

Design of a Wideband Circularly Polarized Patch Antenna for GNSS Applications

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A small and light weight broadband circularly polarized patch antenna operating over GNSS band using proximity-coupled L-probe feeding technique is proposed. The performance of the antenna shows low return loss ($S_{11} < -12$ dB), relatively flat and high gain (4.72 dB $<$ Gain $<$ 8.01 dB), and pretty low axial ratio (0.5 dB $<$ AR $<$ 1.09 dB) over the entire GNSS band (1.16 GHz to 1.61 GHz). In designing this antenna, the electromagnetic wave is coupled to the patch through the four L-probes. Therefore, a broadband feed network that can split the input power into four output ports with equal amplitudes and 90° sequential phase difference is needed.

To Design and simulate the right hand circularly polarized patch antenna CST STUDIO SUITE 2017 has been utilized. After optimizing the printed circuit feed network to provide the sequential feed, the four copper L-shaped probes are connected to the output ports of the printed circuit feed network (rat race + two quadrature hybrid couplers) to excite the aluminum circular patch with a 90° sequential phase difference. The aluminum circular patch is held on top of the feed network using dielectric posts (spacers), and proximity-coupled four L-shaped metallic probes are symmetrically coupled to the patch (C. Sun, et. al, "A novel compact wideband patch antenna for GNSS application." IEEE Transactions on Antennas and Propagation 65.12 (2017): 7334-7339). The diameter of the copper bar used in the L-probes, the length and height of the L-shaped probes, the diameter and thickness of the circular patch, and the height of spacers are our design degrees of freedom. The optimization goal is to obtain maximum flat gain, minimum input return loss, and minimum axial ratio with compact size and light weigh structure. The prototype of the final design of the circular patch antenna is shown in Fig. 1, and has been successfully utilized to receive various GNSS satellite signals.

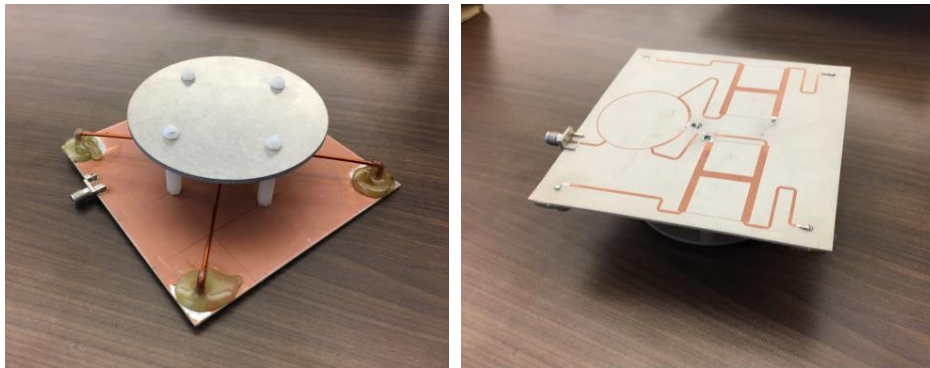


Figure 1. Photograph of the fabricated circularly polarized Patch antenna (dimension: $112 \times 112 \times 32$ mm).