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DEMONSTRATION USING CESSNA AIRCRAFT OF ACTIVE ELECTRONICALLY STEERED ARRAY ANTENNA FOR SATELLITE COMMUNICATIONS

Abstract

This paper describes the evaluation results using a Cessna aircraft of Active Electrically Steered Array (AESA) antenna for aeronautical broadband satellite communications. Recently, the demand of Internet access for people on board aircraft has been increasing to accompany the development of mobile phone. The number of aircraft is expected to increase from 25,000 to 48,000 in the next 20 years Especially, the demand of Regional Jet that is small and medium-sized aircraft of 50 to 100 passenger seats will increase. Therefore, the demand of satellite communication for these aircraft is expected to increase greatly with the request for broadband service. In order to meet the demand, it is necessary to improve frequency utilization efficiency in satellite communication systems. To resolve the issue, the antenna performance for aircraft is required to be improved. The expansion of the antenna aperture size is realized the improvement of antenna performance. One of the conventional antennas for aircrafts is a small reflector antenna. The mechanically driven technique is used to track the satellite. However, it is difficult to be mounted on small and medium size aircraft since the antenna becomes three-dimensionally large to improve the performance of the antenna. NICT (National Institute of Information and Communications Technology) researches and develops low-profile and scalable AESA antenna system to improve the satellite communication antenna performance with the mountable for small and medium size aircraft. The proposed antenna can change the aperture size according to the required performance. The multilevel modulation is adopted by the improvement of EIRP and G/T. Therefore, the frequency usage efficiency will be improved using proposed antenna. We fabricated a 512 elements array antenna for transmission as a partial prototype of the proposed AESA. The antenna was mounted on a Cessna to evaluate its radiation pattern, tracking performance, and communication quality. The receiver consists of a standard gain horn antenna, a Low Noise Block (LNB), a modem and a spectrum analyzer, and is installed on the ground. The radiation patterns are similar to those measured in an anechoic chamber. The manufactured antenna has a high tracking performance because a constant receiving power is obtained even when the attitude of the aircraft changes. Three modulation schemes, QPSK, 8PSK and 16APSK, were used to evaluate the communication quality. It is concluded that the proposed antenna is applicable to the multi-level modulation scheme for

aeronautical broadband satellite communications because sufficient Es/No is obtained in any modulation scheme.