Calculation:
RF-Exposure for the UHF radio modem

Type identification: SATELLINE-M3-TR9
FCC ID: MRBSATEL-TA31

Subject of Investigation

According the 47CFR §2.1091 the SATELLINE-M3-TR9 module from Satel Oy, Salo (FCC ID: MRBSATEL-TA31) has been defined as a mobile device, used in such a way that a separation distance of at least 20 cm is normally maintained between the device and the user. The human exposure to RF emissions from such devices could be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and / or power density. The limits for Occupational / Controlled Exposure are given in Table 1, the limits for General Population / Uncontrolled Exposure are given in Table 2.

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm²]	Averaging Time $\|E\|^2$,$\|H\|^2$ or S [min]
0.3 – 3.0	614	1.63	(100)*	6
3.0 – 30	1842/f	4.89/f	(900/f)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500			f/300	
1500 – 100,000			5	

Table 1: Limits for Occupational / Controlled Exposure.

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm²]	Averaging Time $\|E\|^2$,$\|H\|^2$ or S [min]
0.3 – 1.34	614	1.63	(100)*	30
1.34 – 30	824/f	2.19/f	(180/f)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500			f/1500	30
1500 – 100,000			1.0	

Table 2: Limits for General Population / Uncontrolled Exposure.

Note: f = frequency in MHz; * Plane – wave equivalent power density

MPE evaluation

In accordance to the **CFR Part 47, §2.1091**

S: Limit for power density according to CFR Part 47, §1.1310:

0.601 mW/cm^2 (for f = 902.2 MHz) for General Population / Uncontrolled Exposure (see table 2)

P: 812.8 mW (averaged over 30 min)

G: 6 dBi = 4

D: Duty cycle: 48.5 % = 0.485

R: Distance in what the limit of S has to be reached: 0.25 m

$$S = \frac{P \cdot G \cdot D}{4 \cdot \pi \cdot R^2} \quad \Rightarrow \quad S = \frac{812.8mW \cdot 4 \cdot 0.485}{4 \cdot \pi \cdot (25cm)^2} = \underline{\underline{0.201 \frac{mW}{cm^2}}}$$

The value for the “General population / Uncontrolled Exposure” of the power density is below the limit of CFR Part 47, §1.1310.

Limits and calculated results

The results for SATELLINE-M3-TR9 module are given in Table 3 and based on the power measurements shown in Phoenix Testlab Report F170226E1

Band	CH	f [MHz]	d [cm]	EIRP [dBm]	EIRP [mW]	Power Density [mW/cm²]	Limit of Power Density [mW/cm²]	Evaluation Result
915 MHz*	0	902.2	25	35.1	3235.9	0.201	0.601	Complies

Table 3: Calculated results for the SATELLINE-M3-TR9 module compared to the limit for uncontrolled exposure.

* Worst case emission as measured in Phoenix Testlab Report F170226E1.

The SATELLINE-M3-TR9 module from Satel Oy, Salo (FCC ID: MRBSATEL-TA31) is in compliance with the maximum permissible exposure (MPE) limits for the Power Density given by the FCC 47CFR §1.1310 (4)(e) Table 1.