# RF Exposure Evaluation Report

| | | | |
|---|---|---|---|
| **Date of Report** | 2/04/2020 | **Client's Contact person:** | Juha Soininen |
| **Number of pages:** | 8 | **Responsible Test engineer:** | Ilari kinnunen |
| **Testing laboratory:** | **Verkotan Oy**<br><br>Elektroniikkatie 17<br>90590 Oulu<br>Finland | **Client:** | **Haltian Oy**<br><br>Yrttipellontie 1D<br>90230 Oulu, Finland |
| **Tested device** | **Thingsee Gateway Global** | | |
| **Related reports:** | | | |
| **Testing has been carried out in accordance with:** | **KDB procedures KDB 447498 D01**<br>General RF Exposure Guidance v06 | | |
| **Documentation:** | The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory | | |
| **Test Results:** | **The EUT complies with the requirements in respect of all parameters subject to the test.**<br>The test results relate only to devices specified in this document | | |
| **Date and signatures:** | 02.04.2020 | | |

Miia Nurkkala

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**Laboratory Manager**

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## 1. EVALUATION SUMMARY

### 1.1 Equipment under Evaluation:

| | |
|---|---|
| **Product:** | Thingsee Gateway Global |
| **Manufacturer:** | HALTIAN PRODUCTS OY |
| **Model:** | MTXG |
| **FCC ID Number:** | 2AEU3TSGWGBL |
| **IC ID Number:** | 20236-TSGWGBL |
| **Hardware Version:** | 0201 |
| **Mobile/Portable device** | Mobile |
| **Controlled/ Uncontrolled Environment** | Uncotrolled |
| **Document ID:** | FCC RF exposure evaluation report_MTXG_ID4010_02042020. This report replaces FCC RF exposure evaluation report_MTXG_ID4010_28022020 |

### 1.1 Evaluation Result

Calculated power densities are reported below. The device conforms the radiofrequency radiation exposure limits of 47CFR §1.1310 when the calculated power density value is less than or equal to the limit.

| Modes of Operation | Power Density, S [mW/cm2] | Power Density Limit [mW/cm2] | Evaluation Result |
|---|---|---|---|
| GPRS 850 | 0.18 | 0.59 | **Pass** |
| GPRS 1900 | 0.25 | 1.00 | **Pass** |
| LTE M1 2 | 0.10 | 1.00 | **Pass** |
| LTE M1 4 | 0.13 | 1.00 | **Pass** |
| LTE M1 5 | 0.04 | 0.55 | **Pass** |
| LTE M1 12 | 0.03 | 0.47 | **Pass** |
| LTE M1 13 | 0.04 | 0.50 | **Pass** |
| LTE M1 26 | 0.04 | 0.54 | **Pass** |
| NB-IoT 2 | 0.10 | 1.00 | **Pass** |
| NB-IoT 4 | 0.13 | 1.00 | **Pass** |
| NB-IoT 5 | 0.04 | 0.55 | **Pass** |
| NB-IoT 12 | 0.03 | 0.47 | **Pass** |
| NB-IoT 13 | 0.04 | 0.50 | **Pass** |
| NB-IoT 26 | 0.04 | 0.54 | **Pass** |
| Wirepass | 0.001 | 1.00 | **Pass** |

### 1.1.1 Simultaneous transmission exposure

The compatibility in case of simultaneous cellular and Wirepass transmission was evaluated based on equation $\sum (S_f / L_f) \leq 1$, where: $S_f$ is power density at a specific frequency and $L_f$ is the power density limit for the frequence. GPRS 850 cellular power density was used in the calculation.

(0.18/0.59) + (0.001/1) = 0.3 <1 Thus the evaluation result is **Pass**

## 2. DESCRIPTION OF THE EQUIPMENT UNDER EVALUATION

The DUT is a gateway device collecting data from sensors connected to the same Wirepas protocol mesh network as itself. The data is delivered from the device via cellular connection to a data center

Generally, it is used in such a way that a separation distance of at least 20 centimeters is maintained between the transmitter and the body of the user or nearby persons.

### 2.1 Supported Frequency Bands and Operational Modes

| | Modes of Operation | Modulation Mode | Transmitter Frequency Range (MHz) |
|---|---|---|---|
| **TX Frequency bands** | GSM/GPRS/EDGE 850 | GMSK/8-PSK | 824-894 |
| | GSM/GPRS/EDGE 1900 | GMSK/8-PSK | 1850-1990 |
| | LTE M1 2 | QPSK/16QAM | 1850.7 - 1909.3 |
| | LTE M1 4 | QPSK/16QAM | 1710.7 - 1754.3 |
| | LTE M1 5 | QPSK/16QAM | 824-894 |
| | LTE M1 12 | QPSK/16QAM | 699-716 |
| | LTE M1 13 | QPSK/16QAM | 746-787 |
| | LTE M1 26 | QPSK/16QAM | 814-894 |
| | NB-IoT 2 | QPSK | 1850.7 - 1909.3 |
| | NB-IoT 4 | QPSK | 1710.7 - 1754.3 |
| | NB-IoT 5 | QPSK | 824-894 |
| | NB-IoT 12 | QPSK | 699-716 |
| | NB-IoT 13 | QPSK | 746-787 |
| | NB-IoT 26 | QPSK | 814-894 |
| | Wirepas | GFSK | 2400-2483 |

Wirepass transmitter can be active simultaneously with cellular transmitter.

## 3. GENERAL CONSIDERATIONS

For devices that operate at larger distances from persons, where there are minimal RF coupling interactions between a device and the user or nearby persons, the more complex SAR evaluation can be avoided by evaluating RF exposure compliance using MPE (Maximum Permissible Exposure) limits. When these limits are used, a minimum separation distance of ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons. The limits are presented in table below.

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm 2) | Averaging time (minutes) |
|---|---|---|---|---|
| **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 |
| **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 densi

**Occupational/controlled exposure** limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

**General population/uncontrolled** exposure limits apply in 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 fully aware of the potential for exposure or cannot exercise control over their exposure.

**Power Density** is calculated by equation:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot R^2}$$

Where,
S = Power Density
P = Power Input to Antenna
G = Gain of Antenna
R = Distance from transmitting Antenna

## 4. POWER DENSITY CALCULATIONS

| Modes of Operation | Low Ch Frequency [MHz] | Distance, R [cm] | UL slot configuration | Maximum Power Input to Antenna, P [dBm] | Maximum duty cycle | Power Input to Antenna, P [mW] | Power Gain of Antenna, G [dBi] | Power Density, S [mW/cm$^2$] | Limit [mW/cm$^2$] |
|---|---|---|---|---|---|---|---|---|---|
| GPRS 850 | 880 | 20 | 4/8 | 33 | 1 | 997.6 | -0.5 | 0.18 | 0.59 |
| GPRS 1900 | 1850 | 20 | 4/8 | 30 | 1 | 500.0 | 4 | 0.25 | 1.00 |
| LTE M1 2 | 1850.7 | 20 | NA | 23 | 1 | 199.5 | 4 | 0.10 | 1.00 |
| LTE M1 4 | 1710.7 | 20 | NA | 23 | 1 | 199.5 | 5 | 0.13 | 1.00 |
| LTE M1 5 | 824 | 20 | NA | 23 | 1 | 199.5 | -0.5 | 0.04 | 0.55 |
| LTE M1 12 | 699 | 20 | NA | 23 | 1 | 199.5 | -1.7 | 0.03 | 0.47 |
| LTE M1 13 | 746 | 20 | NA | 23 | 1 | 199.5 | -0.5 | 0.04 | 0.50 |
| LTE M1 26 | 814 | 20 | NA | 23 | 1 | 199.5 | -0.5 | 0.04 | 0.54 |
| NB-IoT 2 | 1850.7 | 20 | NA | 23 | 1 | 199.5 | 4 | 0.10 | 1.00 |
| NB-IoT 4 | 1710.7 | 20 | NA | 23 | 1 | 199.5 | 5 | 0.13 | 1.00 |
| NB-IoT 5 | 824 | 20 | NA | 23 | 1 | 199.5 | -0.5 | 0.04 | 0.55 |
| NB-IoT 12 | 699 | 20 | NA | 23 | 1 | 199.5 | -1.7 | 0.03 | 0.47 |
| NB-IoT 13 | 746 | 20 | NA | 23 | 1 | 199.5 | -0.5 | 0.04 | 0.50 |
| NB-IoT 26 | 814 | 20 | NA | 23 | 1 | 199.5 | -0.5 | 0.04 | 0.54 |
| Wirepas | 2400 | 20 | NA | 4 | 1 | 2.5 | 3 | 0.001 | 1.00 |

Simultaneous transmission can be evaluated based on equation $\sum (S_f / L_f) \leq 1$, where: $S_f$ is power density at a specific frequency and $L_f$ is the power density limit for the frequence.

GPRS 850 cellular power density is used in the calculation with Wirepas power density:

$$(0.18/0.59) + (0.001/1) = 0.3 < 1$$

Based on power density calculations at distance of 20cm, the power density of the equipment under evaluation is below the MPE limit.

== End of the report=