This work investigates the frequency-dependent behaviour of microfracture assemblies, using models with explicit representations of fractures (described in Hildyard and Young, 2001). Models with tens of thousands of microfractures are created and analysed. A method is presented for quantifying the frequency-dependent bulk behaviour of these fracture assemblies in terms of dispersion and attenuation. Consideration is given to the potential for spurious numerical effects in the method, and how these can be eliminated. The approach is then applied to investigate aligned fractures, of varying size and crack density. At low frequency, results are shown to be consistent with expectations. The velocities for a given crack density are constant with frequency and independent of fracture size. In the intermediate frequency region where significant attenuation begins to occur, the bulk velocity is found to reduce further with increasing frequency, before rising to the material wave-speed in the highly attenuating high frequency range. Understanding this frequency-dependence is vitally important for the meaningful interpretation of fracturing from anisotropy. The investigation is extended to characterise multiple orthogonal fracture sets and stress-dependent fracture models. Examples show how these models can be useful in waveform interpretation, and that the results can also be useful for evaluating limits in the validity of equivalent medium representations of anisotropy.