DESIGN OF AN AIRBORNE FULL-POLARIZED RADAR SCATTEROMETER FOR OCEAN SURFACE REMOTE SENSING

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I. Introduction

Radar scatterometer is an efficient instrument for sea surface wind and wave measurement. It observes the ocean in fixed or rotating geometry and then gets a set of normalized radar cross section (NRCS, i.e. σ0) of different surface resolution cells at different view angles.

In this paper, the design of an airborne Ku-band full-polarized scatterometer will be presented. This scatterometer will be equipped with a rotating fan-beam antenna. Details of the system parameters and performance simulation results will be presented.

II. System descriptions

The scatterometer consists of antenna unit, microwave front-end unit, receiver unit, transmitter unit, frequency synthesizer unit, command and processing unit and power supply unit. Fig. 1 is the system drawing. Fig.2 is the observation geometry of the system.

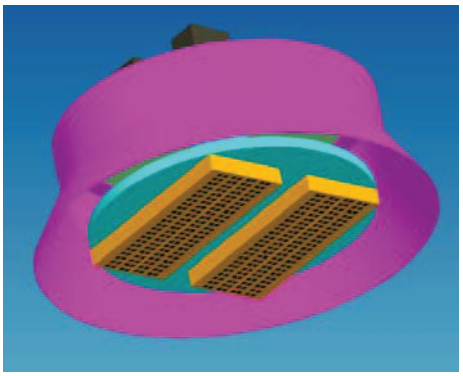

Fig.1 Drawing of the system

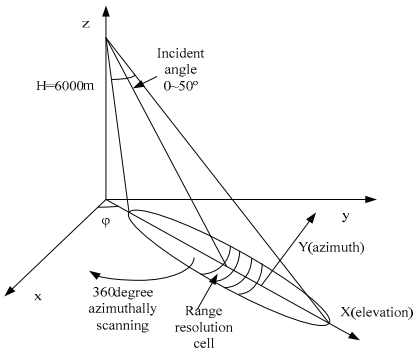

Fig.2 Observation geometry of the system

This system has the following characteristics:

A. Full-polarization measurement capabilities

B. Devoted to sea surface wind and wave spectra measurement

C. Agile system and timing parameters

The antenna unit includes the microstrip antenna, the scanning servo and a microwave RF rotary joint. The system will have a separate receiving antenna a transmitting antenna to ensure the transmitting/receiving isolations and improve the adaptation for different flight height. Fig.3 is the diagram of the antenna and Fig.4 is the simulated pattern of the antenna.

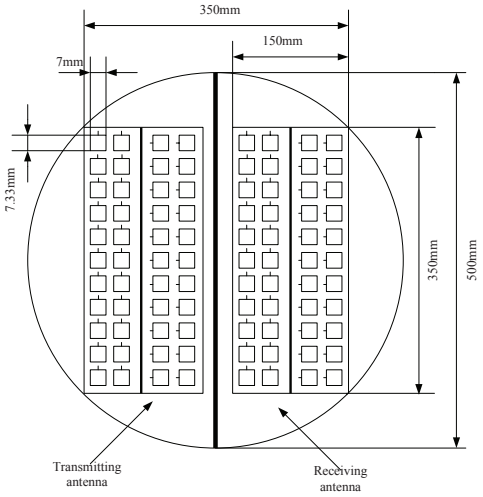

Fig. 3 diagram of the antenna

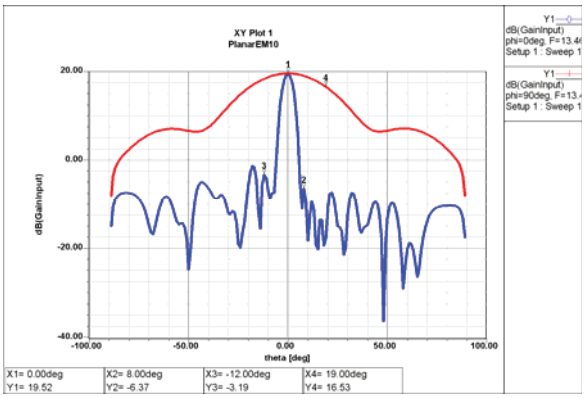

Fig.4 simulated pattern of the antenna

Main specifications of the system including:

（1） Frequency：Ku band (13.4GHz)

（2） Polarization: Covariance matrix of the scattering (HH, VV, HV, VH and complex correlations)

（3） Backscattering accuracy: 0.5dB

（4） Signal flow-diagram and power budget:

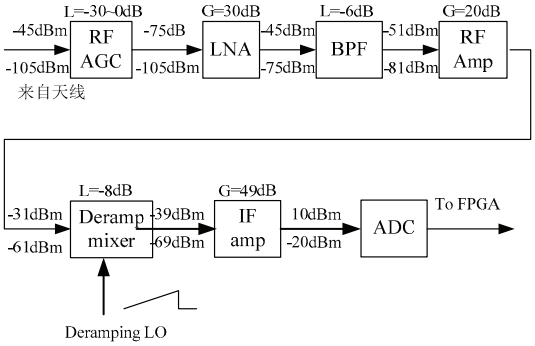

Fig.5 Signal flow-diagram and power budget

（5） Bandwidth and PRF

BW=200MHz, LFM period=4ms; elevation angle=6~50degree;

（6） Resolutions: 600m×1m@6000m altitude

IV. Summary

In this paper, design of a Ku-band full-polarized airborne radar scatterometer is presented. It will employ a rotating fan-beam antenna with high transmitting/receiving and polarization isolations. The system will be dedicated for measurement of ocean surface backscattering, which can be used for sea surface wind vector and directional ocean wave spectra retrieval. Detail of simulation results and some preliminary test results will be provided.