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Design of Broadband Active Radar Calibrator for L, S, C and X Band SAR Satellites

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In current remote sensing scenario, as microwave imaging techniques have taken a quantum leap to provide sub meter resolution imaging for variety of applications, a large number of SAR sensor capable of operating from P – Band to X – Band are developed. With deployment of a SAR sensor its systematic calibration is an imperative task for ground support team. For passive calibration targets viz. dihedrals, triangular and square trihedral, etc., Radar Cross Section (RCS) is a function of their physical size [1]. This necessitates development of a whole new target for every different RCS or frequency requirement. Apart from difficulties in physical deployments, corner reflectors, due to their large physical size act as snow and rain collectors which causes uncertainty in calibration [1]. As dependence of corner reflectors RCS on physical size produces a snag in their versatile applicability, Active Radar Calibrators (ARC) provide a promising option as adaptive (tunable) RCS target.

This paper discusses the design of a ARC system for RCS ranging from 10 dBm^2 to 50 dBm^2. A broad band RF design methodology has been adapted so that a single system should cater the calibration needs for SAR sensors operating in L, S, C and X band of microwave spectrum. The system is designed to provide RCS in range of 10 to 50 dBm^2 is steps of 0.5dB. Two antenna topology consisting of broad band horn antennas capable of operating from 730 MHz to 11 GHz is chosen for system development. Proposed ARC system consist of a RF switch network to select a frequency band (pertaining to a SAR sensor) and to provide cross polarization calibration capabilities viz. HH, HV, VV, VH, HH + HV, VV + VH.

Keywords: Broadband Active Radar Calibrator, SAR Calibration, Radar Cross Section (RCS).

References:

[1]. Kamal Sarabandi, Yisok Oh, James J. Ahne, Fawwaz T. Ulaby, “Design and Implementation of a L – Band Single Antenna Polarimetric Active Radar Calibrator”, Radiation Laboratory, University of Michigan.