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THE DESIGN AND TEST OF SPECTRUM SUBDIVISION RECEIVER FOR MICROWAVE RADIOMETER ON SATELLITE

Abstract

Microwave radiometer, a kind of passive microwave remote sensors, is used to measure the radiation of observation scene and detect the features of target as one of key loads in meteorological satellite and important remote sensing equipment in atmosphere and disaster forecast. The signal, received by radiometer antenna, is frequency conversed by receiver, amplified by spectrum segments and then transformed to the signal power by the detector. The brightness temperature of target is calculated after calibrating the detector outputs, which contains some important of radiators and the transmission medium. This radiometer can measure global atmospheric temperature and moisture profiles anytime and all-weather and then improve the accuracy of forecast. Considering the current documents of radiometers that measure global atmospheric temperature and moisture profiles, there are three frequency bands: 50GHz to 60GHz, 118GHz and 183GHz, the first two frequency bands are used to measure atmospheric oxygen content and temperature, while the last frequency band is used to measure atmospheric moisture. The measurements would be more accurate if the frequency band is divided into more exact part. In this paper we describe the design and test results of 13-spectrum-segments-receiving-channel microwave radiometer receiver in the band of 50GHz to 60 GHz, which is first applied on the FY-3 meteorological satellite. With the development of microwave remote sensing technology and the progress of the integrated circuit, the requirements to microwave radiometer receiver is higher. The trend is high sensitivity, high frequency, wide band, low noise, high gain and high stability. The technical innovation in this paper is: Integration distribution scheme is adopted for radiometer receivers which contains 13 channels, but only one local oscillator, This design reduces size, weight and power consumption. The 0Hz to 8GHz IF signal is processed by subdividing the frequency spectrum, and there are 7 wideband channels and 6 narrowband channels, which improves the detection capability of the microwave radiometer and makes the linearity reach to 0.99999. This design enhances the technical level in the nation and lays the foundation for the following design of microwave radiometer on satellite. This design principle could be applied on all microwave radiometer on satellite.