Rectangular Waveguide Antenna of Square Aperture Using Artificial Magnetic Conductor

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A rectangular waveguide aperture antenna is an elemental component which is commonly used in microwave array antenna applications. This type of antenna is especially preferred for array system since it reveals the superiority of high reliability, stable gain and physical durability. On the other hand, the broadside wall of this type of antenna is about two times longer than the vertical wall, the antenna exhibits an asymmetry radiation pattern between E-plane and H-plane, and shows broader half-power beam width in E-plane. So, it sometimes causes a weakness in antenna array system which scans target space in a wide range of angle, and has a limit of integration because the size of broadside is about half lambda.

To overcome such a weakness of the rectangular waveguide aperture antenna, we have adopted an artificial magnetic conductor to get the waveguide to reduce its broad wall in half. Since the planer artificial magnetic conductor makes a reflected electromagnetic wave to have phase of zero degree, the waveguide which has artificial magnetic conductors on its vertical wall can support much lower frequency band than that of the normal waveguide of the same size. Hence, a modified dimension of aperture square aperture waveguide antenna is available without changing operation frequency.
We have achieved a square dimension of the aperture by using the artificial magnetic conductor. And embedded artificial magnetic conductor is synthesized from the optimization process of genetic algorithm in order to satisfy several requirements such as center frequency, target dimension of the waveguide, substrate information and so on. The obtained artificial magnetic conductor can be easily fabricated via simple photolithographic etching process. The proposed antenna is able to perform symmetry radiation pattern of the waveguide antenna in both E-plane and H-plane. Moreover, the antenna has the smaller dimension in broadside wall and one can save the overall size of antenna array system significantly.

We will present the detail of the design process such as feeding method and optimization of genetic algorithm for planar artificial magnetic conductor. And measured performance of proposed antenna will also be shown and discussed.