TRANSPOLARIZING TRIHEDRAL MEASUREMENT USING UPC X-BAND GBSAR

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1. INTRODUCTION

Polarimetric SAR (PolSAR) systems have caught the interest of the research community since they are able to provide much more information than conventional single polarization systems. This interest will gradually increase since several spaceborne PolSAR missions have been launched in the recent years: ALOS-PALSAR, RADARSAT 2 and TERRASAR-X. Thus, reliable polarimetric calibration procedures and techniques are mandatory.

Trihedral corner reflectors (TCRs) are commonly employed to calibrate SAR data, as they provide a high backscattering RCS response for a wide range of incident angles. Nevertheless, the TCRs lack of a cross-polar response, making them limited for full polarimetric calibration. Different solutions appeared in the 90's to realize TCRs providing cross-polar response taking advantage of transpolarizing surfaces composed of fins or corrugations [1]. Such transpolarizing surfaces (or twist reflector) were placed on one side of the TCR, with the corrugations aligned at 45º with respect of the incident electric field polarization. However, these corrugations have to be designed at least with a depth of λ/4 (the wavelength λ is referred to the operational frequency), and made from a heavy piece of metal, which makes difficult the fabrication process.

A low profile (and low weight) transpolarizing surface was presented in [2]. This novel transpolarizing surface is composed of a periodic arrangement of metallic square patches with a diagonal slot over a metal ground plane. The potentials of this transpolarizing surface applied to polarimetric SAR calibrators were studied in [3].

In this work, we would like to assess the performance of the designed low profile transpolarizing surface placed on one side of a TCR. An initial measurement campaign has been recently carried out at the Universitat Politècnica de Catalunya (Barcelona, Spain), using a ground based SAR system (UPC-GBSAR) operating at 9.65 GHz (X-band) [5].

2. TRANSPOLARIZING SURFACE DESIGN

A transpolarizing surface has been fabricated according to design guidelines presented in [4]. The square patches have a width of 4.8 mm, with a gap of 1 mm between adjacent patches. The diagonal slot has a length of 4.8 mm and a width of 1.4 mm. A Rogers RO4003C (ε_r = 3.38) has been used as dielectric substrate. The overall thickness is 1.52 mm (λ/20), much smaller than the λ/4 thickness required for the fabrication of the corrugations [2]. Once fabricated, this transpolarizing surface is placed on the bottom side of the TCR, as shown in Fig. 1 (left). The copolar and cross-polar responses of the standard (or metallic) and transpolarizing TCRs have been measured in the anechoic chamber and they are shown in Fig. 1

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(right). The standard TCR shows a broadband response with a copolar to cross-polar ratio of more than 30 dB. The transpolarizing TCR produces a high cross-polar response around 9.8 GHz with a ratio of more than 14 dB.

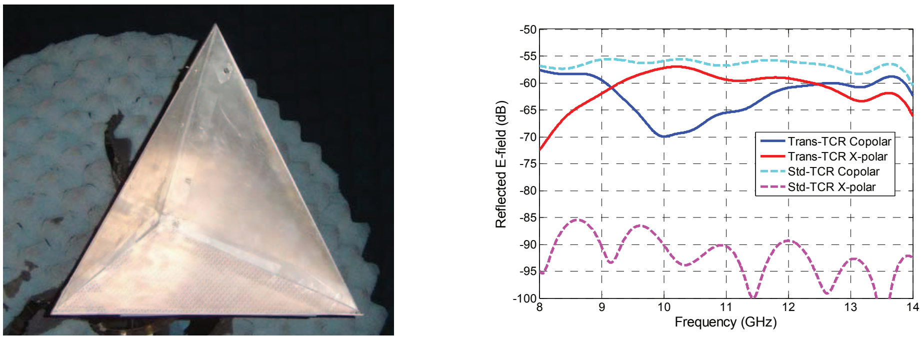

Figure 1: Transpolarizing surface placed on the bottom side of the TCR (left), and the measured back-scattering results (right) of the transpolarizing TCR (solid lines) and standard TCR (dashed lines).

3. FIELD MEASUREMENT RESULTS OF THE TRANSPOLARIZING TCR

Field measurements using the UPC GB-SAR system have been carried out at the Universitat Politècnica de Catalunya (Barcelona, Spain) to assess the performance of the transpolarizing TCR (Trans-TCR). Measured results are plotted in Fig. 2. When putting the transpolarizing surface on one side of the TCR under test, a cross-polarization ratio of 14 dB has been achieved at 9.65 GHz. Notice that, when measured in the anechoic chamber, the maximum cross-polar response of the Trans-TCR was achieved around 9.8 GHz. Moreover, the maximum back-scattering level with and without the transpolarizing surface is slightly different; this fact may be due to a change in directivity suffered by the TCR when putting the transpolarizing surface on one side. However, these initial measurements will be improved in two ways: by using a bigger Trans-TCR in order to have a higher back-scattering response, and by re-designing the transpolarizing surface in order to correct the slight frequency shift and finding the best transpolarization ratio around the operational frequency (9.65 GHz) of the UPC GB-SAR system. Thus, complete results will be presented at the conference, showing the copolar and cross-polar SAR images of a TCR with and without the transpolarizing surface.

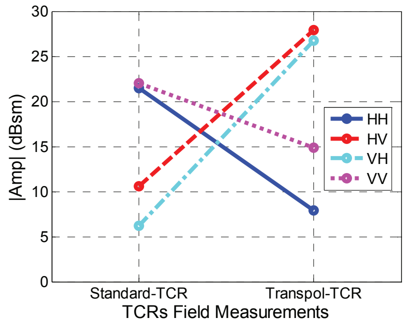

Figure 2: Measured reflected copolar and cross-polar components of the standard and transpolarizing TCRs.

4. REFERENCES

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