# Modeling Microwave Waveguide Components: The Tuned Stub 

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Pryor Knowledge Systems

Introduction to Modeling Microwave Waveguide Compoments: The Tumed Stub

## What is a Stulb?

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## What is a Stulb?

A Stub is a length of Transmission Line that is connected to an active circuit at one end only.

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## WVart i̊s a Sturb?

A Sturb is a length off Tromsmissiom Line that is commected to an active cirreniit ar ome emdl omly.

## What is a Tumed Stub?

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WVart is a Sturb?

A Sturb is a length off Tromsmissiom Kine that is commectedl to an active cirreuirit at ome emdl omly.

What is a Tumed Stulb?
A Tuned Stub is a Stub whose length is optimized to reflect the desired impedance at the circuit connection point.

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## What are the application attributes of Tuned Stub components?

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# What are the application attributes of Tuned Stub components? 

## Widely Employed Technology

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Widelely Employed Techmology<br>Large Literature for Waveguide Components

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# What are the application attributes of Tuned Stub components? 

Widely Employed Techmology<br>Large Litterature for WVaveguide Compoments<br>Critical Path Technology

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Widely Employed Techmology<br>Large Litterature for WVaveguide Compomemts<br>Criticeal Patil Techmology<br>Power Transfer Optimization

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## What type of Tuned Stub Waveguide Component is the focus of this COMSOL Multiphysics Model?

## What type of Tuned Stub Waveguide Component is the focus of this COMSOL Multiphysics Model?

This COMSOL Multiphysics (Version 4.3) RIF Modulle Model is focused on an $\mathbb{S}$-parameter analysis of a two-port, Three Stulb Thuner in the firequency range 2.2 to 3.3 GHz 。


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## The Built Model， Model Builder Tree：

```
IT. Model Builder
    \square口
```



```
* \12 Tuned_Stub_3AB.mph (root)
    \equivGlobal Definitions
    \ Model }1\mathrm{ (modI)
        > \equiv Definitions
        * Geometry 1
        > Materials
        \nabla Electromagnetic Waves, Frequency Domain (emw)
            D-DWave Equation, Electric 1
            D
            D Initial Values 1
            *)}\mathrm{ Impedance Boundary Condition 1
            ((I) Port 1
            -at Port 2
                \frac{\partialu}{\partialt}=f\mathrm{ Equation View}
            Mesh 1
    O0}\mathrm{ Study 1
    V Results
            | : :#: Data Sets
            N.Views
            e-12
            贯 Tables
            * Electric field
    **1D Plot Group 2
    **1D Plot Group 3
    **1D Plot Group 4
    - Export
            [皃Reports
```

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## The Built Model, Electric Field Plot: $3.3 \mathbf{~ G H z}$



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## The Building Model Geometry



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## The Building Model Geometry



## Tuned Stub <br> Parameters and Coordinates

| parameter | value | description |
| :---: | :---: | :---: |
| Wg_ht | 43.18[mm] | Waveguide inside height |
| Wg_dp | $86.36[\mathrm{~mm}$ ] | Waveguide inside depth |
| Wg_wd | 122.45 [mm] | Waveguide inside width |
| x 0 _ cnr | $0[\mathrm{~mm}]$ | x corner of Waveguide |
| y0_cnr | $0[\mathrm{~mm}]$ | y corner of Waveguide |
| $\mathrm{zO}_{-} \mathrm{cnr}$ | $0[\mathrm{~mm}]$ | z corner of Waveguide |
| Stbl_ht | $6.1224[\mathrm{~cm}]$ | Tuning stub height |
| Stb1_dp | $86.36[\mathrm{~mm}]$ | Tuning stub width |
| Stbl_wd | $1.5306[\mathrm{~cm}]$ | Tuning stub length |
| xl _cnr | $22.959[\mathrm{~mm}$ ] | x corner of stub |
| yl_cnr | $0[\mathrm{~mm}]$ | y corner of stub |
| z1_cnr | $43.18[\mathrm{~mm}]$ | z comer of stub |
| Stb2_ht | $6.1224[\mathrm{~cm}]$ | Tuning stub height |
| Stb2_dp | 86.36[mm] | Tuning stub width |
| Stb2_wd | $1.5306[\mathrm{~cm}]$ | Tuning stub length |
| x2_cnr | 53.571 [mm] | x corner of stub |
| $\mathrm{y}_{2} \mathrm{cnr}$ | $0[\mathrm{~mm}]$ | y corner of stub |


| parameter | value | description |
| :---: | :---: | :---: |
| z2_cnr | $43.18[\mathrm{~mm}]$ | z corner of stub |
| Stb3_ht | $6.1224[\mathrm{~cm}]$ | Tuning stub <br> height |
| Stb3_dp | $86.36[\mathrm{~mm}]$ | Tuning stub <br> width |
| Stb3_wd | $1.5306[\mathrm{~cm}]$ | Tuning stub <br> length |
| x 3 _cnr | $84.184[\mathrm{~mm}]$ | x corner of stub |
| y 3 _cnr | $0[\mathrm{~mm}]$ | y corner of stub |
| z3_cnr | $43.18[\mathrm{~mm}]$ | z corner of stub |
| sigma_wall | $6.3 \mathrm{e} 7[\mathrm{~S} / \mathrm{m}]$ | Wall cond. |

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## The Building Model Geometry

|  | Vacuum |  |  |
| :---: | :---: | :---: | :---: |
| Property | Name | Value | Unit |
| relative <br> permittivity | epsilonr | 1 | 1 |
| relative <br> permeability | mur | 1 | 1 |
| electrical <br> conductivity | sigma | $1.0 \mathrm{e}-9$ | $\mathrm{~S} / \mathrm{m}$ |

## Tuned Stub <br> Materials <br> Parameters

|  | Wall |  |  |
| :---: | :---: | :---: | :---: |
| Property | Name | Value | Unit |
| relative <br> permittivity | epsilonr | 1 | 1 |
| relative <br> permeability | mur | 1 | 1 |
| electrical <br> conductivity | sigma | sigma_wall | $\mathrm{S} / \mathrm{m}$ |

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## The Model Solution <br>  <br> Tuned Stub Electric Field



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## The Model Solution <br> Tuned Stub VSWR

$\operatorname{VSWR}=\frac{1+\left|S_{11}\right|}{1-\left|S_{11}\right|}$


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## Thank Y(ou!

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