6.1 Introduction

This chapter contains the conclusions arrived at after analysing the newly developed antenna systems experimentally and theoretically. The merits and demerits of the antenna are discussed and the possible applications are proposed. The importance of the study and the scope for further work in the field are presented.

6.2 Highlights of the results:

6.2.1 Experimental Observations

(a) ETCR

The Extended Triple Corner Reflector (ETCR) Antenna is capable of providing a better directivity than the conventional corner reflector (CR) antennas. Certain configurations are seen to be having a relative gain nearly 4dB over the square corner reflector. The enhancement of gain is most pronounced in cases with large values of primary corner angle. Small primary angles require large dimensions of the reflectors for gain enhancement.

The flare angles of the antenna are small and the radiation characteristics shows a similarity to that of acute angled CR antennas, resulting in narrow beams with high gains.
The reduced half power beam width (HPBW) will offer good selectivity if used as a communication antenna. Also, the antenna is having a low sidelobe level.

The cross-polar level of the antenna is very low.

The studies on the impedance characteristics of the antenna reveal a slight enhancement in the VSWR of the antenna. This will reduce the coupling of power, but the enhanced gain will still offer advantage in the axial direction.

(b) PSACR

The Periodic strip attached corner reflector (PSACR) antennas have a lighter structure with higher gain. They have low wind resistance due to the strip and gap structure. The solid gap ratio of the structure could be altered through a large span without much loss of gain. This reduces the material requirement of the antenna. Even with a wire structure, a gain enhancement over the square corner is obtainable. This points towards a more practical design.

Many configurations of the PSACR antenna were seen to be providing gains of the order of 6dB over the conventional square corner reflector antenna. The flare angles of the antennas are very small and the radiation pattern of the antenna is similar to that of a CR antenna with very small angle. The beam width of the antenna is very small.

The leaky structure offers a better sharpening to the beam, as only the grazing radiation can be reflected by the strip structure. So the main lobe is slim. Still the gain enhancement offers merit over all other designs of similar type.

Large primary corner angles are offering larger gains than the acute angled corners. But the gain of the acute angled cases also will become high when the primary length is high. This makes the antenna a very large one. The advantage of such cases is in a reduction of sidelobe level.

There are configurations which can provide a twin lobed radiation pattern with a null on the axis. The nulls are about 30dB down showing the influence of the modification on the radiation pattern of the CR. Many primary angles are seen to be having this property at some value of the primary width.

Even though the subreflectors have a strip and gap structure, the cross-polar level is not very high. It is of the order of -18dB only.
The loading effect of the subreflector on the CR antenna is small due to the strip and gap design. So the VSWR is not increased very much. The variation of the number of strips of the structure is not directly reflecting in the VSWR characteristics showing that the influence of the strip structure on the impedance characteristics is small.

### 6.2.2 Theoretical Conclusions

During the theoretical analysis it was seen that the experimentally observed performance of the two types of antennas are in accordance with the theory.

The geometrical optics patterns of the two types of antennas are a good approximation of the experimentally observed pattern. The diffraction field components are very weak. Still they can create sidelobes and also modify the profile of the main lobe moderately.

In the case of the ETCR antennas, the subreflector act like a guiding structure and the sidelobe levels are very low. The pattern resembling that of a CR antenna with apex half angle equal to the flare angle of the strip structure. The diffraction field components are very weak. The diffraction field is producing only nominal change in the radiation pattern.

The GO field depend on the number of images formed due to reflection. This is decided by the primary corner angle. The total number of sources at the primary is getting multiplied at the two subreflector. The orientation of these images will be decided by the secondary corner angle, which decides the flare angle of the secondary reflectors.

All the sources will have their own span of influence. For the optimum setting the span of influence of the different sources will overlap on the axis, producing a power gain. The polarity of the different sources will be decided by the number of reflections it is undergoing before going to the target. Depending on the path length, this source can contribute constructively or destructively at the field point.

In the case of the PSACR antenna, the analysis is more complex. The reflection and diffraction field components are numerous. On the subreflector, the alternate zones are reflecting and transmitting. They are to be evaluated separately. Whether a gap is
penetrable or not is decided by the obliquity of the gap to the field. When the gap is transmitting, it produces a sidelobe. But beyond a few periods, the structure appears like a continuous sheet and the reflected radiation will enhance the axial field for optimum settings of the secondary corner angle $\beta$, resulting in a sharp axial beam. All reflecting zones will be sending radiation as if it is coming from the images, just like in the case of the ETCR antenna.

Here the diffracting edges are large in number. But the individual diffraction field components are as feeble as in the ETCR antenna. The combined effect of different diffraction components did not come to significant levels. This may be due to the fact that there is no order in their phase relationships.

Some differences were observed in the sidelobe level of the antenna, between theory and experiment. This may be because the gaps are not as penetrable as expected.

6.2.3 Shortcomings

The main drawback of the new antennas is their size. The size can be manageable in applications involving a field of moderate wavelength. The sidelobe levels of the PSACR antenna are comparatively higher than conventional corner reflector antennas. A moderate enhancement of VSWR also is noted in the case of both the antennas. The bandwidth of the antenna is only around 5% in many cases.

6.3 Importance of the study

CR antennas are very useful in communication as they possess a very simple structure. So the enhancement of the directivity of CR antennas is highly helpful in their application. It was as an attempt to enhance the directivity and reduce the beam width, of CR antennas that these new designs were developed. So the study is very important from a practical point of view.
6.4 Possible applications

The new antennas can successfully substitute the CR antennas and Yagi-Uda antennas in almost all applications involving moderate wavelengths. They can work as a telecast receiver in the UHF bands. The twin lobed pattern is useful for communication in cases where two points at an angular separation are to be contacted simultaneously without turning the antenna.

6.5 Scope for further work

The reduction of the dimensions of the antenna is a very important work remaining to be done. The wire equivalent of the reflector strips can be further explored to get a lighter version. The possibility for a flat beam was evident during the experimental iterations of this work. This indicates the chance for a design capable of producing uniform illumination. Also these designs can be modified to receive circular polarisation. Experimental investigation of these possibilities can be taken for further study.