24Ghz patch antenna

v1.0.0

Thursday, 20 October 2016

# Revision history

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Version | Description | Author |
| 2016-10-20 | 1.0 | Initial specification | Dominik Guz |
|  |  |  |  |

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# Architectural Representation

## purpose

Design of antenna for 24Ghz radar..

## scope

Calculation of dimensions and parameters for microstrip antenna at given center frequency.

## references

## definitions

# Architectural Goals and Constraints

## Non-functional requirements

1. Size not larger than 2cm2 , to find in ring.
2. Manufacturable within PCB, microstrip standard 18um/36um

## functional requirements

1. 24 Ghz center frequency
2. Impedance match to 50 Ohm drive/load
3. Field pattern optimal for <10m range detetion

## environmental requirements

## Dependency requirements

## Operating conditions

1. Temperature ranges : -20°C -> 80°C

## Substrate comparision

### Manufacturers list

1. Rogers
2. Arlon
3. Isola

### Comparison table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Part Code | Manufacturer | Available | Price/1unit($) | Er | Temperature dissipation | Thermal cond |
| Rogers RO4xxx | Rogers | Y | ? | 3,38 | 0,002 |  |
| RO4350 | Rogers | Y | ? | 3,48 | 0,004 |  |
| Arlon AD600 | Arlon | Y | ? | 6,15 | 0,0017 |  |
| Isola I-Tera | Isola | Y | ? | 3,3 |  |  |
| Rogers 6035H | Rogers | Y | ? | 3,5 | 0,0013 |  |
| FR4 High pref | - | Y | ? | 4,5 | ? | ? |

## Selected material

### Rogers RO4350

#### Selection Conditions

1. Low loss at high frequency
2. Good dissipation factor
3. Easily available for manufacturing

# Requirements analysis

## Circuit parameters

Patch antenna with transformer.

### Operating condtions

### Voltage ranges

1. See BGT11

### Frequency ranges

1. 23.9 – 24.1 Ghz

### Dimensions

1. < 2 cm2

## Calculations

Center frequency (f) = 24Ghz

Substrate : Rogers RO4350

Permitivity (e): 3,48

Ground height (h) : 0.254mm

Manufacturing precision : length/width : +/- 0.01mm

### Wavelength (n)

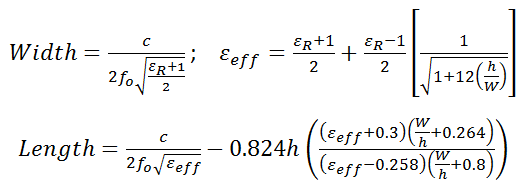
c – speed of light

f – frequency of operation

e – dielectric constant

### Antenna length

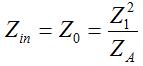
### Width and length of patch



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | |  |  | | --- | --- | | Width: | 4.173 mm | | Length: | 3.259 mm | |

### Quarter wave transformer – input match

Antenna impedance (ZA) : 200



Z0 = 50 Ohm

Length (Z1) = n/4 = 0,0016725m

Width(Z1) = 0.07mm ( @ 24Ghz, 0.254mm h)

## Component selection

## Simulation - matlab

### import geometry – stl

#### Simulation without port matching - bultin

p1 = patchMicrostrip;

p1.Width = 0.004173;

p1.Length = 0.003259;

model = createpde(3);

importGeometry(model,’ 24Ghz-Patch-2.stl');

generateMesh(model)

pdemesh(model)

p1.Substrate = dielectric('Name','Rogers 4350','EpsilonR',3.48);

impedance(p1,linspace(23.9e9,24.1e9,10))

#### Simulation from 2d model – mesh definition

## Component specification

# Circuit model

## Block diagram

# Circuit drawing

# Circuit simulation results

# Implementation notes

# Issues and concerns