

Low Group Velocity Traveling Wave Tube Amplifiers

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Abstract—We report experimental and theoretical results from research into high power X-band traveling wave tube amplifiers designed to eliminate sidebands caused by reflections from the output of such structures. These amplifiers have a low energy velocity, such that the time it takes a wave to be reflected from the output to the input is of the order of, or greater than, the electron beam pulse duration. The elimination of sidebands and the effects of reflections is achieved by this transit time isolation. The bandwidth of the output spectrum is limited by the low pass-band of the periodic structures. Such amplifiers have been operated at power levels of up to 160 MW at 9 GHz for 50 ns pulse durations.

where the cavities are electromagnetically isolated (by the drift region which is below cutoff) the traveling wave structure is a set of coupled cavities, which are separated from each other by short sections of guide which may be above or below cutoff. In this case the beam-wave interaction is distributed along the entire interaction length whereas in a klystron it is limited to the close vicinity of the cavity. The advantage of traveling wave extraction sections is that they can be designed to have bandwidths comparable to the main amplifier but with a larger internal radius and the electric field on the walls can thus be reduced for a given output power