Experimental Verification of Active Traveling Wave Antenna

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Experimental verification in the principle of a parametric amplifying traveling-wave antenna proposed by Kikuchi [1] is tried. Long ago Carson [2] and also Pollaczek [3] developed a theory in regard to wave propagation along a wire above a dissipative ground. The Carson-Pollaczek theory, however, is restricted to a low frequency range, because of neglecting displacement currents in the air and in the ground and also no effects of the dielectric constant of the ground on equivalent circuit parameters. Kikuchi [4] developed a new theory overcoming these defects in Carson-Pollaczek theory. The new theory showed that attenuation characteristics possess a maximum and a minimum, and this was demonstrated by field experiments. The theory predicted fast waves between the maximum attenuation frequency and the minimum attenuation frequency, too. However, experimental verification of the fast waves is insufficient still now, except for a preliminary experiment by Iwai [5]. After that Kikuchi [6] extended the theory in distributed passive parameter lines so as to cover distributed active parameter lines with dissipative-ground return exposed to an electromagnetic environment. He showed that wave propagation along a wire above a dissipative ground exposed to an external electromagnetic field could be reduced to an active dissipative distributed parameter line with active source elements and passive circuit parameters. This new theory in active dissipative distributed lines predicted a new effect of parametric amplification of the induced line wave by an incident sky wave due to strong coupling or resonance between both waves. This is achieved by making the phase velocity of the induced wave nearly equal to the front velocity of the sky wave along the wire under some conditions. The authors try to verify the fast wave characteristic and the parametric amplification effect by an experiment.

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