

Proof of 3MB4 Compliance with MPE RF Limits

The 3MB4 complies with the general population MPE RF limits by a compliance margin factor of more than 1000.

Proof

As shown in the enclosed EMC Emissions Test Report, the 3MB4 was tested to comply with CFR 47, Part 15.249 for fundamental transmission frequencies in the range of 902 – 928 MHz. Proving 3MB4 compliance with MPE limits will be achieved by proving that **any** fixed-location continuous-carrier transmitter, that is within this frequency range and that passes this regulation, will likewise pass the MPE limits. Then, 3MB4 compliance is inferred by simple deductive reasoning.

1. Referring to 15.249, a transmitter's maximum fundamental-frequency field strength permitted at a distance of three meters in the 902 – 928 MHz band is 50 mV/m. Assume that the transmitter is an isotropic radiator and that the field strength at a distance of 20 cm is dominated by the 1/r far-field radiation component. The 20 cm distance was chosen because this is the distance at which MPE limits are measured for mobile transmitters per 2.1091. Since the 3MB4 is a fixed-location device that is typically mounted on a wall, achieving MPE compliance at 20 cm would be achieving compliance under a worst-case criterion. Maximum field strength at 20 cm is determined by

$$E_{20\text{cm}} = E_{3\text{m}} (3 / 0.2) = 50 \text{ mV/m} (15) = 0.750 \text{ V/m}$$

This field strength is then converted to power density by

$$P_{20\text{cm}} = (E_{20\text{cm}})^2 / 377 = (0.750)^2 / 377 = 1.49 \text{ mW/m}^2 = \mathbf{0.000149 \text{ mW/cm}^2}$$

2. In the frequency range of 902 – 928 MHz, the MPE limit per 1.1310 for the general population is given by the formula

$$P_{\text{MPE limit}} = (f / 1500) \text{ mW/cm}^2$$

where f is in the range of 902 to 928 MHz

3. Taking the worst-case transmitter frequency of 902 MHz, the MPE limit is calculated by

$$P_{\text{MPE limit}} = (902 / 1500) \text{ mW/cm}^2 = \mathbf{0.601 \text{ mW/cm}^2}$$

4. Clearly, all fixed-location, continuous-carrier transmitters in the 902 – 928 MHz operating range that comply with 15.249 will comply with this worst-case MPE limit. Since the 3MB4 is one of these transmitter types, it also complies. Additional calculation refinements due to the isotropic and far-field 1/r radiation assumptions are not warranted since the compliance margin is so great.