Measurement of a Multi Feed Reflector Antenna for SAR Systems Based on Digital Beam Forming

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Abstract

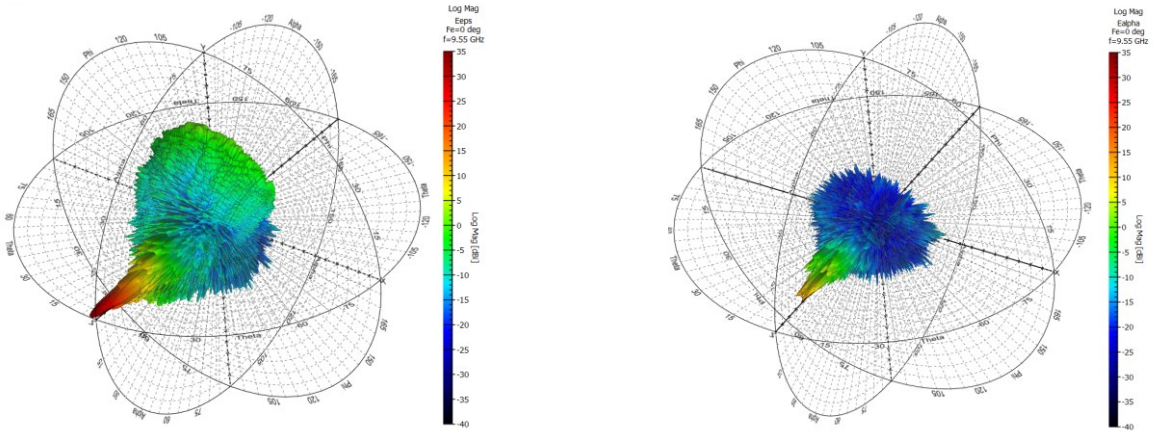
In the last years, the Synthetic Aperture Radar (SAR) systems evolution migrates toward the use of multi-channel systems based on Digital Beam Forming (DBF) techniques [1]. This tendendy allows fulfilling stringent SAR requirements, providing high spatial resolution within a wide swath. Moreover, the combination of DBF techniques with parabolic reflector antennas merges both flexibility and high antenna gain ending up in a high versatile system [2].

One of the main parts in a Digital Beam Forming (DBF) Synthetic Aperture Radar system is constituted by the antenna. An accurate characterization of the antenna radiation pattern is of high interest for the calibration of the system which guarantees the performance and versatility of the DBF network. This paper describes the measurements of a multi-feed single offset reflector antenna designed in X-band. The antenna is part of an on ground multi-channel radar system used to demonstrate ind investigate DBF techniques at HR/DLR [3].

The antenna is made up of a parabolic reflector and 8 feeds. The reflector has an elliptical shape of dimensions 1m x 0.7m with a focal distance of 0.5m and a clearance of 0.35m. The feed system is constituted by 8 rectangular feeds with an aperture dimensions of 40.132mm x 29.2mm. The feeds are located in the azimuth plane and the distance between consecutive feeds is constant and equal to 4.4cm [4].

The antenna has been measured in the Compact Test Range (CTR) at the Microwaves and Radar Institute of the German Aerospace Centre, in Oberpfaffenhofen, see Fig.1 [5]. The azimuth and elevation planes of the radiation patterns corresponding to the 8 feeds activated independently have been measured, providing a first characterization of the antenna in reception. Also 3D radiation pattern measurements were performed for the 8 beams, in this case, a Roll over Azimuth acquisition was performed and the copolar and crosspolar components of both azimuth and elevation planes were computed [6], Fig 2.

Fig. 1. Tested antenna in the Compact Test Range at DLR



(a) (b)

Fig. 2. (a) Copolar and (b) Crosspolar component of the 3D measured radiation pattern of the antenna when one of the two centred feeds is activated

Future DBF SAR systems are expected to increase the number of channels. Therefore, the development of efficient methods for the antenna measurements is of high importance for a good characterization of all channels.

References

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