# Procter & Gamble SAR EXCLUSION REPORT

**SCOPE OF WORK**
SAR EXCLUSION CALCULATION
ON THE IGROWTH GENERATION 2 KITCHEN DEVICE

**REPORT NUMBER**
105422640LEX-001b.2

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# SAR EXCLUSION REPORT

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| **Report Number:** | 105422640LEX-001b.2 |
| **Project Number:** | G105422640 |
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| **Report Issue Date:** | 6/26/2023 |
| **Report Revised Date:** | 1/19/2024 |
|  |  |
| **Product Name:** | iGrowth Generation 2 Kitchen Device |
|  |  |
| **Standards:** | FCC Title 47 CFR Part 2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices |
|  | RSS-102 Issue 5 |

Tested by:
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Client:
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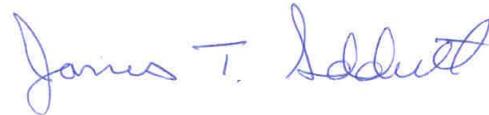
*James Sudduth, Senior Staff Engineer*

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## 1    Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested is **exempt** from routine SAR evaluation. The results obtained in this test report pertain only to the item(s) tested.  Intertek does not make any claims of compliance for samples or variants which were not tested.

## 2    Test Summary

| Section | Test Full Name | Result |
|---------|----------------|--------|
| 6.1 | FCC SAR Exclusion Calculation | Exempt from SAR |
| 6.2 | RSS-102 SAR Exclusion Calculation | Exempt from SAR |

## 3   Client Information

**This product was tested at the request of the following:**

| Client Information | |
|---|---|
| **Client Name:** | Procter & Gamble |
| **Address:** | 5289 Vine St<br>Cincinnati, OH 45217-1027<br>USA |
| **Contact:** | Spencer Miller |
| **Telephone:** | +1 (734) 834-2579 |
| **Email:** | miller.s.19@pg.com |
| **Manufacturer Information** | |
| **Manufacturer Name:** | Procter & Gamble |
| **Manufacturer Address:** | 5289 Vine St<br>Cincinnati, OH 45217-1027<br>USA |

## 4    Description of Equipment under Test and Variant Models

| Equipment Under Test | |
|---|---|
| Product Name | iGrowth Generation 2 Kitchen Device |
| Model Number | 3283 |
| Serial Number | PT2.0-P00021 |
| Supported Transmit Bands | RFID: 13.110MHz – 14.010MHz (FCC Part 15.225 / RSS-210 Issue 10) |
| Embedded Modules | Particle Boron B402 (FCCID: 2AEMI-B402, ICID: 20127-B402) |
| Test Start Date | 10/22/2021 |
| Test End Date | 12/1/2021 |
| Device Received Condition | Good |
| Test Sample Type | Production |
| Input Rating | 7.5VDC |
| Antenna Separation Distance[1] | 10mm |
| Description of Equipment Under Test (provided by client) | |
| 2nd Generation kitchen towel consumption monitoring device for consumer research studies. | |

### 4.1    Variant Models:

There were no variant models covered by this evaluation.

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[1] This information was provided by the client and may affect compliance. Intertek does not make any claim of compliance for values other than those shown.

## 4.2 Duty Factor Calculation

The following information was taken from the operational description provided by the client. Deviations from these values may affect compliance. Intertek does not make any claims of compliance for values other than those shown.

The device communicates on a very limited basis:

- The cellular modem duty cycle is determined by the main processor. The main processor powers the cellular modem and attempts communication once per week. This communication is expected to be a maximum of 49 seconds. Messages are limited by firmware to a 40 second window and 9 seconds is expected for initial cellular registration
- If the time limit is reached, a new uplink will be scheduled for 30 minutes later so that unsent data can be transmitted. For Duty cycle calculations, 30 minutes is the longest total averaging (sliding) window
- During this 49s interval the device will transmit for a maximum of 0.76s
- During the 9 seconds window for cellular registration, measurements taken from a test device showed 0.63sec were spent transmitting. See Figures 2 and 3 for this measurement.
- 0.13sec of the remaining 40 seconds is the maximum time used to transmit data packets. This is due to the hardcoded delay of 0.3 seconds between each data message sent and the LTE Category M1 half-duplex connected mode actively transmitting for 1ms within a 10ms radio frame. See Figures 3, 4, and 5 for further elaboration.
- In Total, 0.76s is the maximum transmission time on a 30minute window. This results in a duty cycle of 0.04% which is below the limit of 2.72%. See Figure 5 for detailed calculation.
- This communication pattern is hard coded in firmware
- The end user cannot change the duty cycle because they would need to disassemble the device and to have special equipment and knowledge to reprogram it.

### 4.3    Antenna Gain

The following information was taken from the Particle B402 quick start guide provided by the client. Any deviations from these values may affect compliance. Intertek does not make any claim of compliance for values other than those shown here.

| PRODUCT | | B Series B402 |
|---|---|---|
| MODEL NAME | | B402,B402S |
| NOMINAL VOLTAGE | | Li+ PIN /Battery connector: DC 3.7V from Li-ion Battery or VUSB PIN /USB connector :DC 5V from USB Host Unit |
| OPERATING TEMPERATURE RANGE | | -20 ~ 75℃ |
| MODULATION TYPE | LTE/BLE | QPSK&16QAM, GFSK(1MHz, 2MHz) |
| TX OPERATING FREQUENCY | LTE/BLE | 1850.7MHz ~ 1909.3MHz   (FOR LTE Band2)<br>1710.7MHz ~ 1754.3MHz   (FOR LTE Band4)<br>824.7MHz ~ 848.3MHz   (FOR LTE Band5)<br>699.7MHz ~ 715.3MHz   (FOR LTE Band12)<br>779.5MHz ~ 784.5MHz   (FOR LTE Band13)<br>2402MHz ~ 2480MHz (FOR BLE) |
| ANTENNA GAIN | LTE Band 2 | FPC Antenna with 3.5dBi gain |
| | LTE Band 4 | FPC Antenna with 3.5dBi gain |
| | LTE Band 5 | FPC Antenna with 1.0dBi gain |
| | LTE Band 12 | FPC Antenna with 1.0dBi gain |
| | LTE Band 13 | FPC Antenna with 1.0dBi gain |
| | BLE | FPCB Antenna with 2.0dBi gain |

## 4.5    Output Power and EIRP

The following information was taken from the Particle B402 Test Report SA190606W003 provided by the client. Any deviations from these values may affect compliance. Intertek does not make any claim of compliance for values other than those shown here.

**LTE**

| Band | Frequency (MHz) | Operating Mode | Antenna Gain (dBi) | Tune-up Power (dBm) | E.I.R.P Power (mW) | Power Density (mW/cm^2) | limit (mW/cm^2) | PASS / FAIL |
|------|-----------------|----------------|--------------------|--------------------|--------------------|-------------------------|-----------------|-------------|
| Band 2 | 1880 | QPSK | 3.50 | 24.80 | 676.083 | 0.135 | 1.00 | PASS |
| Band 4 | 1720 | QPSK | 3.50 | 25.00 | 707.946 | 0.141 | 1.00 | PASS |
| Band 5 | 829 | QPSK | 1.00 | 25.00 | 398.107 | 0.079 | 0.56 | PASS |
| Band 12 | 707.5 | QPSK | 1.00 | 25.00 | 398.107 | 0.079 | 0.47 | PASS |
| Band 13 | 782.0 | QPSK | 1.00 | 25.00 | 398.107 | 0.079 | 0.52 | PASS |

## 5    Test Procedure

### 5.1    FCC SAR Exclusion

**FCC Title 47 CFR Part 2.1093(c)(1):**

Evaluation of compliance with the exposure limits in § 1.1310 of this chapter, and preparation of an EA if the limits are exceeded, is necessary for portable devices having single RF sources with more than an available maximum time-averaged power of 1 mW, more than the ERP listed in Table 1 to § 1.1307(b)(3)(i)(C), or more than the Pth in the following formula, whichever is greater. The following formula shall only be used in conjunction with portable devices not exempt by § 1.1307(b)(3)(i)(C) at distances from 0.5 centimeters to 20 centimeters and frequencies from 0.3 GHz to 6 GHz.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20\,cm}(d/20\,\text{cm})^x & d \leq 20 \text{ cm} \\ ERP_{20\,cm} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\,cm} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

$d$ = the separation distance (cm);

**FCC KDB 447498 D04 Interim General RF Exposure Guidance v01 § 2.2.1:**

Finally, when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

## 5.2    RSS-102 SAR Exclusion

**RSS-102 Issue 5 § 2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation:**

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

| | Exemption Limits (mW) | | | | |
|---|---|---|---|---|---|
| Frequency (MHz) | At separation distance of ≤5 mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300 | 71 mW | 101 mW | 132 mW | 162 mW | 193 mW |
| 450 | 52 mW | 70 mW | 88 mW | 106 mW | 123 mW |
| 835 | 17 mW | 30 mW | 42 mW | 55 mW | 67 mW |
| 1900 | 7 mW | 10 mW | 18 mW | 34 mW | 60 mW |
| 2450 | 4 mW | 7 mW | 15 mW | 30 mW | 52 mW |
| 3500 | 2 mW | 6 mW | 16 mW | 32 mW | 55 mW |
| 5800 | 1 mW | 6 mW | 15 mW | 27 mW | 41 mW |

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

## 6    Results:

### 6.1    FCC SAR Exclusion Calculation

RFID:

| Field Strength @ 3m (dBµV/m) | Field Strength @ 3m (V/m) | EIRP (mW) | Limit (mW) | Exempt? |
|---|---|---|---|---|
| 60.56 | $1.066 \times 10^{-6}$ | $3.41 \times 10^{-4}$ | 1109 | Exempt |

Cellular:

| RF Source | Frequency (GHz) | Separation Distance (cm) | Output Power (mW/dBm) | Duty Factor (%/dB) | Average Output Power (mW/dBm) | $P_{th}$ (mW/dBm) | Exempt from SAR? |
|---|---|---|---|---|---|---|---|
| Band 2 | 1.85 | 0.5 | 302mW 24.8dBm | 0.04% -34.0dB | 0.121mW -9.2dBm | 8.6mW 9.3dBm | Exempt |
| Band 4 | 1.71 | 0.5 | 316mW 25.0dBm | 0.04% -34.0dB | 0.126mW -9.0dBm | 9.1mW 9.6dBm | Exempt |
| Band 5 | 0.824 | 0.5 | 316mW 25.0dBm | 0.04% -34.0dB | 0.126mW -9.0dBm | 23.6mW 13.7dBm | Exempt |
| Band 12 | 0.699 | 0.5 | 316mW 25.0dBm | 0.04% -34.0dB | 0.126mW -9.0dBm | 29.7mW 14.7dBm | Exempt |
| Band 13 | 0.777 | 0.5 | 316mW 25.0dBm | 0.04% -34.0dB | 0.126mW -9.0dBm | 25.6mW 14.1dBm | Exempt |

$(0.121 \text{ mW} / 8.6 \text{ mW}) + (3.41 \times 10^{-4} \text{ mW} / 1109 \text{ mW}) = 0.0141$

Since the combined SAR-to-limit ratio is < 1, the device is deemed to comply with simultaneous exposure requirements according to FCC Title 47 CFR Part 1.1307(b)(3)(ii)(B).

## 6.2 RSS-102 SAR Exclusion Calculation

RFID:

| Field Strength @ 3m (dBμV/m) | Field Strength @ 3m (V/m) | EIRP (mW) | Limit (mW) | Exempt? |
|---|---|---|---|---|
| 60.56 | $1.066 \times 10^{-6}$ | $3.41 \times 10^{-4}$ | 252.5 | Exempt |

Cellular:

| RF Source | Frequency (GHz) | Separation Distance (mm) | EIRP (mW/dBm) | Duty Factor (%/dB) | Average Output Power (mW/dBm) | $P_{th}$ (mW/dBm) | Exempt from SAR? |
|---|---|---|---|---|---|---|---|
| Band 2 | 1.85 | 5 | 676mW 28.3dBm | 0.04% -34.0dB | 0.270mW -5.7dBm | 18.7mW 12.7dBm | Exempt |
| Band 4 | 1.71 | 5 | 708mW 28.5dBm | 0.04% -34.0dB | 0.283mW -5.5dBm | 22.0mW 13.4dBm | Exempt |
| Band 5 | 0.824 | 5 | 398mW 26.0dBm | 0.04% -34.0dB | 0.159mW -8.0dBm | 45.0mW 16.5dBm | Exempt |
| Band 12 | 0.699 | 5 | 398mW 26.0dBm | 0.04% -34.0dB | 0.159mW -8.0dBm | 73.4mW 18.7dBm | Exempt |
| Band 13 | 0.777 | 5 | 398mW 26.0dBm | 0.04% -34.0dB | 0.159mW -8.0dBm | 55.6mW 17.5dBm | Exempt |

$(0.270 \text{ mW} / 18.7 \text{ mW}) + (3.41 \times 10^{-4} \text{ mW} / 252.5 \text{ mW}) = 0.0144$

Since the combined SAR-to-limit ratio is < 1, the device is deemed to comply with simultaneous exposure requirements, in accordance with RSS-102 Issue 5 § 3.1.2 and FCC KDB 447498 D04 Interim General RF Exposure Guidance v01.

## 7 Revision History

| Revision Level | Date | Report Number | Prepared By | Reviewed By | Notes |
|---|---|---|---|---|---|
| 0 | 6/26/2023 | 105422640LEX-001b | B ⅃ | JTS | Original Issue |
| 1 | 11/13/2023 | 105422640LEX-00b.1 | B ⅃ | JTS | Updated calculation using lower duty cycle |
| 2 | 1/19/2024 | 105422640LEX-001b.2 | B ⅃ | JTS | Updated duty cycle |
| | | | | | |
| | | | | | |