

MPE / SAR exemption letter 22-1-0119701T012a

## MPE / SAR exemption letter according Interim procedure KDB 447498 D04

| Customer                                                                         | Product         | Model                   | Type | HW Status | SW status                                                                                                 | FCC ID              |
|----------------------------------------------------------------------------------|-----------------|-------------------------|------|-----------|-----------------------------------------------------------------------------------------------------------|---------------------|
| Grundfos Holding A/S<br>Poul Due Jensens Vej 7<br>DK-8850 Bjerringbro<br>Denmark | Cellular module | CIM 290-MA<br>LPWAN GiC | N/A  | R03       | MCU:<br>92875953V00.00.00.00018<br>_CIM290_R_Merged<br>BLE FW: V06.00.03.00001<br>Cellular FW: M0C.400004 | OG3-<br>CIM290LPWAN |

Declared minimum distance to human body according to customer  $\geq 20$  cm according customer's document "MPE Information Requirements - all EU & AMERICA bands V0928 to adjust GSM rated power".

The customer thus declares that the device is not body-worn.

### RF Exposure Test Exemptions for Single Source

#### MPE-based Exemption

According 1.1307(b)(3)(i)(C) Option C – ERP at frequencies above 300 kHz but at distances  $R > \lambda/2\pi$  can be exempted as follows:

TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES  
SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

| RF Source Frequency                                                                                                                      |   |           | Minimum Distance   |   |                    | Threshold ERP                        |
|------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|--------------------|---|--------------------|--------------------------------------|
| $f_L$ MHz                                                                                                                                |   | $f_H$ MHz | $\lambda_L / 2\pi$ |   | $\lambda_H / 2\pi$ | W                                    |
| 0.3                                                                                                                                      | – | 1.34      | 159 m              | – | 35.6 m             | 1,920 R <sup>2</sup>                 |
| 1.34                                                                                                                                     | – | 30        | 35.6 m             | – | 1.6 m              | 3,450 R <sup>2</sup> /f <sup>2</sup> |
| 30                                                                                                                                       | – | 300       | 1.6 m              | – | 159 mm             | 3.83 R <sup>2</sup>                  |
| 300                                                                                                                                      | – | 1,500     | 159 mm             | – | 31.8 mm            | 0.0128 R <sup>2</sup> f              |
| 1,500                                                                                                                                    | – | 100,000   | 31.8 mm            | – | 0.5 mm             | 19.2R <sup>2</sup>                   |
| Subscripts L and H are low and high; $\lambda$ is wavelength.<br>From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns. |   |           |                    |   |                    |                                      |

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### SAR-based Exemption

According 1.1307(b)(3)(i)(B) Option B – Available maximum time-averaged power or effective radiated power (ERP) at frequencies above 300 kHz and below 6 GHz, but with distances from 0.5 cm to 40 cm may be exempted as follows:

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B. 1})$$

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B. 2})$$

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where

$$x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

Table B.2—Example Power Thresholds (mW)

| Frequency (MHz) | Distance (mm) |    |    |     |     |     |     |     |     |     |
|-----------------|---------------|----|----|-----|-----|-----|-----|-----|-----|-----|
|                 | 5             | 10 | 15 | 20  | 25  | 30  | 35  | 40  | 45  | 50  |
| 300             | 39            | 65 | 88 | 110 | 129 | 148 | 166 | 184 | 201 | 217 |
| 450             | 22            | 44 | 67 | 89  | 112 | 135 | 158 | 180 | 203 | 226 |
| 835             | 9             | 25 | 44 | 66  | 90  | 116 | 145 | 175 | 207 | 240 |
| 1900            | 3             | 12 | 26 | 44  | 66  | 92  | 122 | 157 | 195 | 236 |
| 2450            | 3             | 10 | 22 | 38  | 59  | 83  | 111 | 143 | 179 | 219 |
| 3600            | 2             | 8  | 18 | 32  | 49  | 71  | 96  | 125 | 158 | 195 |
| 5800            | 1             | 6  | 14 | 25  | 40  | 58  | 80  | 106 | 136 | 169 |

Calculation based on external document

“MPE Information Requirements - all EU & AMERICA bands V0928 to adjust GSM rated power”  
provided by customer.

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## GSM

### MPE-based Exemption

| Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION |                |           |                |       |                              |                                            |                   |                                        |                                    |                      |            |       |       |       |               |                         |
|--------------------------------------------------------------------------------------------------------------|----------------|-----------|----------------|-------|------------------------------|--------------------------------------------|-------------------|----------------------------------------|------------------------------------|----------------------|------------|-------|-------|-------|---------------|-------------------------|
| Band                                                                                                         | Technology     | Frequency | $\lambda/2\pi$ | R     | R ≥ $\lambda/2\pi$ fulfilled | Maximum Rated Conducted Output Power (dBm) | Maximum Tolerance | Minimum Path Loss to Antenna connector | Minimum Path Loss in Antenna cable | Maximum Antenna Gain | Duty Cycle | EIRP  | ERP   | ERP   | Threshold ERP | MPE Exemption fulfilled |
|                                                                                                              |                | (MHz)     | (m)            | (m)   |                              |                                            | (dB)              | (dB)                                   | (dB)                               | (dBi)                | (%)        | (dBm) | (dBm) | (W)   | (W)           |                         |
| GSM 850                                                                                                      | GPRS 1UL slot  | 824.2     | 0.058          | 0.200 | yes                          | 32.5                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 12.5       | 27.0  | 24.8  | 0.303 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 27.0  | 24.8  | 0.303 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 27.0  | 24.8  | 0.303 | 0.435         | yes                     |
|                                                                                                              | GPRS 2UL slot  | 824.2     | 0.058          | 0.200 | yes                          | 32.5                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 25.0       | 30.0  | 27.8  | 0.607 | 0.422         | no                      |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 30.0  | 27.8  | 0.607 | 0.428         | no                      |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 30.0  | 27.8  | 0.607 | 0.435         | no                      |
|                                                                                                              | GPRS 3UL slot  | 824.2     | 0.058          | 0.200 | yes                          | 29.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 37.5       | 28.2  | 26.1  | 0.406 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 28.2  | 26.1  | 0.406 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 28.2  | 26.1  | 0.406 | 0.435         | yes                     |
|                                                                                                              | GPRS 4UL slot  | 824.2     | 0.058          | 0.200 | yes                          | 27.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 50.0       | 27.5  | 25.3  | 0.342 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 27.5  | 25.3  | 0.342 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 27.5  | 25.3  | 0.342 | 0.435         | yes                     |
|                                                                                                              | EGPRS 1UL slot | 824.2     | 0.058          | 0.200 | yes                          | 27.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 12.5       | 21.5  | 19.3  | 0.085 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 21.5  | 19.3  | 0.085 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 21.5  | 19.3  | 0.085 | 0.435         | yes                     |
|                                                                                                              | EGPRS 2UL slot | 824.2     | 0.058          | 0.200 | yes                          | 27.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 25.0       | 24.5  | 22.3  | 0.171 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.5  | 22.3  | 0.171 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.5  | 22.3  | 0.171 | 0.435         | yes                     |
|                                                                                                              | EGPRS 3UL slot | 824.2     | 0.058          | 0.200 | yes                          | 26.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 37.5       | 25.2  | 23.1  | 0.204 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 25.2  | 23.1  | 0.204 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 25.2  | 23.1  | 0.204 | 0.435         | yes                     |
|                                                                                                              | EGPRS 4UL slot | 824.2     | 0.058          | 0.200 | yes                          | 25.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 50.0       | 25.5  | 23.3  | 0.216 | 0.422         | yes                     |
|                                                                                                              |                | 836.5     | 0.057          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 25.5  | 23.3  | 0.216 | 0.428         | yes                     |
|                                                                                                              |                | 848.8     | 0.056          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 25.5  | 23.3  | 0.216 | 0.435         | yes                     |

### SAR-based Exemption

| Exemption acc. Formula of § 1.1307(b)(3)(i)(B)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION |               |           |       |                                              |                                            |                        |                                             |                                         |                            |                |            |           |          |                    |                         |
|--------------------------------------------------------------------------------------------------------------|---------------|-----------|-------|----------------------------------------------|--------------------------------------------|------------------------|---------------------------------------------|-----------------------------------------|----------------------------|----------------|------------|-----------|----------|--------------------|-------------------------|
| Band                                                                                                         | Technology    | Frequency | R     | $R \geq 0.5$ cm and $R \leq 40$ cm fulfilled | Maximum Rated Conducted Output Power (dBm) | Maximum Tolerance (dB) | Minimum Path Loss to Antenna connector (dB) | Minimum Path Loss in Antenna cable (dB) | Maximum Antenna Gain (dBi) | Duty Cycle (%) | EIRP (dBm) | ERP (dBm) | ERP (mW) | Threshold ERP (mW) | MPE Exemption fulfilled |
| GSM 850                                                                                                      | GPRS 2UL slot | 824.2     | 0.200 | yes                                          | 32.5                                       | 2.0                    | 0.0                                         | 0.50                                    | 2.0                        | 25.0           | 30.0       | 27.8      | 606.653  | 1681.368           | yes                     |
|                                                                                                              |               | 836.5     | 0.200 | yes                                          |                                            |                        |                                             |                                         |                            |                | 30.0       | 27.8      | 606.653  | 1706.460           | yes                     |
|                                                                                                              |               | 848.8     | 0.200 | yes                                          |                                            |                        |                                             |                                         |                            |                | 30.0       | 27.8      | 606.653  | 1731.552           | yes                     |
|                                                                                                              |               |           |       |                                              |                                            |                        |                                             |                                         |                            |                |            |           |          |                    |                         |

### MPE-based Exemption

| Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION |                |           |                |       |                              |                                            |                   |                                        |                                    |                      |            |       |       |       |               |                         |
|--------------------------------------------------------------------------------------------------------------|----------------|-----------|----------------|-------|------------------------------|--------------------------------------------|-------------------|----------------------------------------|------------------------------------|----------------------|------------|-------|-------|-------|---------------|-------------------------|
| Band                                                                                                         | Technology     | Frequency | $\lambda/2\pi$ | R     | R ≥ $\lambda/2\pi$ fulfilled | Maximum Rated Conducted Output Power (dBm) | Maximum Tolerance | Minimum Path Loss to Antenna connector | Minimum Path Loss in Antenna cable | Maximum Antenna Gain | Duty Cycle | EIRP  | ERP   | ERP   | Threshold ERP | MPE Exemption fulfilled |
|                                                                                                              |                | (MHz)     | (m)            | (m)   |                              |                                            | (dB)              | (dB)                                   | (dB)                               | (dBi)                | (%)        | (dBm) | (dBm) | (W)   |               |                         |
| GSM 1900                                                                                                     | GPRS 1UL slot  | 1850.2    | 0.026          | 0.200 | yes                          | 29.5                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 12.5       | 24.0  | 21.8  | 0.152 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.0  | 21.8  | 0.152 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.0  | 21.8  | 0.152 | 0.768         | yes                     |
|                                                                                                              | GPRS 2UL slot  | 1850.2    | 0.026          | 0.200 | yes                          | 29.5                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 25.0       | 27.0  | 24.8  | 0.304 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 27.0  | 24.8  | 0.304 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 27.0  | 24.8  | 0.304 | 0.768         | yes                     |
|                                                                                                              | GPRS 3UL slot  | 1850.2    | 0.026          | 0.200 | yes                          | 29.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 37.5       | 28.2  | 26.1  | 0.406 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 28.2  | 26.1  | 0.406 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 28.2  | 26.1  | 0.406 | 0.768         | yes                     |
|                                                                                                              | GPRS 4UL slot  | 1850.2    | 0.026          | 0.200 | yes                          | 28.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 50.0       | 28.5  | 26.3  | 0.430 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 28.5  | 26.3  | 0.430 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 28.5  | 26.3  | 0.430 | 0.768         | yes                     |
|                                                                                                              | EGPRS 1UL slot | 1850.2    | 0.026          | 0.200 | yes                          | 26.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 12.5       | 20.5  | 18.3  | 0.068 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 20.5  | 18.3  | 0.068 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 20.5  | 18.3  | 0.068 | 0.768         | yes                     |
|                                                                                                              | EGPRS 2UL slot | 1850.2    | 0.026          | 0.200 | yes                          | 26.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 25.0       | 23.5  | 21.3  | 0.136 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 23.5  | 21.3  | 0.136 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 23.5  | 21.3  | 0.136 | 0.768         | yes                     |
|                                                                                                              | EGPRS 3UL slot | 1850.2    | 0.026          | 0.200 | yes                          | 25.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 37.5       | 24.2  | 22.1  | 0.162 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.2  | 22.1  | 0.162 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.2  | 22.1  | 0.162 | 0.768         | yes                     |
|                                                                                                              | EGPRS 4UL slot | 1850.2    | 0.026          | 0.200 | yes                          | 24.0                                       | 2.0               | 0.0                                    | 0.5                                | 2.0                  | 50.0       | 24.5  | 22.3  | 0.171 | 0.768         | yes                     |
|                                                                                                              |                | 1880.0    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.5  | 22.3  | 0.171 | 0.768         | yes                     |
|                                                                                                              |                | 1909.8    | 0.025          | 0.200 | yes                          |                                            |                   |                                        |                                    |                      |            | 24.5  | 22.3  | 0.171 | 0.768         | yes                     |

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## LTE Cat M1

MPE-based Exemption

| Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C) —SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION |               |           |                |       |                                    |                                                  |                      |                                                 |                                             |                            |            |       |       |       |                  |                               |
|---------------------------------------------------------------------------------------------------------------|---------------|-----------|----------------|-------|------------------------------------|--------------------------------------------------|----------------------|-------------------------------------------------|---------------------------------------------|----------------------------|------------|-------|-------|-------|------------------|-------------------------------|
| Band                                                                                                          | Technology    | Frequency | $\lambda/2\pi$ | R     | $R \geq \lambda/2\pi$<br>fulfilled | Maximum<br>Rated<br>Conducted<br>Output<br>Power | Maximum<br>Tolerance | Minimum<br>Path Loss<br>to Antenna<br>connector | Minimum<br>Path Loss<br>in Antenna<br>cable | Maximum<br>Antenna<br>Gain | Duty Cycle | ERP   | ERP   | ERP   | Threshold<br>ERP | MPE<br>Exemption<br>fulfilled |
|                                                                                                               |               | (MHz)     | (m)            | (m)   |                                    | (dBm)                                            | (dB)                 | (dB)                                            | (dB)                                        | (dBi)                      | (%)        | (dBm) | (dBm) | (W)   | (W)              |                               |
| B2                                                                                                            | LTE<br>Cat M1 | 1850.0    | 0.026          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1880.0    | 0.025          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1910.0    | 0.025          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
| B4                                                                                                            | LTE<br>Cat M1 | 1710.0    | 0.028          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1732.5    | 0.028          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1755.0    | 0.027          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
| B5                                                                                                            | LTE<br>Cat M1 | 824.0     | 0.058          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.422            | yes                           |
|                                                                                                               |               | 836.5     | 0.057          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.428            | yes                           |
|                                                                                                               |               | 849.0     | 0.056          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.435            | yes                           |
| B12                                                                                                           | LTE<br>Cat M1 | 699.0     | 0.068          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.358            | yes                           |
|                                                                                                               |               | 707.5     | 0.067          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.362            | yes                           |
|                                                                                                               |               | 716.0     | 0.067          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.367            | yes                           |
| B13                                                                                                           | LTE<br>Cat M1 | 777.0     | 0.061          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.398            | yes                           |
|                                                                                                               |               | 782.0     | 0.061          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.400            | yes                           |
|                                                                                                               |               | 787.0     | 0.061          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.403            | yes                           |
| B25                                                                                                           | LTE<br>Cat M1 | 1850.0    | 0.026          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1882.5    | 0.025          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1915.0    | 0.025          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
| B26                                                                                                           | LTE<br>Cat M1 | 814.0     | 0.059          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.417            | yes                           |
|                                                                                                               |               | 831.5     | 0.057          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.426            | yes                           |
|                                                                                                               |               | 849.0     | 0.056          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.435            | yes                           |
| B66                                                                                                           | LTE<br>Cat M1 | 1710.0    | 0.028          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1745.0    | 0.027          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
|                                                                                                               |               | 1780.0    | 0.027          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.768            | yes                           |
| B85                                                                                                           | LTE<br>Cat M1 | 698.0     | 0.068          | 0.200 | yes                                | 23.0                                             | 2.0                  | 0.0                                             | 0.5                                         | 2.0                        | 100        | 26.5  | 24.4  | 0.272 | 0.357            | yes                           |
|                                                                                                               |               | 707.0     | 0.068          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.362            | yes                           |
|                                                                                                               |               | 716.0     | 0.067          | 0.200 | yes                                |                                                  |                      |                                                 |                                             |                            |            | 26.5  | 24.4  | 0.272 | 0.367            | yes                           |

## BLE

MPE-based Exemption

| Exemption acc. TABLE 1 TO § 1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION |              |           |                |       |                                 |                                      |                   |                                        |                                    |                      |            |       |       |       |               |                         |
|--------------------------------------------------------------------------------------------------------------|--------------|-----------|----------------|-------|---------------------------------|--------------------------------------|-------------------|----------------------------------------|------------------------------------|----------------------|------------|-------|-------|-------|---------------|-------------------------|
| Band                                                                                                         | Technology   | Frequency | $\lambda/2\pi$ | R     | $R \geq \lambda/2\pi$ fulfilled | Maximum Rated Conducted Output Power | Maximum Tolerance | Minimum Path Loss to Antenna connector | Minimum Path Loss in Antenna cable | Maximum Antenna Gain | Duty Cycle | EIRP  | ERP   | ERP   | Threshold ERP | MPE Exemption fulfilled |
|                                                                                                              |              | (MHz)     | (m)            | (m)   |                                 | (dBm)                                | (dB)              | (dB)                                   | (dB)                               | (dBi)                | (%)        | (dBm) | (dBm) | (W)   | (W)           |                         |
| 2.4 GHz                                                                                                      | Bluetooth LE | 2402.0    | 0.020          | 0.200 | yes                             | 5.0                                  | 0.0               | 0.00                                   | 0.00                               | 2.15                 | 100        | 7.2   | 5.0   | 0.003 | 0.768         | yes                     |
|                                                                                                              |              | 2442.0    | 0.020          | 0.200 | yes                             |                                      |                   |                                        |                                    |                      |            | 7.2   | 5.0   | 0.003 | 0.768         | yes                     |
|                                                                                                              |              | 2480.0    | 0.019          | 0.200 | yes                             |                                      |                   |                                        |                                    |                      |            | 7.2   | 5.0   | 0.003 | 0.768         | yes                     |

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## Simultaneous Transmission

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

|                | Ratio of Value/Limit | Bluetooth LE |
|----------------|----------------------|--------------|
|                |                      | 0.004118     |
| GSM 850        | 0.963227             | 0.967345     |
| GSM 1900       | 0.560543             | 0.564660     |
| LTE Cat M1 B2  | 0.354518             | 0.358636     |
| LTE Cat M1 B4  | 0.354518             | 0.358636     |
| LTE Cat M1 B5  | 0.645361             | 0.649479     |
| LTE Cat M1 B12 | 0.760769             | 0.764887     |
| LTE Cat M1 B13 | 0.684398             | 0.688516     |
| LTE Cat M1 B25 | 0.354518             | 0.358636     |
| LTE Cat M1 B26 | 0.653289             | 0.657407     |
| LTE Cat M1 B66 | 0.354518             | 0.358636     |
| LTE Cat M1 B85 | 0.761859             | 0.765977     |

Remark: only maximum value in band / mode is shown

|               |   |          |
|---------------|---|----------|
| Maximum Value | = | 0.967345 |
|---------------|---|----------|

## Conclusion

MPE-/ SAR Based Exemption fulfilled



Dipl.-Ing. Niels Jeß



B.Eng. Martin Nunier

| Version | Applied changes | Date of release |
|---------|-----------------|-----------------|
| --      | Initial release | 2023-Oct-13     |