium	B2	n/a	0	0	14.45	0.219	-0.070
09 Apr 2018	B5	A03298	Body/Touch - Left	2417	DSSS-1Mbps	Default	P1 - Lithium	B2	n/a	0	0	14.45	0.730	-0.060
09 Apr 2018	B6	A03298	Body/Touch - Left	2437	DSSS-1Mbps	Default	P1 - Lithium	B2	n/a	0	0	13.41	0.738	0.280
09 Apr 2018	B7*	A03298	Body/Touch - Left	2457	DSSS-1Mbps	Default	P1 - Lithium	B2	n/a	0	0	13.59	0.793	1.330
10 Apr 2018	B8	A03298	Body/Touch - Left	2457	DSSS-1Mbps	Default	P2 - NiMH	B2	n/a	0	0	13.50	0.817	0.610
10 Apr 2018	B9	A03298	Body/Touch - Left	2457	DSSS-1Mbps	Default	P3 - NiMH Pack	B2	n/a	0	0	13.51	0.948	0.210
10 Apr 2018	B10	A03298	Body/Touch - Left	2457	DSSS-1Mbps	Default	P4 - Alkaline	B2	n/a	0	0	13.44	0.773	1.360
SAR Limit							Spatial Peak					RF Exposure Category		
FCC 47 CFR 2.1093				Health Canada Safety Code 6			Body	1g Average		4.0 W/kg		General Population		

*Per KDB 248227 When reported SAR is ≤ to 0.8Wkg, no further SAR testing is required for 802.11b DSS in that exposure configuration.

*Per KDB 248227 When output power is reduced for channel 1 and 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

Reference Section 7.0 for details

10.0 SCALING OF MAXIMUM MEASURE SAR

Table 10.0 SAR Scaling

Scaling of Maximum Measured SAR [1]							
		Freq	Measured Fluid Deviation		Measured Conducted Power	Measured Drift	Measured SAR (1g)
Plot ID	Configuration	(MHz)	Permittivity	Conductivity	(dBm)	(dB)	(W/kg)
B9	Body	2457	-2.28%	0.87%	13.5	0.210	0.948
Step 1							
Fluid Sensitivity Adjustment							
Plot ID	Scale Factor (%)		x	Measured SAR (W/kg)		=	Step 1 Adjusted SAR (1g) (W/kg)
B9	n/a		x	0.948		=	0.948
Step 2							
Manufacturer's Tune-Up Tolerance							
Plot ID	Measured Conducted Power (dBm)	Rated Power (dBm)	Delta (dB)	+	Step 1 Adjusted SAR (W/kg)	=	Step 2 Adjusted SAR (1g) (W/kg)
B9	13.5	14.5	-1.0	+	0.226	=	1.190
Step 3 (ISED)							
Drift Adjustment							
Plot ID	Measured Drift (dB)		+	Step 2 Adjusted SAR (W/kg)		=	Step 3 Adjusted SAR (1g) (W/kg)
B9	0.210		+	1.190		=	1.190
Step 4 (FCC)							
Simultaneous Transmission - Bluetooth and/or WiFi							
Plot ID	Rated Output Power (Pmax) (mW)	Freq (MHz)	Separation Distance (mm)	Measured SAR (W/kg)	+	Step 2 Adjusted SAR (W/kg)	=	Step 4 Adjusted SAR (1g) (W/kg)
B9	3	2480	0	0.000	+	1.190	=	1.190
Step 5							
Reported SAR							
Plot ID	FCC From Steps 1, 2 and 4 1g SAR (W/kg)			ISED From Steps 1 through 3 1g SAR (W/kg)			
B1	**1.190**			**1.190**			

The SAR test exclusion threshold for the Bluetooth transmitter as per FCC KDB 447498 4.3.1 is as follows:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] X [√f(GHz)] ≤ 3.0 for 1-g SAR

[(3.00)/(5)] X [√2.480] = 0.94≤ 3.0

Where:
Max power of channel, including tune-up tolerance, mW = 3mW
min. test separation distance, mm = 5mm
f(GHz) = 2.480GHz

*The WiFi, BlueTooth (BLE) and ANT transmitters share the same antenna and cannot simultaneously transmit.

NOTES to Table 10.0
(1) Scaling of the Maximum Measured SAR is based on the highest, 100% duty cycle, Face, Body and/or Head SAR measured of ALL test channels, configurations and accessories used during THIS evaluation. The Measured Fluid Deviation parameters apply only to deviation of the tissue equivalent fluids used at the frequencies which produced the highest measured SAR. The Measured Conducted Power applies to the Conducted Power measured at the frequencies producing the highest Face and Body SAR. The Measured Drift is the SAR drift associated with that specific SAR measurement. The Reported SAR is the accumulation of all SAR Adjustments from the applicable Steps 1 through 4. The Plot ID is for indentification of the SAR Measurement Plots in Annex A of this report. NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text.
Step 1
Per IEC-62209-1 and FCC KDB 865664. Scaling required only when Measured Fluid Deviation is greater than 5%. If the Measured Fluid Deviation is greater than 5%, Table 9.1 will be shown and will indicate the SAR scaling factor in percent (%). SAR is MULTIPLIED by this scaling factor only when the scaling factor is positive (+).
Step 2
Per KDB 447498. Scaling required only when the difference (Delta) between the Measured Conducted Power and the Manufacturer's Rated Conducted Power is (-) Negative. The absolute value of Delta is ADDED to the SAR.
Step 3
Per IEC 62209-1. Scaling required only when Measured Drift is (-) Negative. The absolute value of Measured Drift is added to Reported or Simultaneous Reported SAR.
Step 4
Per KDB 447498 4.3.2. The SAR, either measured or calculated, of ANY and ALL simultaneous transmitters must be added together and includes all contributors.
Step 5
The Reported SAR is the Maximum Final Adjusted Cumulative SAR from the applicable Steps 1 through 4 and are reported on Page 1 of this report.

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.	 Trevor Whillock Test Lab Engineer Celltech Labs Inc. 20 April 2018 Date

11.0 SAR EXPOSURE LIMITS

Table 11.0 Exposure Limits

SAR RF EXPOSURE LIMITS			
FCC 47 CFR§2.1093	Health Canada Safety Code 6	General Population / Uncontrolled Exposure(4)	Occupational / Controlled Exposure(5)
Spatial Average(1) (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak(2) (Head and Trunk averaged over any 1 g of tissue)		**1.6 W/kg**	8.0 W/kg
Spatial Peak(3) (Hands/Wrists/Feet/Ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
(1) The Spatial Average value of the SAR averaged over the whole body.			
(2) The Spatial Peak value of the SAR averaged over any 1 gram of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time.			
(3) The Spatial Peak value of the SAR averaged over any 10 grams of tissue, defined as a tissue volume in the shape of a cube and over the appropriate averaging time.			
(4) Uncontrolled environments are defined as locations where there is potential exposure to individuals who have no knowledge or control of their potential exposure.			
(5) Controlled environments are defined as locations where there is potential exposure to individuals who have knowledge of their potential exposure and can exercise control over their exposure.			

12.0 DETAILS OF SAR EVALUATION

12.0 Day Log

DAY LOG							
Date	Ambient Temp °C	Fluid Temp °C	Humidity	TSL	Fluid Dielectric	SPC	Test
07 Apr 2018	24	22.6	26%	2450B	X	X	X
*09 Apr 2018	22	21.9	25%	2450B			X
*10 Apr 2018	24	23.1	25%	2450B			X

*SAR test evaluation was conducted April 7th, 9th and 10th; however, only worst case test data was reported. See section 12.3 Reporting for details.

12.1 DUT Setup and Configuration

DUT Setup and Configuration	
1	The DUT was evaluated for SAR in accordance with the procedures described in IEEE 1528, FCC KDB 865646, 248277, 941225 and RSS-102. The device was evaluated at a phantom separation distance of 0mm.
2	2.4GHz 802.11g/n OFDM SAR Test Exclusion As Per KDB 248277 D01v02r02 - 5.2.2, b) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg. Maximum 802.11g/n OFDM specified power(POFDM)= 13.4 dBm Maximum 802.11b DSSS specified power (PDSSS)= 14.47 dBm Ratio OFDM/DSSS power =-1.07 dBm(93%) Highest reported* SAR (SARMAX)= 1.18 W/kg POFDM/PDSSS X SARMAX =0.92 W/kg Since the ratio of the ODFM/DSSS specified power is less than one (0dB), the reported SAR would not exceed 1.2W/kg *The reported SAR in this case is the measured SAR adjusted for fluid sensitivity.
3	The Device was capable of transmitting at various modulations and data rates. The Conducted Power was higher when measured in DSS Mode-1 Mbps than any other configuration. The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer. The DUT was tested in all required positions and modes with the default Li-ion AA. The worst case test was then repeated with NiMH AA, Alkaline AA and the supplied proprietary NiMH battery pack. Each SAR evaluation was performed with a fully charged battery.
4	1.Since the Overall dimensions of the device were less than 20cm.The DUT was evaluated for body SAR in accordance with the test positions required by FCC KDB 941225 D07. Based on this; 3 sides of the device required testing, front, back and Left side, at a distance of less than or equal to 5mm to the phantom surface. 2. The front surface (screen side) of the DUT is 1.1cm from the antenna. 3. The back surface (battery side) of the DUT is 1.95 cm from the antenna. 4. The Left side surface of the DUT is 0.43 cm from the antenna. 5. All other DUT surfaces are > 2.5cm from the antenna.

12.2 DUT Positioning

DUT Positioning
Positioning
The DUT Positioner was securely fastened to the Phantom Platform. Registration marks were placed on the DUT and the Positioner to ensure consistent positioning of the DUT for each test evaluation.
FACE Configuration
This device is not intended to be held to the face and was not tested in the FACE configuration.
BODY Configuration
The DUT was securely clamped into the device holder with the surface of the DUT normally in contact with the body in direct contact with the bottom of the phantom, or 0mm separation from the DUT's accessory to the phantom surface.
HEAD Configuration
This device is not intended to be held to the ear and was not tested in the HEAD configuration.
Limb Worn Configuration
This device is not intended to be worn on the limb and was not tested in the Limb Worn configuration.

12.3 General Procedures and Report

General Procedures and Reporting
General Procedures
The fluid dielectric parameters of the Active Tissue Simulating Liquid (TSL) were measured as described in this Section, recorded and entered into the DASY Measurement Server. Active meaning the TSL used during the SAR evaluation of the DUT. The temperature of the Active TSL was measured and recorded prior to performing a System Performance Check (SPC). An SPC was performed with the Active TSL prior to the start of the test series. The temperature of the Active TSL was measured throughout the day and the Active TSL temperature was maintained to ± 0.5°C. The Active TSL temperature was maintained to within ±1.0°C throughout the test series. TSL analysis and SPC were repeated when the Active TSL use exceeded 84 hours. An Area Scan exceeding the length and width of the DUT projection was performed and the locations of all maximas within 2dB of the Peak SAR recorded. A Zoom Scan centered over the Peak SAR location(s) was performed and the 1g and 10g SAR values recorded. The resolutions of the Area Scan and Zoom Scan are described in the Scan Resolution table(s) in this Section. A Power Reference Measurement was taken at the phantom reference point immediately prior to the Area Scan. A Power Drift measurement was taken at the phantom reference point immediately following the Zoom Scan to determine the power drift. A Z-Scan from the *Maximum Distance to Phantom Surface* to the fluid surface was performed following the power drift measurement.
Reporting
The 1g SAR, 10g SAR and power drift measurements are recorded in the SAR Measurement Summary tables in the SAR Measurement Summary Section of this report. The SAR values shown in the 100% DC (Duty Cycle) column are the SAR values reported by the SAR Measurement Server with the DUT operating at 100% transmit duty cycle. These tables also include other information such as transmit channel and frequency, modulation, accessories tested and DUT-phantom separation distance.Test data recorded in the preliminary stages of testing aided in overall test planning and preparation, but was a non-contributing factor to the Max Reported SAR level .Therefore, preliminary test data was deemed nonessential and was not included in the report. In the Scaling of Maximum Measured SAR Section of this report, the highest measured SAR in the BODY configuration, within the entire scope of this assessment, are, when applicable, scaled for Fluid Sensitivity, Manufacturer's Tune-Up Tolerance, Simultaneous Transmission and Drift. With the exception of Duty Cycle correction/compensation, SAR values are ONLY scaled up, not down. The final results of this scaling is the *reported SAR* which appears on the Cover Page of this report.

12.4 Fluid Dielectric and Systems Performance Check

Fluid Dielectric and Systems Performance Check
Fluid Dielectric Measurement Procedure
The fluid dielectric parameters of the Tissue Simulating Liquid (TSL) are measured using the Open-Ended Coax Method connected to an Agilent 8753ET Network Analyzer connected to a measurement server running Aprel Dielectric Property Measurement System. A frequency range of ± 100MHz for frequencies > 300MHz and ± 50MHz for frequencies ≤ 300MHz with frequency step size of 10MHz is used. The center frequency is centered around the SAR measurement probe's calibration point for that TSL frequency range. A calibration of the setup is performed using a short-open-deionized water (at 23°C in a 300ml beaker) method. A sample of the TSL is placed in a 300ml beaker and the open-ended coax is submerged approximately 8mm below the fluid surface in the approximate center of the beaker. A check of the setup is made to ensure no air is trapped under the open-ended coax. The sample of TSL is measured and compared to the FCC OET Bulletin 65 Supplement C targets for HEAD or BODY for the entire fluid measurement range. Fluid adjustment are made if the dielectric parameters are > 5% in range that the DUT is to be tested. If the adjustments fail to bring the parameters to ≤ 5% but are < 10%, the SAR Fluid Sensitivity as per IEC 62201-1 and FCC KDB 865664 are applied to the highest measured SAR. A TSL with dielectric parameters > 10% in the DUT test frequency range are not used.
Systems Performance Check
The fluid dielectric parameters of the Active TSL are entered into the DASY Measurement Server at each of the 10MHz step size intervals. Active meaning the TSL used during the SAR evaluation of the DUT. The DASY Measurement System will automatically interpolate the dielectric parameters for DUT test frequencies that fall between the 10MHz step intervals. A Systems Performance Check (SPC) is performed in accordance with IEEE 1528 "System Check" and FCC KDB 865664 "System Verification". A validation source, dipole or Confined Loop Antenna (CLA), is placed under the geometric center of the phantom and separated from the phantom in accordance to the validation source's Calibration Certificate data. A CW signal set to the frequency of the validate source's and SAR measurement probe's calibration frequency with a forward power set to the validation source's Calibration Certificate data power setting is applied to the validation source. An Area Scan is centered over the projection of the validation source's feed point and an Area Scan is taken. A Zoom Scan centered over the Peak SAR measurement of the Area Scan and the 1g and 10g SAR is measured. The measured 1g and 10g SAR is compared to the 1g and 10g SAR measurements from the validation source's Calibration Certificate. When required, the measured SAR is normalized to 1.0W and compared to the normalized SAR indicated on the validation source's Calibration Certificate. The SPC is considered valid when the measured and normalized SAR is ≤ 10% of the measured and normalize SAR of the validation source's Calibration Certificate. The fluid dielectric parameters of the Active TSL and SPC are repeated when the Active TSL has been in use for greater than 84 hours or if the Active TSL temperature has exceed ± 1°C of the initial fluid analysis.

12.5 Scan Resolution 100MHz to 2GHz

Scan Resolution 100MHz to 2GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	**4 ± 1 mm**
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	**5° ± 1°**
Area Scan Spatial Resolution ΔX, ΔY	**15 mm**
Zoom Scan Spatial Resolution ΔX, ΔY	**7.5 mm**
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	**5 mm**
Zoom Scan Volume X, Y, Z	**30 mm**
Phantom	**ELI**
Fluid Depth	**150 ± 5 mm**
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

12.6 Scan Resolution 2GHz to 3GHz

Scan Resolution 2GHz to 3GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	**4 ± 1 mm**
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	**5° ± 1°**
Area Scan Spatial Resolution ΔX, ΔY	**12 mm**
Zoom Scan Spatial Resolution ΔX, ΔY	**5 mm**
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	**5 mm**
Zoom Scan Volume X, Y, Z	**30 mm**
Phantom	**ELI**
Fluid Depth	**150 ± 5 mm**
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

12.7 Scan Resolution 5GHz to 6GHz

Scan Resolution 5GHz to 6GHz	
Maximum distance from the closest measurement point to phantom surface: (Geometric Center of Probe Center)	**4 ± 1 mm**
Maximum probe angle normal to phantom surface. (Flat Section ELI Phantom)	**5° ± 1°**
Area Scan Spatial Resolution ΔX, ΔY	**10 mm**
Zoom Scan Spatial Resolution ΔX, ΔY	**4 mm**
Zoom Scan Spatial Resolution ΔZ (Uniform Grid)	**2 mm**
Zoom Scan Volume X, Y, Z	**22 mm**
Phantom	**ELI**
Fluid Depth	**100 ± 5 mm**
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1-gram and 10-gram peak spatial-average SAR	

13.0 MEASUREMENT UNCERTAINTIES

Table 13.0 Measurement Uncertainty

UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEEE 1528-2013 Table 9)									
Uncertainty Component	**IEEE 1528 Section**	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	**ci 1g**	**ci 10g**	**Uncertainty Value ±% (1g)**	**Uncertainty Value ±% (10g)**	**V_i or V_{eff}**
Measurement System									
Probe Calibration*	E.2.1	6.6	Normal	1	1	1	6.60	6.60	∞
Axial Isotropy*	E.2.2	4.7	Rectangular	1.732050808	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy*	E.2.2	9.6	Rectangular	1.732050808	0.7	0.7	3.9	3.9	∞
Boundary Effect*	E.2.3	8.3	Rectangular	1.732050808	1	1	4.8	4.8	∞
Linearity*	E.2.4	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
System Detection Limits*	E.2.4	1.0	Rectangular	1.732050808	1	1	0.6	0.6	∞
Modulation Response	E.2.5	4.0	Rectangular	1.732050808	1	1	2.3	2.3	∞
Readout Electronics*	E.2.6	1.0	Normal	1	1	1	1.0	1.0	∞
Response Time*	E.2.7	0.8	Rectangular	1.732050808	1	1	0.5	0.5	∞
Integration Time*	E.2.8	1.4	Rectangular	1.732050808	1	1	0.8	0.8	∞
RF Ambient Conditions - Noise	E.6.1	0.0	Rectangular	1.732050808	1	1	0.0	0.0	∞
RF Ambient Conditions - Reflection	E.6.1	0.0	Rectangular	1.732050808	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance*	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell*	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation*	E.5	3.9	Rectangular	1.732050808	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	0.3	Normal	1	1	1	0.3	0.3	5
Device Holder Uncertainty*	E.4.1	3.6	Normal	1	1	1	3.6	3.6	∞
SAR Drift Measurement**	E.2.9	0.0	Rectangular	1.732050808	1	1	0.0	0.0	∞
SAR Scaling***	E.6.5	2.0	Rectangular	1.732050808	1	1	1.2	1.2	∞
Phantom and Tissue Parameters									
Phantom Uncertainty*	E.3.1	4.0	Rectangular	1.732050808	1	1	2.3	2.3	∞
SAR Correction Uncertainty	E.3.2	1.2	Normal	1	1	0.84	1.2	1.0	∞
Liquid Conductivity (measurement)	E.3.3	6.8	Normal	1	0.78	0.71	5.3	4.8	10
Liquid Permittivity (measurement)	E.3.3	5.3	Normal	1	0.23	0.26	1.2	1.4	10
Liquid Conductivity (Temperature)	E.3.2	0.1	Rectangular	1.732050808	0.78	0.71	0.1	0.0	∞
Liquid Permittivity Temperature)	E.3.2	0.0	Rectangular	1.732050808	0.23	0.26	0.0	0.0	∞
Effective Degrees of Freedom(1)								**V_{eff} =**	**873.2**
Combined Standard Uncertainty			**RSS**				**12.59**	**12.40**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**25.18**	**24.80**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003									

(1) The Effective Degrees of Freedom is > 30 therefore a coverage factor of k=2 represents an approximate confidence level of 95%.

* Provided by SPEAG

Table 13.1 Calculation of Degrees of Freedom

Calculation of the Degrees and Effective Degrees of Freedom	
$v_i = n - 1$	$v_{eff} = \frac{u_c^4}{\frac{m}{\sum_{i=1} \frac{c_i^4 u_i^4}{v_i}}}$

14.0 FLUID DIELECTRIC PARAMETERS

Table 14.0 Fluid Dielectric Parameters 2450MHz BODY TSL

****

Aprel Laboratory
Test Result for UIM Dielectric Parameter
Sat 07/Apr/2018 15:07:03
Freq Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.3500	52.83	1.85	51.87	1.82
2.3600	52.82	1.86	51.40	1.84
2.3700	52.81	1.87	51.71	1.85
2.3800	52.79	1.88	51.56	1.86
2.3900	52.78	1.89	51.43	1.85
2.4000	52.77	1.90	51.62	1.89
2.4100	52.75	1.91	51.53	1.90
2.4200	52.74	1.92	51.53	1.91
2.4300	52.73	1.93	51.40	1.96
2.4400	52.71	1.94	51.50	1.97
2.4500	52.70	1.95	51.48	1.96
2.4600	52.69	1.96	51.50	1.98
2.4700	52.67	1.98	51.27	2.00
2.4800	52.66	1.99	51.16	2.00
2.4900	52.65	2.01	51.15	2.01
2.5000	52.64	2.02	51.37	2.01
2.5100	52.62	2.04	51.26	2.05
2.5200	52.61	2.05	51.11	2.05
2.5300	52.60	2.06	51.22	2.07
2.5400	52.59	2.08	51.14	2.10
2.5500	52.57	2.09	51.14	2.11

FLUID DIELECTRIC PARAMETERS

Date:	7 Apr 2018	Fluid Temp:	22.6	Frequency:	2450MHz	Tissue:	Body

Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
2350.0000		51.8700	1.8200	52.8300	1.85	-1.82%	-1.62%
2360.0000		51.4000	1.8400	52.8200	1.86	-2.69%	-1.08%
2370.0000		51.7100	1.8500	52.8100	1.87	-2.08%	-1.07%
2380.0000		51.5600	1.8600	52.7900	1.88	-2.33%	-1.06%
2390.0000		51.4300	1.8500	52.7800	1.89	-2.56%	-2.12%
2400.0000		51.6200	1.8900	52.7700	1.90	-2.18%	-0.53%
2410.0000		51.5300	1.9000	52.7500	1.91	-2.31%	-0.52%
2417.0000	*	51.5300	1.9070	52.7430	1.92	-2.30%	-0.52%
2420.0000		51.5300	1.9100	52.7400	1.92	-2.29%	-0.52%
2430.0000		51.4000	1.9600	52.7300	1.93	-2.52%	1.55%
2437.0000	*	51.4700	1.9670	52.7160	1.94	-2.36%	1.55%
2440.0000		51.5000	1.9700	52.7100	1.94	-2.30%	1.55%
2450.0000		51.4800	1.9600	52.7000	1.95	-2.31%	0.51%
2457.0000	*	51.4940	1.9740	52.6930	1.96	-2.28%	0.87%
2460.0000		51.5000	1.9800	52.6900	1.96	-2.26%	1.02%
2467.0000		51.3390	1.9940	52.6760	1.97	-2.54%	1.01%
2470.0000		51.2700	2.0000	52.6700	1.98	-2.66%	1.01%
2480.0000		51.1600	2.0000	52.6600	1.99	-2.85%	0.50%
2490.0000		51.1500	2.0100	52.6500	2.01	-2.85%	0.00%
2500.0000		51.3700	2.0100	52.6400	2.02	-2.41%	-0.50%
2510.0000		51.2600	2.0500	52.6200	2.04	-2.58%	0.49%
2520.0000		51.1100	2.0500	52.6100	2.05	-2.85%	0.00%
2530.0000		51.2200	2.0700	52.6000	2.06	-2.62%	0.49%
2540.0000		51.1400	2.1000	52.5900	2.08	-2.76%	0.96%
2550.0000		51.1400	2.1100	52.5700	2.09	-2.72%	0.96%

*Channel Frequency Tested

15.0 SYSTEM VERIFICATION TEST RESULTS

Table 15.0 System Verification Results 2450MHz BODY TSL

System Verification Test Results					
Date		Frequency (MHz)	Validation Source		
			P/N		S/N
07 Apr 2018		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Body	22.6	24	26%	250	10
Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
51.48	52.70	-2.31%	1.96	1.95	0.51%
Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
12.30	13.00	-5.38%	5.70	6.05	-5.79%
Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
49.20	50.70	-2.96%	22.80	23.80	-4.20%

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEEE 1528-2013, FCC KDB 846224 and IEC 62209-1.

The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer.

The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.

The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.

16.0 SYSTEM VALIDATION SUMMARY

Table 16.0 System Validation Summary

System Validation Summary											
Frequency (MHz)	Validation Date	Probe Model	Probe S/N	Validation Source	Source S/N	Tissue	Tissue Dielectrics		Validation Results		
							Permittivity	Conductivity	Sensitivity	Linearity	Isotropy
30		EX3DV4	3600	CLA-30	1005	Head					
150	03-May-17	EX3DV4	3600	CLA-150	4007	Body	66.48	0.79	Pass	Pass	Pass
150	04-May-17	EX3DV4	3600	CLA-150	4007	Head	51.51	0.81	Pass	Pass	Pass
450	08-May-17	EX3DV4	3600	D450V3	1068	Body	54.65	0.95	Pass	Pass	Pass
450	16-May-17	EX3DV4	3600	D450V3	1068	Head	43.70	0.83	Pass	Pass	Pass
835	17-May-17	EX3DV4	3600	D835V2	4d075	Body	54.39	0.95	Pass	Pass	Pass
835	19-May-14	EX3DV4	3600	D835V2	4d075	Head	42.01	0.89	Pass	Pass	Pass
900	01-Aug-17	EX3DV4	3600	D900V2	045	Body	51.30	1.01	Pass	Pass	Pass
900	02-Aug-17	EX3DV4	3600	D900V2	045	Head	39.10	0.93	Pass	Pass	Pass
1640	06-Feb-18	EX3DV4	3600	1620-S-2	207-00102	Body	39.87	1.27	Pass	Pass	Pass
1640	07-Feb-18	EX3DV4	3600	1620-S-2	207-00102	Head	39.87	1.27	Pass	Pass	Pass
1800	21-Jul-17	EX3DV4	3600	D1800V2	247	Body	54.77	1.53	Pass	Pass	Pass
1800	18-Jul-17	EX3DV4	3600	D1800V2	247	Head	40.70	1.33	Pass	Pass	Pass
2450	24-Jul-17	EX3DV4	3600	D2450V2	825	Body	49.51	1.92	Pass	Pass	Pass
2450	24-Jul-17	EX3DV4	3600	D2450V2	825	Head	37.95	1.87	Pass	Pass	Pass
5250	24-Jul-17	EX3DV4	3600	D5GHzV2	1031	Body	46.42	5.69	Pass	Pass	Pass
5250	24-Jul-17	EX3DV4	3600	D5GHzV2	1031	Head	35.96	4.99	Pass	Pass	Pass

17.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 17.0 Measurement System Specifications

Measurement System Specification	
Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability	+/- 0.035 mm
No. of axis	6.0
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	Intel(R) Core(TM) i7-7700
Clock Speed	3.60 GHz
Operating System	Windows 10 Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY6, V 6.4.0.12171 / DASY52 V52.10.0.1446
	Postprocessing Software: SEMCAD X, V14.6.10(Deployment Build)
Connecting Lines	Optical downlink for data and status info., Optical uplink for commands and clock
DASY Measurement Server	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	Intel ULV Celeron CPU 400 MHz; 128 MB chip disk; 128 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
E-Field Probe	
Model	EX3DV4
Serial No.	3600
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Phantom	
Type	ELI Elliptical Planar Phantom
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	> 30 Liter

Measurement System Specification

Probe Specification

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In head simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in head tissue (rotation around probe axis) ± 0.4 dB in head tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm; Tip length: 16 mm; Body diameter: 12 mm; Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz; Compliance tests of mobile phone

EX3DV4 E-Field Probe

Phantom Specification

The ELI V5.0 phantom is an elliptical planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEEE 1528-2013, IEC 62209-1 and IEC 62209-2.

ELI Phantom

Device Positioner Specification

The DASY device positioner has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65^{O}. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

Device Positioner

18.0 TEST EQUIPMENT LIST

Table 18.0 Equipment List and Calibration

Test Equipment List				
DESCRIPTION	**ASSET NO.**	**SERIAL NO.**	**DATE CALIBRATED**	**CALIBRATION INTERVAL**
Schmid & Partner DASY 6 System	-	-	-	-
-DASY Measurement Server	00158	1078	CNR	CNR
-Robot	00046	599396-01	CNR	CNR
-DAE4	00019	353	24-Apr-17	Annual
-EX3DV4 E-Field Probe	00213	3600	27-Apr-17	Annual
-CLA30 Validation Dipole	00300	1005	23-Nov-17	Triennial
-CLA150 Validation Source	00251	4007	27-Apr-17	Triennial
-D450V3 Validation Dipole	00221	1068	21-Apr-15	Triennial
-D835V2 Validation Dipole	00217	4D075	23-Apr-15	Triennial
-D900V2 Validation Dipole	00020	54	24-Apr-15	Triennial
-D1640/1620-S-2 Validation Dipole	00299	207-00102	07-Nov-17	Triennial
-D2450V2 Validation Dipole	00219	825	23-Apr-15	Triennial
-D5GHzV2 Validation Dipole	00126	1031	20-Apr-15	Triennial
ELI Phantom	00247	-	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	none	CNR	CNR
Gigatronics 8652A Power Meter	00110	1835801	29-Feb-16	Triennial
Gigatronics 80701A Power Sensor	00248	1833687	29-Feb-16	Triennial
HP 8753ET Network Analyzer	00134	US39170292	29-Dec-17	Triennial
Rohde & Schwarz SMR20 Signal Generator	00006	100104	29-May-17	Triennial
Amplifier Research 10W1000C Power Amplifier	00041	27887	CNR	CNR
Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
Narda Directional Coupler 3020A	00064	-	CNR	CNR
Traceable VWR Thermometer	00291	-	19-Nov-16	Triennial
Traceable VWR Jumbo Humidity/Thermometer	00295	170120555	17-Feb-17	Triennial
DC-18G 10W 30dB Attenuator	00102	-	COU	COU
R&S FSP40 Spectrum Analyzer	00241	100500	15-May-18	Triennial
RF Cable-SMA	00311	-	COU	COU
HP Calibration Kit	00145	-	10-Feb-17	Triennial

CNR = Calibration Not Required

COU = Calibrate on Use

19.0 FLUID COMPOSITION

Table 19.0 Fluid Composition 2450MHz BODY TSL

Tissue Simulating Liquid (TSL) Composition				
Component by Percent Weight				
Water	Glycol	Salt(1)	HEC(2)	Bacteriacide(3)
69.98	30.0	0.02	0.0	0.0

(1) Non-Iodinized
(2) **H**ydroxy**E**thyl-**C**ellulose: Sigma-Aldrich P/N 54290-500g
(3) Dow Chemical Dowicil 75 Antimicrobial Perservative

APPENDIX A – SYSTEM VERIFICATION PLOTS

Date/Time: 4/7/2018 3:21:54 PM

Test Laboratory: Celltech Labs

SPC-2450B Apr 7 2018

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:825

Communication System: UID 0, CW (0); Communication System Band: FullSpan (0.0 - 6000.0 MHz); Frequency: 2450 MHz;Communication System PAR: 0 dB; PMF: 1

Medium: TSL_2450B[07AP18]
Medium parameters used: f = 2450 MHz; σ = 1.96 S/m; ε_r = 51.48; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

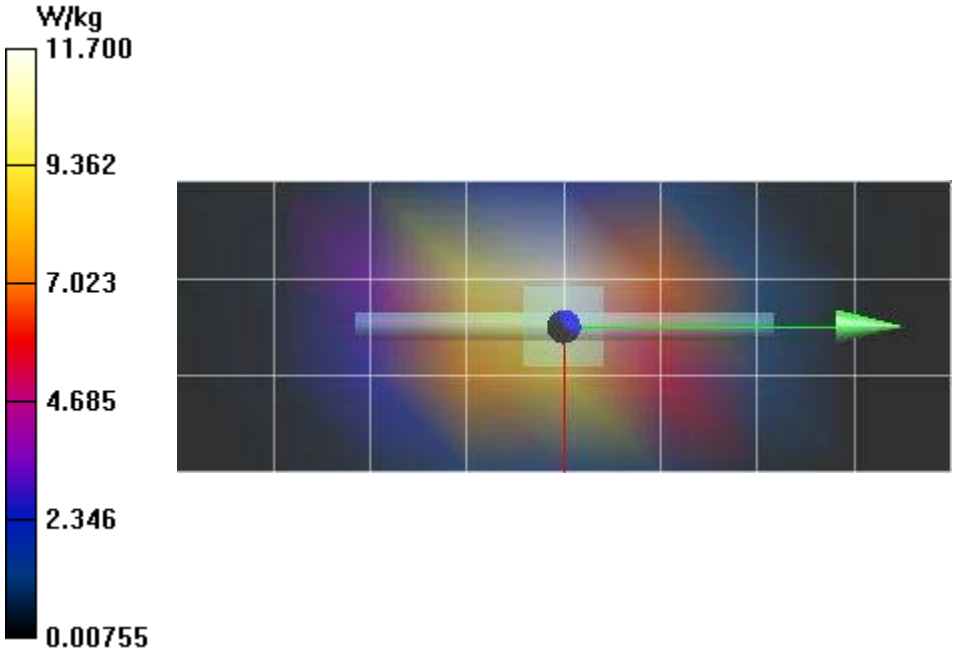
- Probe: EX3DV4 - SN3600; ConvF(6.56, 6.56, 6.56); Calibrated: 4/27/2017;
  - Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = -1.5, 31.0, -99.0
- Electronics: DAE4 Sn353; Calibrated: 4/24/2017
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax;
- DASY52 52.10.0(1446);

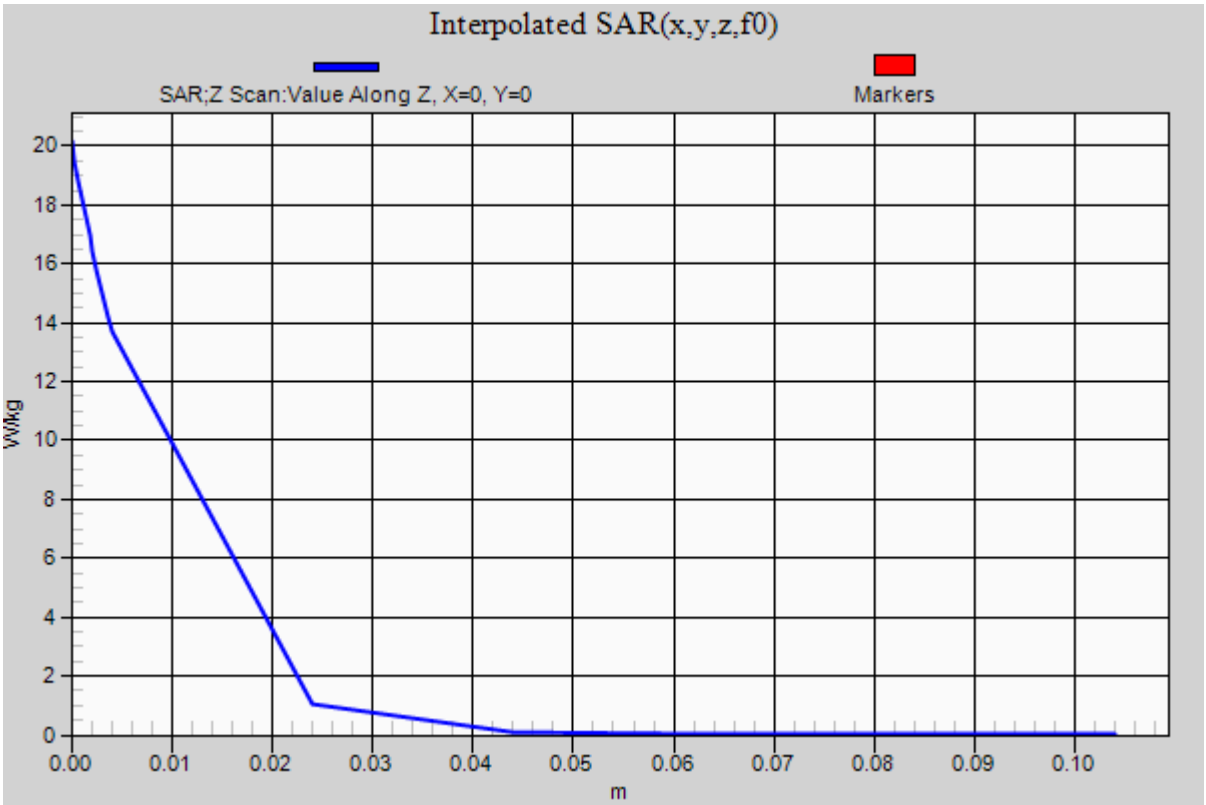
Frequency: 2450 MHz

SPC/SPC 2450B Input=250mw, Target=13.0W/kg/Area Scan (4x9x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 11.7 W/kg

SPC/SPC 2450B Input=250mw, Target=13.0W/kg/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 83.99 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 25.2 W/kg
SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.7 W/kg
Maximum value of SAR (measured) = 14.3 W/kg

SPC/SPC 2450B Input=250mw, Target=13.0W/kg/Z Scan (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=20mm
Penetration depth = n/a (n/a, 7.729) [mm]
Maximum value of SAR (interpolated) = 20.1 W/kg


W/kg
11.700
9.362
7.023
4.685
2.346
0.00755


Interpolated SAR(x,y,z,f0)
SAR;Z Scan:Value Along Z, X=0, Y=0
Markers
W/kg
20
18
16
14
12
10
8
6
4
2
0
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
m

APPENDIX B – MEASUREMENT PLOTS OF MAXIMUMUM MEASURED SAR

Plot B9

Date/Time: 4/10/2018 9:43:13 AM

Test Laboratory: Celltech Labs

Garmin-2450B Apr 10 2018

DUT: Garmin A03298; Type: Sample; Serial: IMEI Number

Communication System: UID 10012 - CAB, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps); Communication System Band: WLAN 2.4GHz (2412.0 - 2484.0 MHz); Frequency: 2457 MHz;Communication System PAR: 1.87 dB; PMF: 1.04833

Medium: TSL_2450B[07AP18]
Medium parameters used (interpolated): f = 2457 MHz; σ = 1.974 S/m; ε_r = 51.494; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3600; ConvF(6.56, 6.56, 6.56); Calibrated: 4/27/2017;
  - Modulation Compensation: PMR for UID 10012 - CAB, Calibrated: 4/27/2017
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = -1.5, 31.0, 151.0
- Electronics: DAE4 Sn353; Calibrated: 4/24/2017
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 Ax;
- DASY52 52.10.0(1446);

Frequency: 2457 MHz

2450B/B9-A03298, 2457MHz Body-Touch Left Side, WIFI, Bat P3 NiMH Pack 1.2V 2000mAH, Ant T1, Body Accessory B2/Area Scan (9x18x1):
Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.814 W/kg

2450B/B9-A03298, 2457MHz Body-Touch Left Side, WIFI, Bat P3 NiMH Pack 1.2V 2000mAH, Ant T1, Body Accessory B2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.706 V/m; Power Drift = 0.21 dB
Peak SAR (extrapolated) = 2.38 W/kg
SAR(1 g) = 0.948 W/kg; SAR(10 g) = 0.354 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.16 W/kg

2450B/B9-A03298, 2457MHz Body-Touch Left Side, WIFI, Bat P3 NiMH Pack 1.2V 2000mAH, Ant T1, Body Accessory B2/Z Scan (1x1x19):
Measurement grid: dx=20mm, dy=20mm, dz=20mm

Info: Interpolated medium parameters used for SAR evaluation.
Penetration depth = n/a (n/a, 8.077) [mm]
Maximum value of SAR (interpolated) = 0.0385 W/kg