



Maximum Permissible Exposure Evaluation

For the
Owlet Baby Care Inc.
Base Station
FCC ID: 2AIEP-OBS1B
ISED: 21386-OBS1B

August 31, 2016
Revised October 23, 2016
WLL JOB# 14578-MPE Rev 2

Prepared for:
OWLET BABY CARE INC.
32 W. CENTER STREET.
SUITE 201
PROVO, UT 84601

Prepared by:
WASHINGTON LABORATORIES, LTD.
7560 LINDBERGH DRIVE
GAITHERSBURG, MARYLAND 20879



Testing Certificate AT-1448

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Prepared by:



James Ritter
EMC Compliance Engineer

Reviewed by:



Steven D. Koster
President

Abstract

This report has been prepared on behalf of Owlet Baby Care Inc. Base Station to document the findings of the maximum permissible exposure evaluation on the Owlet Baby Care Inc. Base Station. The purpose of this evaluation is to establish a minimum safe distance as per the RF exposure requirements as defined in FCC §1.1307 & §1.1310 and ISED RSS102.

This report documents the results of testing to the requirements of:

- CFR Title 47 Volume 1 Practice and Procedure; (1.1307) Environmental Assessments
- RSS102 issue 5 March 2015 “Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)”
- Safety Code 6: “LIMITS OF HUMAN EXPOSURE TO RADIOFREQUENCY ELECTROMAGNETIC ENERGY IN THE FREQUENCY RANGE FROM 3 KHZ TO 300 GHZ”

The Evaluation was performed by Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Washington Laboratories, Ltd. has been accepted as an EMC Conformity Assessment Body (CAB) under the United States/European Union Memorandum of Agreement. Washington Laboratories, Ltd. is accredited by ANAB under Testing Certificate AT-1448.

Revision History	Reason	Date
Rev 0	Initial Release	August 31, 2016
Rev 1	Added ISED exposure results	October 2, 2016
Rev 2	Replaced full RF exposure with exemption data, Corrected tytp in section 5.5	October 23,2016

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1 Introduction

This report has been prepared on behalf of Owlet Baby Care Inc. Base Station Transmitter to show compliance with the RF exposure requirements as defined in FCC §1.1307.

Testing supporting this evaluation was performed at Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Washington Laboratories, Ltd. has been accepted as an EMC Conformity Assessment Body (CAB) under the United States/European Union Memorandum of Agreement. Washington Laboratories, Ltd. is accredited with ACLASS under Testing Certificate AT-1448.

2 Requirements

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable. Additionally, the FCC categorizes the use of the devices based on the user's awareness and the ability to exercise control over his or her exposure. The two categories are defined as Occupational/Controlled Exposure and General Population/Uncontrolled Exposure.

2.1 Transmitter Categories

2.1.1 Fixed Installations

A fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.

2.1.2 Mobile Devices

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.

2.1.3 Portable Devices

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. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR §2.1093).

2.2 Exposure Categories

The limits for exposure are determined by the type of situation the individual is exposed to. Table 1 lists the limits for the particular environment.

2.2.1 Occupational/Controlled Exposure

In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.

2.2.2 General Population/Uncontrolled Exposure

The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category and the general population/uncontrolled exposure limits apply to these devices.

Table 1: MPE Limits

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	6
300–1500	N/A	N/A	f/300	6
1500–100,000	N/A	N/A	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
30–300	27.5	0.073	0.2	30
300–1500	N/A	N/A	f/1500	30
1500–100,000	N/A	N/A	1	30

3 Device Summary

Table 1 below summarizes the criteria used to evaluate the Base Station.

The EUT uses a low power 2,4GHz DTS spread spectrum and an 802/11a/b/n transceiver.

Table 2: Device Summary of the Base Station

Model Evaluated:	Base Station
Transmitter Category:	Mobile
Exposure Category:	General Population
Antenna Gain:	2.4GHz DTS Radio: -2.13dBi 802.11b/g/n Wi-Fi Radio: -2.37dBi
Power Output (dBm):	2.4GHz DTS Radio: 16.07mW (12.06dBm) conducted 802.11b/g/n Wi-Fi Radio: 204.17mW (23.1dBm) conducted
Evaluation Distance:	20cm
Frequency Range:	2.4GHz DTS Radio: 2402-2480MHz 802.11b/g/n Wi-Fi Radio: 2412 – 2462MHz
Limit:	1mW/cm ²

4 Radio Frequency Radiation Exposure Evaluation

The highest RF output power of the unit was measured and recorded. According to §1.1310 of the FCC rules, the power density limit for General Population/Uncontrolled Exposure is $1\text{mW}/\text{cm}^2$.

The MPE shall be calculated at 20cm to show compliance with the power density limit. The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at the Antenna Terminals

G = Gain of Transmit Antenna (linear gain-isotropic)

R = Distance from Transmitting Antenna

Table 3: Transmitter MPE Calculation Summary

One Transmitter

Frequency	2402	MHz
Limit	1.000	mW/cm ²
Distance (cm), R =	20	cm
Power (dBm), P =	12.06	dBm
TX Ant Gain (dBi), G =	-2.13	dB

Power Density: 0.0020 mW/cm² **Separation<20 cm**
Minimum Distance: 0.9 cm

Second Transmitter

Frequency	2412	MHz
Limit	1.000	mW/cm ²
Distance (cm), R =	20	cm
Power (dBm), P =	23.1	dBm
TX Ant Gain (dB), G =	-2.37	dB

Power Density: 0.0235 mW/cm² **Separation<20 cm**
Minimum Distance: 3.1 cm

Multiple Transmitter Summary

Power Density: 0.0255 mW/cm² **Separation<20 cm**
Minimum Distance: 4.0 cm **Sum of the Distances**

5 RSS102 issue 5 Routine RF evaluation:

5.1 RSS102 Exemption Limits

According to RSS102 Section 2.5.2 “at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz”.

As both transmitters have negative antenna gain the conducted power out without the antenna gain is used as worst case. This is the heist of radiated and conducted EIRP.

5.2 RSS102 Exemption Limits Results

Based on the above formula of than $1.31 \times 10^{-2} f^{0.6834}$ W, The DTS transmitter transmitting at 2402MHz and the Wi-Fi radio transmitting at 2412MHz will have an exemption limit of 2.6W.

As the DTS conducted power is 16.07mW and the Wi-Fi conducted power is 204.17mW both transmitters are significantly under the individual radio exemption limits.

5.3 RSS102 exposure Power Density for individual transmitters

One Transmitter			
Frequency	2402	MHz	
Distance (cm), R =	20	cm	
Power (dBm), P =	12.06	dBm	
TX Ant Gain (dBi), G =	-2.13	dB	
Power Density:	0.0196	W/m ²	
Second Transmitter			
Frequency	2412	MHz	
Distance (cm), R =	20	cm	
Power (dBm), P =	23.1	dBm	
TX Ant Gain (dB), G =	-2.37	dB	
Power Density:	0.2354	W/m ²	

*These Readings are based on Conducted Measurements as these are higher than radiated measurements.

5.4 Colocation Requirements of Industry Canada Safety Code 6

In accordance with Safety Code 6 “Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz” co-located devices must comply with Note 4 of Table 5. Note 4 is used as power density was determined in the above test results. The test requirement is as follows:

For frequencies above 10MHz

“For simultaneous exposure to multiple frequencies and where exposure is estimated in terms of power density, each of the power density frequency component amplitudes shall be divided by the corresponding reference level for that frequency, and the sum of all these ratios shall not exceed unity. This may be expressed as: $\sum (S_i / SRL) \leq 1$ ”

For this device the formula will be the sum of $(DTS/SRL) + (WiFi/SRL) \leq 1$

5.5 Test summary

From Section 5.2 of this report the power density of the DTS transmitter is 0.0196W/m². The reference level limit =5.351 W/m² from RSS102 table 4.

From Section 5.2 of this report the power density of the Wi-fi transmitter is 0.2354W/m². The reference level limit =5.366 W/m² from RSS102 table 4

DTS TX:

$$(Si/SRL) = 0.0196/5.351=0.00366$$

Wi-FI TX

$$(Si/SRL) =(0.2354/5.366)=0.04387$$

The sum of these ratios = 0.00366 + 0.04387= 0.04753

As 0.04753<1 the unit complies with co-located exposure limits.