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Mobile Satellite Communications and Navigation Technology (4)

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REGENERATIVE REPEATING PERFORMANCE OF AN ONBOARD PACKET SWITCH FOR THE  
FADING CHANNEL IN GEOSTATIONARY SATELLITE ORBIT**Abstract**

An onboard switch increases the efficiency of satellite communications systems with multi-beam structures. The National Institute of Information and Communications Technology of Japan has been studying the mobile satellite communications network, and developing an onboard packet switch. A compact mobile earth station that can be installed in mobile systems or easily carried anywhere has been assumed for this communication system. It is utilized to achieve mobile satellite communications networks with a signal transmission rate of more than several hundreds of kbps. The onboard packet switch functions as bridges operating at the data link layer of the open systems interconnect networking model. When the switch is located in a satellite, the satellite can be regarded as a central hub. One beam of the mobile links corresponds to one segment of the network. The bridges' learning process is carried out between the beams, and the switching system builds and maintains tables with media access control address information. The onboard packet switch is installed in the Engineering Test Satellite Eight (ETS-VIII) which was launched by H-IIA rocket in December 2006. The switch is composed of a modulator/demodulator (MODEM) component and a baseband switch component. The pi/4-shift quadrature phase shift keying (pi/4-QPSK) modulation is used to obtain highly efficient frequency spectrum utilization and to reduce the nonlinear effect of the transmitter. The MODEM includes analog-digital (A/D) converters and digital filters. Most functions – switching, modulation, demodulation, filtering, and switch control – operate through digital signal processing. Since the regenerative repeating function and the switch function are located on the satellite, one-hop communication between mobile terminals via the satellite can be carried out. The performance tests of the onboard packet switch were conducted, and tests results show that the onboard packet switch, which functions as bridges, can operate in communication networks and that it sufficiently meets system requirements. The field tests were also conducted in rural, suburban and urban environments. When signals were line-of-sight, the statistics of their levels tend to the Rician distribution on both down-link and up-link. The bit error rate (BER) test results for the demodulator of the onboard packet switch on the up-link under the rice fading environment, in which direct-path to multi-path signal power ratio (C/M) was 10dB, show that the degradation of performance is 3dB in the case that the BER is 1E-5.