ABSTRACT

Mobile Cognitive Radio Base Station (MCRBS) is a technology to recover communication in the disaster area, where a problem arises when MCRBS needs the best routing but the antenna is unable to focus the transmission to the particular area. To solve this problem, this thesis proposes a network beamforming with Rotman lens connected to array antenna that has amplitude distributions and phase shifting to direct beam to several directions for supporting backbone link construction in post-disaster networks using multiple MCRBSs.

The Rotman lens is designed to simultaneously transmit signal from MCRBS to other MCRBS without moving the antenna system. The Rotman lens is selected because it is practical and having low cost, compact design, and wide-angle scanning. Array antenna with slotted rectangular patch is used for thin substrates for compact design and provides directive characteristics to reach directional radiation pattern. This thesis performs computer simulations and makes a hardware realization of the Rotman lens and antenna design.

This thesis has successfully designed the Rotman lens connected to array antenna to switch and steer the beam into 5 directions. This thesis has obtained S-parameters having: (i) the reflection coefficient for return loss beam ports below -15 dB and average value for the coupling beam port below -30 dB and (ii) the transmission coefficient for phase error performance of maximum in 6° and amplitude performance for insertion loss and sidelobe level below 3 dB and -4 dB, respectively. The integrated Rotman lens and antenna has achieved the performances to switch and direct the beam in -23°,-9°, -2°, 21°, 25°. This thesis founds: (i) the Rotman lens properly considers parameters of α, β, f_1, and γ to create compact design for effecting electrical length from beam contour through array contour on controlling beam steering capability, and (ii) the phase error is important factor to evaluate the effectiveness of Rotman lens phase performance. The results show that integrated beamforming network of Rotman lens in antenna system can satisfy the MCRBS requirements to support beam direction of backbone communication link between MCRBSs.

Keywords: Network beamforming, Rotman lens, Mobile cognitive radio base station (MCRBS)