

Section 10:MPE Calculation Tabs Beacon Type 9

RF Exposure Considerations for the MiX Telematics Europe Ltd Tabs Beacon Type 9

FCC ID: 2AFMS-B59B

The transmitter in the Tabs Beacon Type 9 operates in the 902 MHz to 928 MHz ISM band.

The following FCC Rule Parts and procedures were referenced:

- §1.1310 – Radiofrequency radiation exposure limits
- §2.1091 – Radiofrequency radiation exposure evaluation: mobile devices
- §2.1093 – Radiofrequency radiation exposure evaluation: portable devices.
- KDB447498 D01 v06 *Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies*

Analysis for FCC portable use

Standalone SAR test exclusion considerations are defined in KDB 447498 D01 v06 §4.3.1 where the 1-g head or body and 10-g extremity SAR exclusion threshold is defined by the following formula:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

For the Tabs Beacon Type 9 the maximum conducted output power is 20.5 dBm (112.2 mW).

The duty cycle for the normal mode of operation (normal tracking) is 12 ms every 10 minutes (600 seconds) = 0.002%

The source-based time-averaged maximum conducted output power is 112.2 mW x 0.00002 = 0.002244 mW

Applying the above data using the given KDB 447498 D01 formula, and minimum separation distance of 5mm, the following results:

$(0.002244 \text{ mW} / 5 \text{ mm}) * \sqrt{0.928 \text{ GHz}} = \mathbf{0.0004}$ (i.e.: ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR)

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The Tabs Beacon Type 9 also has a firmware update operational mode (estimated use is only once in the device's operating lifetime)

The firmware update mode duty cycle is 12 ms every 78 ms = 15.38%

FCC rule parts §2.1093(d)(2) and §1.1310(c) state that exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

Maximum length of time for over the air firmware update is 5 minutes therefore there are a maximum of 3846 cycles of the 12 ms transmission during this maximum time period.

$$3846 \text{ cycles} \times 12 \text{ ms} = 46.152 \text{ seconds}$$

Time-averaged duty cycle over a period of 30 minutes is $46.152 / 1800 = 2.564\%$

The source-based time-averaged (over a period of 30 minutes) maximum conducted output power is $112.2 \text{ mW} \times 0.02564\% = 2.88 \text{ mW}$

Applying the above data using the given KDB 447498 D01 formula, and minimum separation distance of 5mm, the following results:

$$(2.88 \text{ mW} / 5 \text{ mm}) \times \sqrt{0.928 \text{ GHz}} = \mathbf{0.55} \text{ (i.e.: } \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR)}$$

The above calculations demonstrate that the Tabs Beacon Type 9 meets the criteria for 1-g head/ body and 10-g extremity SAR test exemption in both its normal tracking mode of operation and when performing a firmware update.

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Analysis for FCC mobile use

For mobile usage at >20cm the following equation applies:

$$S = \text{EIRP}/(4 \pi R^2)$$

Where

- S = Power density
- EIRP = P x G
- P = Maximum transmitter power
- G = Antenna gain
- R = distance to the centre of radiation of the antenna

Normal mode of operation (normal tracking)

For 902 - 928 MHz band:

Values

- S = f/1500 mW/cm² for General population uncontrolled exposure (FCC Part 1.1310, Table 1(B) Radiofrequency radiation exposure limits)
- S = 902/1500 mW/cm²
- S = 0.6 mW/cm²**
- P = 20.5 dBm (112.2 mW)
- Duty Cycle = 0.002%
- P = -26.5 dBm (0.002244 mW)
- G = -5.0 dBi (x 0.316)
- R = 20 cm

Calculation:

$$S = PG/4 \pi R^2$$

$$S = 0.002244 \times 0.316 / (12.56 \times (20)^2)$$

$$S = 0.0007 / 5026$$

$$S = 0.00000014 \text{ mW/cm}^2$$

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Firmware update mode

For 902 - 928 MHz band:

Values $S = f/1500 \text{ mW/cm}^2$ for General population uncontrolled exposure
(FCC Part 1.1310, Table 1(B) Radiofrequency radiation exposure limits)

$S = 902/1500 \text{ mW/cm}^2$

$S = 0.6 \text{ mW/cm}^2$

$P = 20.5 \text{ dBm (112.2 mW)}$

Duty Cycle = 2.564%

$P = 4.6 \text{ dBm (2.88 mW)}$

$G = -5.0 \text{ dBi (x 0.316)}$

$R = 20 \text{ cm}$

Calculation:

$$S = PG/4 \pi R^2$$

$$S = 2.88 \times 0.316 / (12.56 \times (20)^2)$$

$$S = 0.91 / 5026$$

$$\mathbf{S = 0.00018 \text{ mW/cm}^2}$$

Conclusion

The Tabs Beacon Type 9 complies with the FCC requirements for Portable and Mobile usage.