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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

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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

Tested by:
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Client:
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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) (Limits for General Population / Uncontrolled Exposure)	Pass
	RSS-102 Issue 6 RF Field Strength Limits (For Devices Used by the General Public)	Pass



3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Oreon Holding BV
Address:	Lorentzlaan 6, 3401MX IJsselstein (UT), The Netherlands
Contact:	Guido Dirkx
Telephone:	+31(0)627299710
Email:	guido@oreon-led.com
Manufacturer Information	
Manufacturer Name:	Oreon Holding BV
Manufacturer Address:	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 ¹	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.

¹ 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 ⁻¹)	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 ²)	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 ²)	<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 ²)	<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 _{RMS} /m)	Magnetic field (A _{RMS} /m)	Power density (W/m ²)	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 ²)	MPE Limit (mW/cm ²)
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 ²)	MPE Limit (W/m ²)
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 Corrected Naming