

# Microstrip Antenna Arrays

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## CONTENTS

<b>I</b>	<b>Single Patch Antenna: Physical Design</b>	1
I-A	Design Context . . . . .	1
I-B	Fringing Effects . . . . .	1
I-C	Effective Relative Permittivity . . . . .	1
I-D	Effective Length . . . . .	1
I-E	Physical Design Length . . . . .	1
I-F	Summary . . . . .	1
<b>II</b>	<b>Single Patch Antenna: Radiation Pattern</b>	1
II-A	E-Plane . . . . .	1
II-B	H-Plane . . . . .	1
II-C	Far-Zone Total Electric Field . . . . .	2
II-D	Directivity . . . . .	2
II-E	Efficiency . . . . .	2
II-F	Summary . . . . .	2
<b>III</b>	<b>N-Element Patch Antenna</b>	2
III-A	Coordinates . . . . .	2
III-B	Relative Phase . . . . .	2
III-C	Array Factor from Summed Elements . . . . .	2
III-D	Directivity . . . . .	2
III-E	Efficiency . . . . .	2
III-F	Summary . . . . .	2
<b>IV</b>	<b>Impedance Matching by Insetting the Feed-Point</b>	2
IV-A	Input Impedance . . . . .	2
IV-B	Inset Position . . . . .	2
<b>V</b>	<b>Conclusion</b>	2
<b>References</b>		2
<i>Abstract—Hello</i>		

$$\frac{\Delta L}{h} = 0.412 \frac{(\epsilon_{\text{eff}} + 0.3) \left( \frac{W}{h} + 0.264 \right)}{(\epsilon_{\text{eff}} - 0.258) \left( \frac{W}{h} + 0.8 \right)}. \quad (1)$$

### C. Effective Relative Permittivity

To find the effective relative permittivity, we use

$$\epsilon_{\text{eff}} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left( 1 + 12 \cdot \frac{h}{W} \right)^{-1/2}. \quad (2)$$

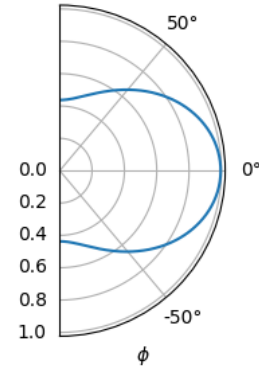
### D. Effective Length

### E. Physical Design Length

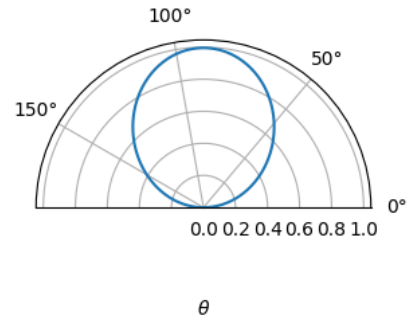
### F. Summary

## II. SINGLE PATCH ANTENNA: RADIATION PATTERN

### A. E-Plane



### B. H-Plane



## I. SINGLE PATCH ANTENNA: PHYSICAL DESIGN

### A. Design Context

### B. Fringing Effects

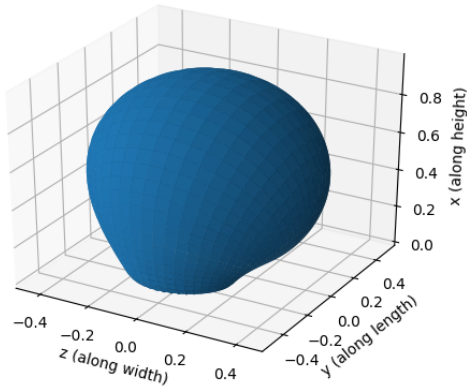
Fringing fields at the lengths of the patch makes the patch appear to have a greater length than it actually does. This is important since the effective dimensions of the patch affect the resonant frequency. If the physical length of the patch is  $L$ , then the effective length,  $L_{\text{eff}}$ , can be written as

$$L_{\text{eff}} = L + \Delta L,$$

where  $\Delta L$  is the additional length on one end of the patch.

The additional length can be related to the width of the patch,  $W$  and the effective relative permittivity of the dielectric substrate,  $\epsilon_{\text{eff}}$ , as

### C. Far-Zone Total Electric Field



### D. Directivity

### E. Efficiency

### F. Summary

## III. N-ELEMENT PATCH ANTENNA

### A. Coordinates

### B. Relative Phase

### C. Array Factor from Summed Elements

### D. Directivity

### E. Efficiency

### F. Summary

## IV. IMPEDANCE MATCHING BY INSETTING THE FEED-POINT

### A. Input Impedance

### B. Inset Position

## V. CONCLUSION

## REFERENCES