An Ultra-Wideband 45° Oblique Polarized Antenna Array

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Abstract - A 45° oblique polarized ultra-wideband wide-angle scan antenna array is designed and made. The work frequency bandwidth of it is 3:1, the scan angle is ±30° scan at horizontal direction, and the array size is 16×4. The antenna is the printed log-periodic antenna made by dielectric substrate, and it's feed by a semirigid coaxial line. It has some advantages such as little weight, easy manufacture, high accuracy and consistency. The structure of the antenna and simulation method is introduced. After be measured, the VSWRs of the antenna at 3:1 bandwidth with ±30° scan angle are blew 2.5. The lobe diagrams of the antenna shows the antenna array can achieve ±30° scan at horizontal direction..

Index Terms —Ultra-wideband; 45° oblique polarized; printed log-periodic antenna;

1. Introduction

As the ultra-wideband work can reduce a lot of equipments and costs, the wide-angle scan work can cover more airspace[1], the 45° oblique polarized work can receive and send both the horizontal polarization signal and the vertical polarization signal. So the 45° oblique polarized ultra-wideband wide-angle scan antenna array is very popular at the Electronic warfare domain.

The log-periodic antenna has characteristics of ultra-wideband work and stable performance[2-3], but the ordinary log-periodic antenna has large size and low accuracy. The printed log-periodic antenna is made by dielectric substrate, and has some advantages such as little weight, easy manufacture, high accuracy and consistency, which is suitable for the ultra-wideband wide-angle scan array [4-5] .

2. Design and simulation

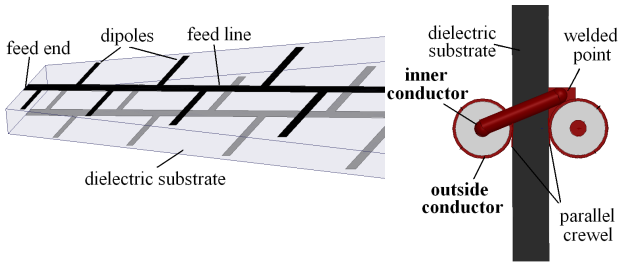


Fig. 1. Structure of the printed log-periodic antenna.

For the printed log-periodic antenna in this paper, the dipoles and feed line are printed at both two face of the dielectric substrate by light eroded, and the dipoles are feed by parallel crewel, as shown in the figure1. The antenna is feed by a semirigid coaxial line from the short dipole end. The outside conductor of the coaxial line is welded to one of the parallel crewel, and the inner conductor is welded to another.

The antenna is simulated and optimized by HFSS with two-dimensional periodic boundary as shown in the figure2. The acive-VSWR simulation results of antenna with no scan and scan 30° is shown in figure3, and both be blew 2.5.

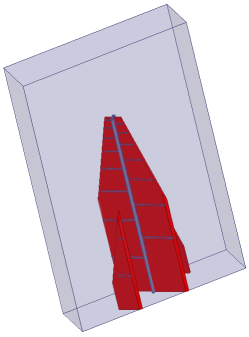


Fig. 2. Simulation model of the antenna.

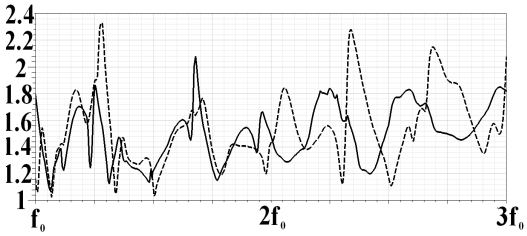


Fig. 3. Active-VSWR simulation results.

3. Results

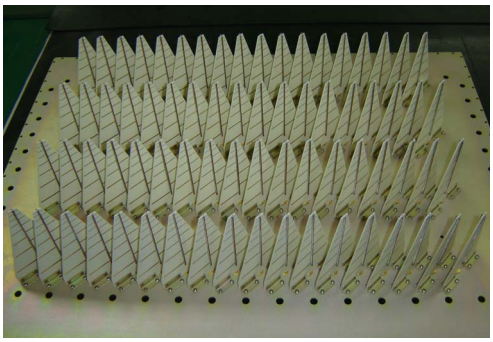


Fig. 4. Real picture of the antenna array.

The figure4 is the real picture of the antenna array. The figure5 is the acive-VSWR measurement results. The real line and broken line are no scan and scan 30° results, and both be blew 2.5. The figure6 and figure7 are the lobe diagrams at horizontal section with no scan and scan 30° at low, middle and high frequency. The real line and broken line are horizontal polarization results and the vertical polarization results, and both two polarization results of main diagram at work band are meet very well, and the difference are blew 1 dB.

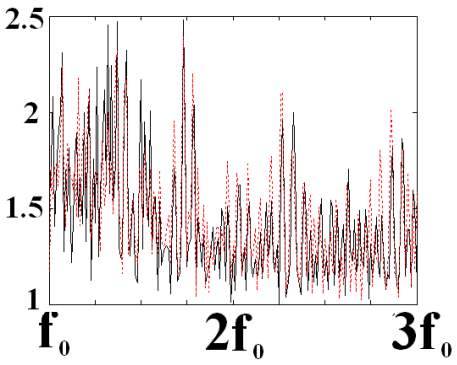
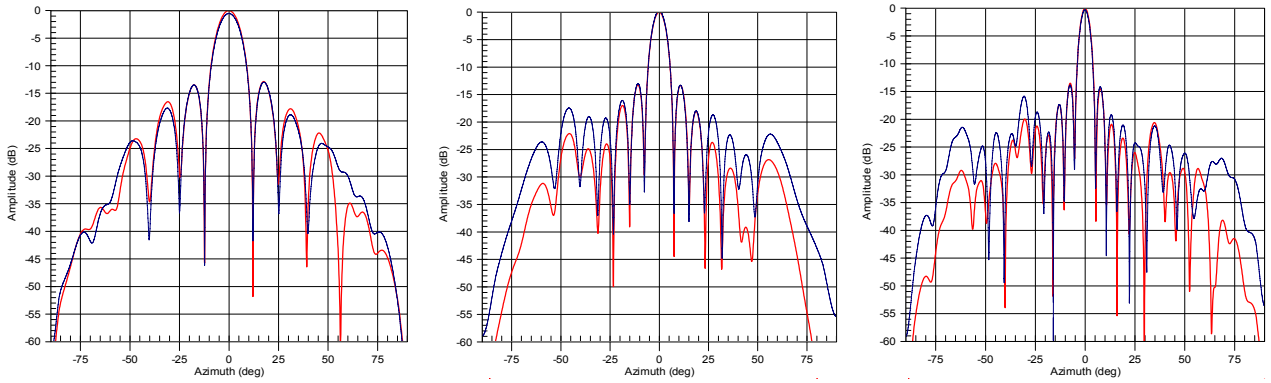


Fig. 5. Active-VSWR measurement results.



f0 2f0 3f0

Fig. 6. Lobe diagrams at horizontal section with no scan.

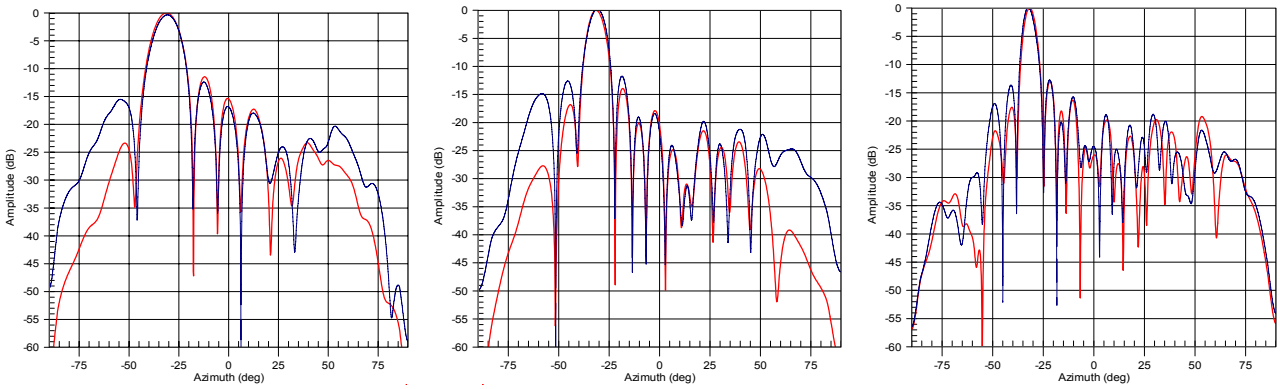


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Fig. 7. Lobe diagrams at horizontal section with scan 30° .

4. Conclusion

A 45° oblique polarized 3:1 bandwidth ±30° scan at horizontal direction antenna array is designed and made. The antenna is the printed log-periodic antenna made by dielectric substrate, and it's feed by a semirigid coaxial line. The measured results shows this antenna array can achieve 45° oblique polarized 3:1 bandwidth ±30° scan work plane.

References

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