Estimate of RF Field Maximum Exposure

OET Bulletin 65, Edition 97-1, August 1997

Calculations can be made to predict RF power density levels around typical RF sources. For example, in the case of a single radiating antenna, a prediction for power density in the far-field of the antenna can be made by use of the equation below. This equation is generally accurate in the far-field of an antenna but will **over-predict** power density in the near field, where it could be used for making a "**worst case**" or conservative prediction.:

$$S = \frac{EIRP}{4\pi R^2}$$

where:

S = power density (in appropriate units, e.g. mW/cm^2)
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)
EIRP = equivalent (or effective) isotropically radiated power (in appropriate units, e.g., mW)

Power Density Calculations Using EIRP Value From 7-Layers Test Report

Depending on the final application, the Bluetooth UART SPP Module, model ASY90177-3 can be classified as a Mobile or Portable Device. As per 47 CFR §2.1091 Portable Devices have their radiating elements operating 20 cm or less from the body of the user or of a nearby person. FCC power density limit for MPE for General Population/Uncontrolled Exposure is $\mathbf{S_{max} = 1.0\ mW/cm^2}$ (OET Bulletin 65 Supplement C, Edition 97-01).
The maximum EIRP of a Bluetooth transmitter Class 2 is 2.5 mW. The power density at the distance of r = 2.5 cm from the antenna is:

$$W = \frac{EIRP}{4\pi r^2} = \frac{2.5 \times 10^{-3}}{4\pi \times 0.025^2} = 0.32[W/m^2]$$

The power density of the Bluetooth ASY90177-3 transmitter at 2.5 cm distance is still more than an order of magnitude below the FCC exposure limit for General Population.

The maximum power density of 10 W/m^2 would theoretically be exceeded at a distance of less than 4.5 mm:

$$r = \sqrt{\frac{EIRP}{4\pi W}} = \sqrt{\frac{2.5 \times 10^{-3}}{4\pi \times 10}} = 4.5 \times 10^{-3}[m]$$