Abstracts

The Dependence of Reflection on Incidence Angle

R. Redheffer. "The Dependence of Reflection on Incidence Angle." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 423-429.

A lossy dielectric sheet has complex dielectric constant epsilon = epsilon (x) and complex permeability μ = μ(x), where x is the distance to one interface. This sheet is backed by a conducting surface and used as an absorber. If | epsilon (x)μ(x) | >>epsilon/sub 0/μ/sub 0/, so that (epsilon/epsilon/sub0/)(μ/μ/sub0/) - sin² theta is nearly independent of the incidence angle theta, then the amplitude reflection R(theta) is wholly determined by R(0). Typical results: When R(theta/sub0/) = 0 at one polarization, then at theta=theta/sub 0/ the reflection for the other polarization corresponds to a voltage standing-wave ratio SWR =sec² theta/sub 0/. At perpendicular polarization max | R(theta) | on (theta/sub 1/, theta/sub 2/) is least, for given | R(0) I, if R(0) is real and positive; and then R(theta) = 0 at tan²theta/2 = R(0). But for parallel polarization R(0) must be real and negative to get optimum performance. When the absorber functions at both polarizations the best obtainable result is | R(theta) | = tan²theta/2, no matter what interval (theta/sub 1/, theta/sub 2/) is specified. The error in the approximation is investigated theoretically and experimentally. A complete set of graphs is included, suitable for design of those absorbers to which the theory applies. The analysis also yields an exact expression for the limiting behavior of the reflection at grazing incidence. This can be used in problems such as computation of the field due to a dipole over a plane earth. Finally, the theory of the Salisbury screen is re-examined as an aid in checking the other developments.

❑ Return to main document.