**Radio- and Microwave Electromagnetic Fields**

The classiﬁcation of the frequency regions of electromagnetic ﬁelds is rather arbitrary, but there are a number of physical and biophysical peculiarities which makes it reasonable to distinguish between “low” and “high” frequency.

The spectrum of technically used frequencies of electromagnetic fields (HF = high frequency, LF = low frequency, E = extremely, S = super, U= ultra, V = very, M = mean)



The frequency bands which in Fig. contain the Letter “H,” in their lower part, are mostly called “radio frequency.” In the region above about 3 GHz on the other hand the term “microwaves” is used. In contrast to low frequency ﬁelds, in the HF region a splitting into the magnetic and electric ﬁeld vector is impossible. Although up to UHF frequencies it is technically possible to apply ﬁelds at least with pronounced electrical or magnetic components, in the practical use of technical devices, both components are connected. In this frequency region the so-called skin effect becomes important. This is the result of the eddy currents, induced in the conductor, cancelling the current ﬂow in the center, and reinforcing it at the surface. With increasing frequency the tendency for an alternating electric current to distribute itself within a conductor increases so that the current density near the surface of the conductor is larger than that at its core. This effect also determines the depth of penetration of high-frequency electromagnetic ﬁelds in a homogeneous body. It is characterized by the skin depth (d) which can be calculated for practical use by:



