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Impact of Ion Acoustic Wave Instabilities in the Flow Field of a Hypersonic Vehicle on EM Signals SABA MUDALIAR, VLADIMIR SOTNIKOV, Air Force Research Laboratory — Flow associated with a high speed air vehicle (HSAV) can get partially ionized. In the absence of external magnetic field the flow field turbulence is due to ion acoustic wave (IAW) instabilities. Our interest is in studying the impact of this turbulence on the radiation characteristics of EM signals from the HSAV. We decompose the radiated signal into coherent and diffuse parts. We find that the coherent part has the same spectrum as that of the source signal, but it is distorted because of dispersive coherent attenuation. The diffuse part is expressed as a convolution (in wavenumber and frequency) of the source signal with the spectrum of electron density fluctuations. This is a constrained convolution in the sense that the spectrum has to satisfy the IAW dispersion relation. A quantity that characterizes the flow is the mean free path (MFP). When the MFP is large compared to the thickness of the flow the coherent part is significant. If the MFP is larger than the thickness of the flow the diffuse part is the dominant part of the received signal. In the special case when the source signal frequency is close the electron plasma frequency, there can exist in the flow region Langmuir modes in addition to the EM modes. The radiation characteristics of EM source signals from the HSAV in this case are quite different.

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