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ACTIVE ELECTRONICALLY STEERABLE PHASED ARRAYS FOR MOBILE SATELLITE COMMUNICATIONS

Abstract

The increasing use of broadband satellite systems to provide ubiquitous and high-capacity communications-on-the-move draws a demand for lightweight, low-profile steerable-beam antennas with a small footprint that can be installed unobtrusively on land vehicles, aircrafts and UAVs. Most mobile antenna systems available on the market are based on fixed beam apertures that track the satellite by means of a three-axis mechanical positioner that steers the beam to continuously point towards the satellite. Such systems are generally not low profile, are maintenance intensive, bulky, and subject to G-forces. These properties are not very appealing to the Land-Mobile and Airborne market where reliability, aerodynamics and stealth attributes are important. Electronically steerable array antennas can provide low profile solutions with less mechanical components and higher reliability, and are the most suitable antenna solutions for satellite communications on the move. Such systems, either for aeronautical, land or maritime applications, must be able to receive and transmit on-the-move. This paper presents the results of two developments in active phased array antennas carried out by JAST. While the presented results are based on antennas developed for Ku-Band, both array architecture are also realizable at Ka-band. The first solution presented is a hybrid phased arrays which steers the antenna beam electronically along the elevation and polarisation angles and mechanically along the azimuth angle. The reduction to a single mechanical movement along the horizontal plane allows building low–profile antennas with a minimum of mechanical movements. In addition the limitation of electronic steering to only elevation and polarisation axes allow to reduce dramatically the number of active components and hence minimise the cost. The second solution is a fully electronically steerable beam antenna. The antenna is based on an original architecture design that allows reducing the number of bits of the phase shifting components. The antenna is implemented on a low-cost monolithic multilayer printed circuit board that is suitable for large production quantities. First prototypes of both antenna designs have been built and validated. Details of the antenna implementation as well as the results of measured antenna parameters will be presented in the final paper.