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# Oreon Holding BV

## RF EXPOSURE REPORT

### SCOPE OF WORK

RF EXPOSURE CALCULATION  
ON THE OLCC TRANSCEIVER MODULE

### REPORT NUMBER

105659039LEX-003.1

### ISSUE DATE

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## RF EXPOSURE TEST REPORT

**Report Number:** 105659039LEX-003.1

**Project Number:** G105659039

**Report Issue Date:** 5/17/2024

**Product Name:** OLCC Transceiver Module

**Product Model:** OLCC-TM017-B

**Standards:** FCC Title 47 CFR Part 1.1310(e)(1) Limits for  
Maximum Permissible Exposure (MPE)

RSS-102 Issue 6 RF Field Strength Limits for  
Devices Used by the General Public

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Client:  
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Table of Contents

|           |   |           |
|-----------|---|-----------|
| <b>1</b>  | <b><i>Introduction and Conclusion.....</i></b>                            | <b>4</b>  |
| <b>2</b>  | <b><i>Test Summary .....</i></b>  | <b>4</b>  |
| <b>3</b>  | <b><i>Client Information .....</i></b>                                    | <b>5</b>  |
| <b>4</b>  | <b><i>Description of Equipment under Test and Variant Models.....</i></b> | <b>6</b>  |
| <b>5</b>  | <b><i>Output Power.....</i></b>   | <b>7</b>  |
| <b>6</b>  | <b><i>Antenna Gain .....</i></b>  | <b>7</b>  |
| <b>7</b>  | <b><i>FCC RF Exposure Limits .....</i></b>                                | <b>8</b>  |
| <b>8</b>  | <b><i>RSS-102 Issue 6 RF Exposure Limits.....</i></b>                     | <b>9</b>  |
| <b>9</b>  | <b><i>Test Procedure .....</i></b>  | <b>10</b> |
| <b>10</b> | <b><i>Results:.....</i></b>   | <b>11</b> |
| <b>11</b> | <b><i>Revision History.....</i></b>                                       | <b>12</b> |



## 1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 4. 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 **complies** with the requirements of the standard(s) indicated. 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 |
|---------|---|--------|
| 10      | FCC Title 47 CFR Part 1.1310(e)(1) Limits for Maximum Permissible Exposure (MPE)<br>(Limits for General Population / Uncontrolled Exposure) | Pass   |
|         | RSS-102 Issue 6 RF Field Strength Limits<br>(For Devices Used by the General Public)  | Pass   |



### 3 Client Information

This product was tested at the request of the following:

| Client Information           |   |
|------------------------------|---|
| <b>Client Name:</b>          | Oreon Holding BV  |
| <b>Address:</b>              | Lorentzlaan 6, 3401MX IJsselstein (UT), The Netherlands |
| <b>Contact:</b>              | Guido Dirkx   |
| <b>Telephone:</b>            | +31(0)627299710   |
| <b>Email:</b>                | guido@oreon-led.com                                     |
| Manufacturer Information     |   |
| <b>Manufacturer Name:</b>    | Oreon Holding BV  |
| <b>Manufacturer Address:</b> | Lorentzlaan 6, 3401MX IJsselstein (UT), The Netherlands |



#### 4 Description of Equipment under Test and Variant Models

| Equipment Under Test   |                            |
|--|----------------------------|
| Product Name   | OLCC Transceiver Module    |
| Model Number   | OLCC-TM017-B               |
| Hardware Version   | OLCC-TM017-B               |
| Software Version   | 193502DB                   |
| FCC ID   | 2BDGPTM017                 |
| ICID   | 31569-TM017                |
| Wireless Technology  | Bluetooth Low Energy (BLE) |
| Supported Transmit Bands   | 2402 MHz – 2480 MHz        |
| Supported Transmit Modulations   | GFSK                       |
| Antenna Gain <sup>1</sup>  | 1.95 dBi                   |
| Maximum Output Power   | -28.09 dBm EIRP            |
| Ratings  | 12V                        |
| Description of Equipment Under Test (provided by client)   |                            |
| The Oreon Holding BV OLCC Transceiver Module model OLCC-TM017-B is a device for connecting to Bluetooth mesh networks. |                            |

##### 4.1 Variant Models:

There were no variant models covered by this evaluation.

<sup>1</sup> Values were provided by the client and may affect compliance. Intertek does not make any claims of compliance for values other than those shown.



## 5 Output Power

The output power was measured and reported in Intertek report 105659039LEX-001.

| Frequency (MHz) | Receiver Reading (dBuV) | Cable Loss (dB) | Antenna Factor (dBm <sup>-1</sup> ) | Electric Field (dBuV/m) | EIRP (dBm) | Antenna Gain (dBi) | Calculated Conducted Power (dBm) |
|-----------------|-------------------------|-----------------|-------------------------------------|-------------------------|------------|--------------------|----------------------------------|
| 2402            | 27.29                   | 7.04            | 32.02                               | 66.35                   | -28.88     | 1.95               | -30.83                           |
| 2426            | 27.14                   | 7.08            | 32.20                               | 66.42                   | -28.81     | 1.95               | -30.76                           |
| 2480            | 27.48                   | 7.18            | 32.48                               | 67.14                   | -28.09     | 1.95               | -30.04                           |

## 6 Antenna Gain

The antenna gain was taken from the STMicroelectronics application note AN5129 provided by the client. Intertek does not make any claims of compliance for values other than those shown below.

At center ISM Band frequency 2.44175 GHz, the antenna shows the following key performance parameters:

- Directivity 2.21 dB
- Gain 1.95 dBi
- Maximum intensity 0.125 W/Steradian



## 7 FCC RF Exposure Limits

### Title 47 CFR Part 1.1310(d)(2):

For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part, except for portable devices as defined in § 2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in § 2.1093.

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 <sup>2</sup> ) | 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 <sup>2</sup> )              | <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 <sup>2</sup> )              | <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.



## 8 RSS-102 Issue 6 RF Exposure Limits

### RSS-102 Issue 6 § 6.6:

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP 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
- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

### RSS-102 Issue 6 § 5.3.2:

The electric and magnetic field strength reference levels, power density reference levels, and associated reference period for devices employed by the general public (uncontrolled environment) and controlled-use devices (controlled environment) are specified in table 7 and table 8. Note that the power density limits specified in these tables apply to whole body exposure conditions.

Table 7: RF field strength and power density limits for devices used by the general public (uncontrolled environment)

| Frequency range (MHz) | Electric field (V <sub>RMS</sub> /m) | Magnetic field (A <sub>RMS</sub> /m) | Power density (W/m <sup>2</sup> ) | Reference period (minutes) |
|-----------------------|--------------------------------------|--------------------------------------|-----------------------------------|----------------------------|
| 10-20                 | 27.46                                | 0.0728                               | 2                                 | 6                          |
| 20-48                 | $58.07 / f^{0.25}$                   | $0.1540 / f^{0.25}$                  | $8.944 / f^{0.5}$                 | 6                          |
| 48-300                | 22.06                                | 0.05852                              | 1.291                             | 6                          |
| 300-6000              | $3.142 f^{0.3417}$                   | $0.008335 f^{0.3417}$                | $0.02619 f^{0.6834}$              | 6                          |
| 6000-15000            | 61.4                                 | 0.163                                | 10                                | 6                          |
| 15000-150000          | 61.4                                 | 0.163                                | 10                                | $616000 / f^{1.2}$         |
| 150000-300000         | $0.158 f^{0.5}$                      | $4.21 \times 10^{-4} f^{0.5}$        | $6.67 \times 10^{-5} f$           | $616000 / f^{1.2}$         |

**Note:**  $f$  is frequency in MHz.



## 9 Test Procedure

An RF exposure calculation was performed to show that the device was compliant with the general population exposure limits from FCC Title 47 CFR Part 1.1310(e)(1), RSS-102 Issue 6, and ICNIRP Guidelines (2020). The maximum power density was calculated for each transmitter at a separation distance of 20cm using the maximum conducted output power (including tune up tolerance) plus antenna gain, or measured EIRP.

For each transmitter the maximum power density at a 20cm distance using the formula:

$$EIRP(dBm) = Conducted\ Power(dBm) + Antenna\ Gain(dBi)$$

$$EIRP(mW) = 10^{EIRP(dBm)/10}$$

$$Power\ Density\left(mW/cm^2\right) = \frac{EIRP(mW)}{4\pi \cdot (20cm)^2}$$

$$Power\ Density\left(W/m^2\right) = \left(\frac{100cm}{1m}\right)^2 \left(\frac{1W}{1000mW}\right) Power\ Density\left(mW/cm^2\right)$$

For transmitters that could operate simultaneously, the ratio of calculated power density to the corresponding limit for each transmitter was calculated and then summed. If the sum of the ratios was less than 1, that specific combination of transmitters was deemed to comply.



## 10 Results:

The calculated maximum power density at 20cm was less than or equal to the limits for general population exposure in FCC Title 47 CFR Part 1.1310(e)(1) and RSS-102 Issue 6.

### 10.1 FCC RF Exposure Data

| Band / Modulation | Frequency (MHz) | Declared Max Cond. Power (Inc. Tolerance) (dBm) | Duty Cycle (%) | Duty Cycle Adjusted Cond. Output Power (dBm) | Antenna Gain (dBi) | MPE Value @ 20cm (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|-------------------|-----------------|---|----------------|--|--------------------|--|---------------------------------|
| BLE               | 2402            | -30.83  | 100%           | -30.83                                       | 1.95               | 2.57E-07                               | 1.0000                          |
|                   | 2426            | -30.76  | 100%           | -30.76                                       | 1.95               | 2.62E-07                               | 1.0000                          |
|                   | 2480            | -30.04  | 100%           | -30.04                                       | 1.95               | 3.09E-07                               | 1.0000                          |

### 10.2 RSS-102 Issue 6 RF Exposure Data

| Band / Modulation | Frequency (MHz) | Declared Max Cond. Power (Inc. Tolerance) (dBm) | Duty Cycle (%) | Duty Cycle Adjusted Cond. Output Power (dBm) | Antenna Gain (dBi) | MPE Value @ 20cm (W/m <sup>2</sup> ) | MPE Limit (W/m <sup>2</sup> ) |
|-------------------|-----------------|---|----------------|--|--------------------|--------------------------------------|-------------------------------|
| BLE               | 2402            | -30.83  | 100%           | -30.83                                       | 1.95               | 2.57E-06                             | 5.3508                        |
|                   | 2426            | -30.76  | 100%           | -30.76                                       | 1.95               | 2.62E-06                             | 5.3873                        |
|                   | 2480            | -30.04  | 100%           | -30.04                                       | 1.95               | 3.09E-06                             | 5.4689                        |



## 11 Revision History

| Revision Level | Date      | Report Number      | Prepared By | Reviewed By | Notes                               |
|----------------|-----------|--------------------|-------------|-------------|-------------------------------------|
| 0              | 5/2/2024  | 105659039LEX-003   | BZ          | MC          | Original Issue                      |
| 1              | 5/17/2024 | 105659039LEX-003.1 | BZ          | MC          | Corrected limit<br>Corrected Naming |
|                |           |                    |             |             |                                     |
|                |           |                    |             |             |                                     |
|                |           |                    |             |             |                                     |