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„Microwave design on lossy multilayer substrate“

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Abstract – In microwave circuits, a consequence of layout dimensions comparable to wavelength is the need to take into account dielectric losses, which in microstrip lines are directly proportional to its electric length. This is why typical planar microwave circuits are printed on ceramic (alumina) or plastic (PTFE) substrates, which exhibit low losses (about 0.1dB/λ). Until 10 tears ago, most of microwave circuits at our plant were produced on alumina substrates. The increasing demand for volumes and drastic cost reduction led us to consider FR4 substrate, starting at lower frequency bands. The reason is not only the cheapness of such substrates, but also the possibility to put microwave circuits on the same board together with functional units like IF, controls, power supply. Main issues in using FR4 substrates at microwave frequencies are dimensional tolerances of standard FR4 PCB process, which can affect the electrical performance of the circuits, and FR4 dielectric losses (about 1dB/λ). In this paper we focus on the second issue, providing an overview of our ways of managing loss issues in microwave designs, providing examples of our practical solutions.