The radar emissions of a slot array antenna enclosed within an aerodynamic dielectric radome on a low-flying platform over the sea surface are computed. Physical optics is used to compute the transmission through the radome, and validated with the finite-element/boundary integral method, iterative physical optics, and measurements. The rough sea surface is modeled with simple closed-form coherent and incoherent scattering coefficients. It is observed that the radome gives rise to cross-polarization sidelobes near the main beam of the antenna. The cross-polarization ratio is relatively independent of the receiver height and sea surface roughness for a receiving platform located close to the surface.