ABSTRACT

Planar antennas have the advantages of small size, low profile, and easy to mount hosts and are very promising candidates for satisfying these design considerations. The tapered slot-line antennas (TSA) as one type of the planar antennas are travelling-wave end-fire antenna with advantages of uni-directive beam, and thin sheet structure. They are used widely in many applications such as the elements of phased arrays, the feed of reflector or reflect array, the UWB radiator for time-domain systems, etc. However, its gain is less than a broadside antenna with similar size. Also, the bandwidth depends on the ratio of the maximum/ minimum of the slot-width and the length of taper. The TSA has the disadvantages of complex matching and high back lobe level. The feeding structure usually consists of a microstrip feeding line coupled to the slot line of the tapered antenna. Tapered antennas are classified according to the shape of the taper. The most important types are linear tapered slot antenna, exponential tapered slot antenna, Vivaldi antenna, elliptical tapered slot antenna, etc. Many techniques are used to improve the radiation properties and bandwidth such as cavity behind the slot, using aperture coupling, using proper shapes for the slot, using a combination of the shape of feed and slot, etc.

The objective of this thesis is to enhance the antenna bandwidth, gain and to realize a compact size for the TSA by using different techniques such as adding gratings to the taper aperture and also by cutting slits on the edges of the taper profile with different lengths and shapes to obtain the UWB range of frequency. The antenna was fabricated on Teflon (PTFE) substrate (εr = 2.2) with a height of 0.5 mm, $\tan \delta = 0.0004$. The novelty of this antenna is that it combines two technologies together which are metallic gratings in the

dielectric taper and slits in the metallic sides of the antenna. The achieved simulated -10 dB bandwidth extends from 5.8 GHz up to 11.8 GHz, while the measured bandwidth extends from 4.48 GHz to 11.8 GHz. This antenna achieves a bandwidth increase of about 27.5 %, size reduction of about 22.4 % and gain increase by about 17.54 % as compared to published results