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RF EXPOSURE FCC KDB 447498 CALCULATIONS

Applicant Name:
Owlet Baby Care Inc.
32 W. Center Street
Suite 201
Provo, UT 84601

Date of Testing:
08/08/2016
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1608121326.2AIEP-R1

FCC ID:	**2AIEP-OSS1B**
APPLICANT:	**OWLET BABY CARE INC.**

DUT Type:	Wearable Sensor
Test Methods Applied:	FCC KDB 447498, 865664
Model(s):	OSS 1.1

According to FCC KDB 447498 D01 4.3, SAR evaluation is not required for this device as the SAR Test Exclusion Threshold condition is satisfied as below:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 7.5 for 10-g extremity SAR

Where,
f(GHz) = 2.5 GHz
max. power of channel, including tune-up tolerance, mW = 13.5 dBm → 10.522 mW
Duty Factor = 47%
min. test separation distance = 5mm
Note: Power and distance are rounded to the nearest mW and mm before calculation

FCC 447498 D01 4.3 Formula = 11.0/5.0 * sqrt(2.5) = 3.4785 **≤ 7.5**

Therefore, Extremity SAR testing is not required to be tested for this device per FCC KDB 447498.

Note: This revised Test Report (S/N: 0Y1608121326.2AIEP-R1) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

A1. SAR TEST RESULTS (INFORMATION ONLY)

The following annex describes the SAR testing voluntarily performed by the applicant, although excluded for FCC Testing, according to FCC KDB 447498.

1 DEVICE UNDER TEST (INFORMATIVE ONLY)

1.1 Device Overview

This device is a wearable sensor intended only to be used with the back of the device to be used in close contact (0 mm) with feet. Therefore, this device was evaluated for extremity SAR.

Band & Mode	Operating Modes	Tx Frequency
Bluetooth LE	Data	2402 - 2480 MHz

1.2 Device Serial Numbers

Several samples that are programmed to transmit at one of 3 frequencies (2402, 2440 & 2480 MHz) were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

Mode	Extremity Serial Number
Bluetooth LE	000B8 / 0008E / 000B2

1.3 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.

1.4 Extremity Exposure Configurations

The device is evaluated with the back in direct contact against a flat phantom filled with body tissue-equivalent medium, although the 10-g extremity SAR Exclusion Thresholds in KDB Publication 447498 D01v06 show that SAR testing is not required.

2 SYSTEM VERIFICATION (INFORMATIVE ONLY)

2.1 Tissue Verification

Table 2-1
Measured Tissue Properties

[illegible]	[illegible]	[illegible] (°C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	%dev σ	%dev ε
8/8/2016	2450B	22.6	2400	1.975	51.618	1.902	52.767	*3.84%*	*-2.18%*
			2450	2.025	51.379	1.950	52.700	*3.85%*	*-2.51%*
			2500	2.108	51.169	2.021	52.636	*4.30%*	*-2.79%*

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

2.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix E.

Table 2-2
System Verification Results – 10g

[illegible] & [illegible]												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{10g} (W/kg)	[illegible] ([illegible])	[illegible] [illegible] ([illegible])	[illegible] (%)
E	2450	BODY	08/08/2016	21.7	22.0	0.100	719	7406	2.270	24.300	22.700	-6.58%

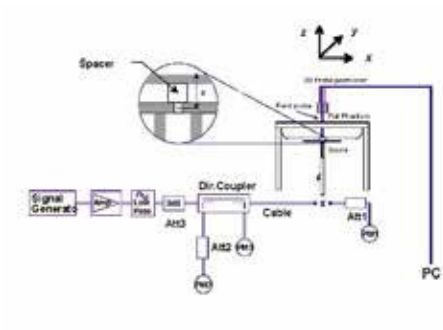

Figure 2-1
System Verification Setup Diagram

Figure 2-2
System Verification Setup Photo

3 SAR DATA (INFORMATIVE ONLY)

3.1 Standalone Extremity SAR Data

Table 3-1
Bluetooth LE Extremity SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	(10g)	Scaling Factor (Cond. Power)	Scaling Factor (Duty Cycle)	Reported SAR (10g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2402	0	Bluetooth LE	GFSK	13.5	10.97	0.00	0 mm	000B8	1	back	47.0	0.193	1.791	2.128	**0.735**	A1
2440	19	Bluetooth LE	GFSK	13.5	11.89	-0.02	0 mm	0008E	1	back	47.0	0.109	1.449	2.128	0.336	
2480	39	Bluetooth LE	GFSK	13.5	12.54	0.08	0 mm	000B2	1	back	47.0	0.121	1.247	2.128	0.321	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Extremity 4.0 W/kg (mW/g) averaged over 10 grams									

3.2 SAR Test Notes

General Notes:

1. The Test results show the 10g measured SAR below the 4.0 W/kg Extremity FCC Limit
2. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 447498 D01v06.
3. Batteries are fully charged at the beginning of the SAR measurements.
4. Liquid tissue depth was at least 15.0 cm for all frequencies.
5. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
6. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
7. Per FCC KDB 865664 D01v01r04, variability SAR tests were not required since the measured SAR results were less than 2.0 W/kg for 10g SAR. Please see Section **Error! Reference source not found.** for more information.
8. This device was tested at a low duty cycle so that the components and transmitter would operate as expected throughout the duration of the SAR test. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. The EMC Reports contain the calculations and procedures for measuring the duty factor of the device.

4 EQUIPMENT LIST (INFORMATIVE ONLY)

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Gigatronics	80701A	(0.05-18GHz) Power Sensor	11/4/2015	Annual	11/4/2016	1833460
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/2/2016	Annual	3/2/2017	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	3/2/2016	Annual	3/2/2017	JP38020182
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Anritsu	MT8820C	Radio Communication Analyzer	4/14/2016	Annual	4/14/2017	6201240328
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Rohde & Schwarz	CMU200	Base Station Simulator	12/2/2015	Annual	12/2/2016	833855/0010
Agilent	E5515C	Wireless Communications Test Set	11/4/2014	Biennial	11/4/2016	GB43193563
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433978
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/10/2016	Annual	5/10/2017	1070
Mitutoyo	CD-6"CSX	Digital Caliper	3/2/2016	Biennial	3/2/2018	13264165
Control Company	4040	Digital Thermometer	3/18/2015	Biennial	3/18/2017	150194896
Control Company	4353	Long Stem Thermometer	3/5/2015	Biennial	3/5/2017	150149565
Seekonk	NC-100	Torque Wrench	11/6/2015	Biennial	11/6/2017	22313
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Anritsu	MA2481A	Power Sensor	3/3/2016	Annual	3/3/2017	5318
Anritsu	MA2411B	Pulse Power Sensor	12/7/2015	Annual	12/7/2016	1339018
Anritsu	MA24106A	USB Power Sensor	6/2/2016	Annual	6/2/2017	1244512
Anritsu	MA24106A	USB Power Sensor	6/2/2016	Annual	6/2/2017	1248508
SPEAG	EX3DV4	SAR Probe	4/19/2016	Annual	4/19/2017	7406
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/14/2016	Annual	4/14/2017	1407
SPEAG	D2450V2	2450 MHz SAR Dipole	8/20/2015	Annual	8/20/2016	719

Note:

1. All equipment was used solely within its calibration period.
2. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

5 MEASUREMENT UNCERTAINTIES (INFORMATIVE ONLY)

a	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**□□□ (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System								
Probe Calibration	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	2.0	R	1.73	1.0	1.0	1.2	1.2	∞
Linearity	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	0.25	R	1.73	1.0	1.0	0.1	0.1	∞
Readout Electronics	0.3	N	1	1.0	1.0	0.3	0.3	∞
Response Time	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	6.7	R	1.73	1.0	1.0	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	2.7	N	1	1.0	1.0	2.7	2.7	35
Device Holder Uncertainty	1.67	N	1	1.0	1.0	1.7	1.7	5
Output Power Variation - SAR drift measurement	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
SAR Scaling	0.0	R	1.73	1.0	1.0	0.0	0.0	∞
Phantom & Tissue Parameters								
Phantom Uncertainty (Shape & Thickness tolerances)	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	4.2	N	1	0.78	0.71	3.3	3.0	10
Liquid Permittivity - measurement uncertainty	4.1	N	1	0.23	0.26	1.0	1.1	10
Liquid Conductivity - Temperature Uncertainty	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)		RSS				11.5	11.3	60
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2				23.0	22.6	

6 REFERENCES (INFORMATIVE ONLY)

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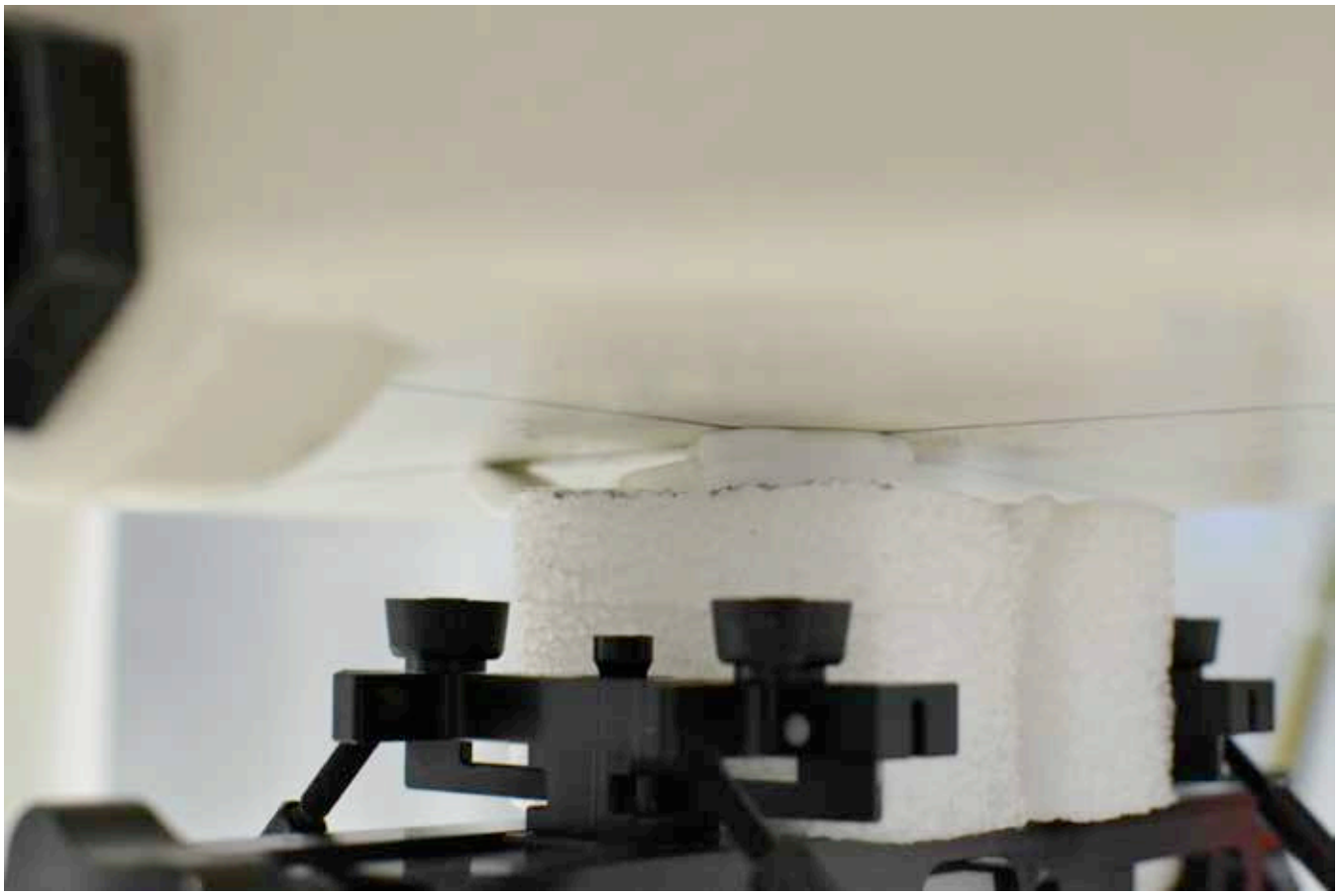
7 SAR TEST SETUP PHOTOGRAPHS



SAR Test Setup Photo 1 - Back side at 0.0 cm