

An X-Band Multiband Patch Antenna for Spectrally Sparse Waveforms

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Antennas are a key component of every wireless and electromagnetic system, with applications in cellular communications, satellite communications, radar systems, wireless computer networks and countless others. Patch antennas are of particular interest due to their small size, low cost, and ease of fabrication. While there has been much research in applications of multi-band patch antennas, these efforts have focused on wide-band operation. To optimize two-tone signal transmission essential for high-accuracy ranging applications, narrow bandwidth performance at separate frequencies is necessary (J. A. Nanzer *et al.*, Open-Loop Coherent Distributed Arrays, IEEE Trans. on MTT, PP (99), 1-11, 2017). Separation of these tones in the range of several gigahertz is beneficial in reduction of interference and noise contributions from the unused spectrum between tones

This work presents the design, fabrication and measurement of a patch antenna with two narrow operating bands. A slot-loaded patch antenna has been designed for narrow-band operation at 9.5GHz and 10.5GHz. The antenna is fabricated on a Rogers RO4350B substrate, with a thickness of 1.524mm, and 17.5 μm of copper. Narrow slots are located along the sides, as well as the radiating edge of the antenna as shown in Fig. 1. The design has been simulated and optimized using Ansys High Frequency Structure Simulator.

Multiple prototypes were fabricated and tested during the optimization of this antenna. Return loss of less than -10dB have been measured at the desired operating frequencies. Radiation pattern measurements will be presented, demonstrating successful performance. Future work with this antenna will include the utilization of a genetic algorithm to add a third frequency band that will transmit operational signals for the distributed sparse array. Additionally, the omnidirectionality of the system will need to be addressed as a planar structure cannot achieve this on its own.

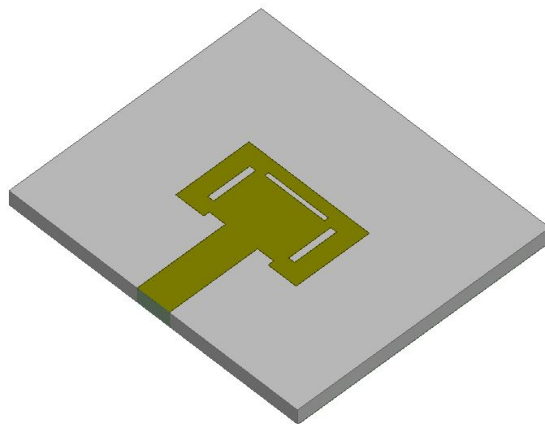


Figure 1: Slot-loaded patch antenna geometry.