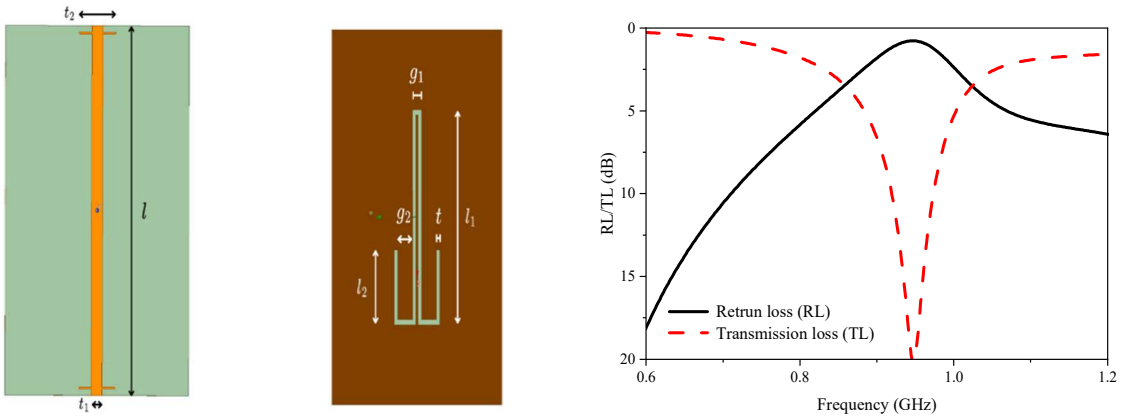
URSI-RCRS 2024, ARIES/GEHU, Bhimtal, India, 22 - 25 October, 2024

Deflected Ground Structure (DGS) based Microstrip Notch Filter Design for Radio Astronomy Application

Jishnu Das[1], Sougata Chatterjee[1,2], S Suresh Kumar[1], Somak Bhattacharyya[2]
(1) IIT-BHU, Electronics Department, Varanasi-India, email- sougatachatterjee.rs.ece20@iit.bhu.ac.in
(2) GMRT-NCRA-TIFR-India

Radio astronomy is the branch of science where we can detect the astronomical signal in the meter wavelength [1]. Being feeble in nature, the radio astronomical receiver system demands extremely high sensitivity. Researchers have developed various front-end receivers to improve the sensitivity of the radio telescope [2] like improved feed and receivers. On the contrary, those highly sensitive radio receivers get easily saturated by the man-made unwanted radio frequency interference (RFI) signals and their intermodulation products [3].

In this present work, we propose a defective ground structure (DGS) based microstrip notch filter design for radio astronomical receivers. The top and side views of the band notch filter operating at 950 MHz have been shown in Figs. 1(a) and 1(b) respectively. The response of the filter is illustrated in Fig. 1(c). The dimensions of the filter are mentioned in caption of Fig. 1. The dimensions of the DGS-based microstrip configuration can be easily scaled to achieve band notch features at 550 MHz and 850 MHz too to eliminate the unwanted RFI. All the filters achieve a narrow bandwidth of 30 MHz with a stopband attenuation of 20 dB. The design can be primarily used for protecting the band from the unwanted RFI signal. Further, the dynamic range of the radio receiver gets enhanced in the low-frequency band where the sky temperature dominates.



(a) (b) (c)

Figure.1. (a) Front side and (b) back side of the proposed filter. [t_1=3, t_2= 9.8, l=75, $g2$=21, l_1=60, l_2=15, t=1] all dimensions are mm (c) RL and TL response of the proposed notch filter.

[1] "Low-Frequency Radio Astronomy ", Edited by J N Chengalur, Y Gupta, and K S Dwarkanath.

[2] Gupta, Y. *et al*., The upgraded GMRT: opening new windows on the radio Universe", Current Science, vol. 113, no. 4, pp. 707–714, 2017. doi:10.18520/cs/v113/i04/707-714.

[3] *P. A. Fridman*., et al," RF I mitigation methods in radio astronomy", A&A 378, 327–344 (2001) DOI: 10.1051/0004-6361:20011166.