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DEVELOPMENT OF ON-BOARD COMPONENTS FOR WIDEBAND AND HIGH OUTPUT POWER TRANSPONDER OF 21GHZ-BAND BROADCASTING SATELLITE

Abstract

The 21GHz-band satellite broadcasting is expected to provide advanced services such as UHDTV and 3DTV, etc. NHK STRL is developing a 8K UHDTV, Super Hi-Vision, which has 33 megapixels (7,680 4,320 pixels) and 22.2 multichannel sound to give an extremely realistic presentation whereby viewers may feel as though they are actually at the site shown on the screen. To achieve high transmission capacity to provide advanced services, we assume to allocate two 300-MHz class wideband channels in the band 21.4 - 22.0 GHz. The information bitrates obtained in one wideband channel for the QPSK1/2, QPSK3/4 and 8PSK3/4 will be reached to about 240, 350 and 530 Mbps, respectively. In order to achieve high e.i.r.p. considering 300-MHz class channel and a severe rain attenuation in the 21-GHz band, we assume to apply an on-board array-fed reflector antenna to combine high power while avoiding electrical discharges caused by the power concentration of single feed waveguide and horn in the space environment. In addition, the antenna has an ability to control radiation patterns in order to increase locally in areas of severe fading while keeping a flat radiation pattern. On the other hand, unwanted emission threshold levels of -146 dB(W/m2/290MHz) and -162 dB(W/m2/250kHz) for nearby radio astronomy in the band 22.21 - 22.5 GHz is considerably low compared to the maximum pfd of -105 dB(W/m2/MHz) for the 21GHz-band broadcasting satellites. Currently, we are developing an engineering model of the on-board components for the wideband and high output power transponder of the 21GHz-band broadcasting satellite such as an array-fed reflector antenna consisting of 32 horns, a beam forming network and reflectors, a high-power TWTA and an output filter. In addition, we are developing a wideband modem consisting of modulation schemes of QPSK and 8PSK and an error correction of LDPC code with a symbol rate of up to 250 Mbaud and a sharp roll-off factor of down to 0.1. In this paper, we mainly show results of a test manufacture of the 21GHz-band wideband output filter. For the transmission of the wideband single carrier signal, low group delay deviation characteristics of less than 0.9 ns within 74.9 MHz, less than 2.4 ns within 108.1 MHz and less than 5.7ns within 129.3 MHz were achieved at the thermal test from – 20 to + 55 degrees C. Where, a center frequency was 21.83679 GHz.