



## Declaration of Conformity to EN 62311:2008 Human Exposure Restrictions for Electromagnetic Fields

We Triorail GmbH & Co. KG  
Luitpoldstrasse 2a  
85276 Pfaffenhofen  
Germany

declare under our sole responsibility that the products

**Triorail® Modules / Modems: TRM-5, TRM-5 ext, TRM-5T USB, TRM-5T USB ext, TTS-TRM-5T USB**

suitable for the frequency bands:	GSM-R / EGSM	900 MHz
	GSM	1800 MHz

with the RF power classes:	4 (33 dBm / 2 W)	GSM-R / EGSM	900 MHz
	1 (30 dBm / 1 W)	GSM	1800 MHz

are conform with the requirements of the standard EN 62311:2008 "Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)" if the safety distance to an isotropic radiator is more than 18.8 cm.

### Maximum Permissible Exposure (MPE)

According to EN 62311 the following maximum power densities ( $S_{eq}$ ) are defined:

$$\begin{aligned} 900 \text{ MHz} \quad f/200 &\rightarrow S_{eq} \leq 4.5 \text{ W/m}^2 \\ 1800 \text{ MHz} \quad f/200 &\rightarrow S_{eq} \leq 9.0 \text{ W/m}^2 \end{aligned}$$

Higher antenna gain requires increased safety distance. For more details see table and calculations below.

**Table: Safety distance of antenna depending on antenna gain**

D [dBi] (antenna gain)	r [cm] (safety distance)
0	18.8
3	26.6
6	37.5
9	53.0
12	74.8

The manufacturer of applications based on the above mentioned Triorail products is responsible to define safety distances in accordance to the applied antenna gain of his products and to the table and calculations provided in this document.

## Calculation

- $S_{eq}$ : Power density
- $P$ : Transmitted power
- $D$ : Antenna gain
- $r$ : Distance to antenna
- $i$ : Isotropic ( $D=1$  or  $D=0$  dB<sub>i</sub>)

$$S_{eq} = \frac{P * D}{\int_{\varphi=-\frac{\pi}{2}}^{\varphi=+\frac{\pi}{2}} 2\pi * r * r * \sin\varphi d\varphi} = \frac{P * D}{4\pi * r^2 * \int_{\varphi=0}^{\varphi=+\frac{\pi}{2}} \sin\varphi d\varphi} = \frac{P * D}{4\pi * r^2 * (-\cos\varphi) \Big|_{\varphi=0}^{\varphi=+\frac{\pi}{2}}} = \frac{P * D}{4\pi * r^2}$$

$$r = \sqrt{\frac{P * D}{4\pi * S_{eq}}}$$

$$D [\text{dB}_i] = 10 \log D$$

$$D = 10^{\frac{D [\text{dB}_i]}{10}}$$

$$r = r_i * \sqrt{10^{\frac{D [\text{dB}_i]}{10}}}$$

$$r = r_i * 10^{\frac{D [\text{dB}_i]}{20}}$$

The technical documentation (TCF) relevant to the above named products are kept at:

Triorail GmbH & Co. KG, Luitpoldstrasse 2a, 85276 Pfaffenhofen, Germany.

Signed for and on behalf of Triorail GmbH & Co. KG

Pfaffenhofen, 17-07-2015



Horst Fenske  
Chief Executive Officer