Abstract

This research work is targeted towards the development of a shared antenna dual-band radar system. The wide stop band diplexer circuit is proposed which provides the advantage of use a single antenna for dual band system. The mathematical analysis and design equations for diplexer circuit is presented. Also, the proposed technique is implemented for S-C, S-X band application and the design steps are discussed. The spurious responses are reduced to maintain the stop band response below 20 dB at the first odd mode of higher pass band section of diplexer circuit using stepped impedance resonators.

In order to use a single antenna for dual band radar system, the efficient antenna is proposed by considering the transmitting and receiving performances. The main beam direction changes by 90^0 for two consecutive modes in case of resonating antennas. Therefore, the travelling wave antennas are designed for circularly polarized and linearly polarized radiation with modified geometry to reduce the side lobes and pulse spreading effects. The integration with diplexer circuit and antenna provides the flexibility to use shared antenna for dual band radar system. The pulse spreading effects, in near and far field are the key points to qualify the receiving performance of antennas, these performances are quantified with the help of system fidelity factors.

The development of shared antenna dual-band radar system for displacement monitoring using the diplexer circuit is implemented for both linear and circularly polarized radar system. The integration of circularly polarized antenna with S-C band diplexer is reported for dual mode radar system. The S-X band radar system is proposed for displacement monitoring when the S-X band diplexer is used with vivaldi antenna for dual band application. To be more specific, the S-C band circularly polarized radar system is designed for tracking the target movement in S band and the detection of vital sign at C band. On the other hand, the S-X band radar system is developed to detect the displacement of target using six-port interferometry radar technique.

Keywords: Antenna, Antipodal vivaldi antenna, Circularly polarized antenna, Continuous wave radar, Clutter correction, Diplexer, Frequency modulated continuous wave radar, Pulse spreading effect, System fidelity factor, Ranging, Six port network, Ultra wide band antenna.