

In the frequency range 33 GHz to 325 GHz, spurious frequencies are measured as power densities. For further remarks see section 1.). The EUT is operating with FMCW-modulation and on/off keying. The RBW and VBW are set to such a value that spurious power levels are clearly readable above the fundamental noise level of spectrum analyzer.

4. Measurements of maximum safe level for radiated power density

According to FCC § 1.1307, 1.1310, 2.1091, and 2.1093 and also according to ETSI/EN 301 091 measurements are carried out in order to evaluate the impact of human exposure to RF radiation. For this test the EUT is in normal operation mode: FMCW and normal pulse mode. The measurement is performed at 6 different distances: 4 m, 2 m, 1 m, 0.5 m, 0.25 m, and 0.125 m. See ETSI test report 5-4423-01-02/03 page 15.

The measurements are applicable only for far field conditions. The near field area extends to a distance of R (meters) and can be calculated from the following equation:

$$R < 2 * L^2 / \lambda$$

with R = distance in meters, L = largest dimension of either receiving or transmitting horn antenna (L = 0.02 m), and λ = wavelength in meters. In case of 76 GHz ($\lambda = 0.0039$ m), the far field starts at $R > 0.205$ m.

The peak power density is measured in 3 m distance as $3.0 \mu\text{W}/\text{cm}^2$ ($-25.23 \text{ dBmW}/\text{cm}^2$).

$$\begin{aligned} \text{Peak Power (EIRP)} \quad \text{EIRP} &= \text{PD} * 4\pi * R^2 \\ \text{EIRP} &= 3.392 \text{ W (Peak)} \end{aligned}$$

This is a PEP value which must be multiplied with the duty cycle correction factor (dcc) in order to get the average value. With $t_{\text{on}} = 1.3$ ms, and $t_{\text{off}} = 1.920$ ms.

$$\begin{aligned} \text{Average power (EIRP)} \quad \text{dcc} &= 20 * \log(t_{\text{on}} / t_{\text{off}}) \\ \text{dcc} &= -3.39 \text{ dB} \\ \text{eirp} &= 10 \log(\text{EIRP Peak}) - \text{dcc} \\ \text{eirp} &= -1.914 \text{ dBW} \\ \text{EIRP} &= 1.554 \text{ W} \end{aligned}$$

Limit of maximum ERP for frequencies above 1.5 GHz is 3 W. See FCC § 2.1091

RF Exposure for mobile conditions at R = 20 cm distance from EUT

$$\begin{aligned} \text{PD} &= \text{EIRP average} / (4\pi * R^2) \\ \text{PD} &= 0.3092 \text{ mW}/\text{cm}^2 \end{aligned}$$

Limit of maximum permissible exposure (MPE) for uncontrolled environment: $1.0 \text{ mW}/\text{cm}^2$. See FCC § 1.1310.