Abstract—In remote correspondence framework reception apparatuses are the most imperative component for making correspondence join amongst source and destination. Wanted patch reception apparatus outline is reproduced by utilizing high recurrence recreation programming and fix radio wire is composed according to prerequisite. Radio wire measurements, for example, Length (L), Width (W), and substrate dielectric consistent and parameters like Return Loss, Gain, impedance and current dissemination are ascertained utilizing CAD-FEKO. A wide working transfer speed for a solitary component rectangular microstrip patch receiving wire can be gotten by cutting a U-shaped space on the patch. By utilizing U opening on the patch reception apparatus can be worked in a few groups at various frequency. The receiving wire has been outline to be worked in the scope of 8-12GHz. Consequently this reception apparatus is exceedingly reasonable for X-band applications. In this work, the parametric investigation of single component U opening MSA, a 2×1 and 4×1 varieties of microstrip radio wire has for broadband cutting edge remote applications covering double or triple band operations has been introduced. Proposed work started by considering a double band single component reception apparatus, which works in X groups of cutting edge remote correspondences. Single-food reception apparatus operation has been done. Outlined reception apparatus has sprightly enraptured. Proposed reception apparatus accomplishes S11< -10dB at all specified groups.

Keywords- Microstrip Patch Array Antenna, Surface Current, VSWR, Impedance, Efficiency, Gain.

I. INTRODUCTION

The microstrip receiving antenna contains metallic patch, dielectric substrate and ground plane. The dielectric substrate is sandwich amongst patch and ground plane. Low dielectric steady substrates are by and large favored for most extreme radiation. So this patch is for the most part made up from different metals like silver, gold, zinc, and so forth. But here we have used copper metal because it is cheap and easily available in market. The patch metal may have distinctive shapes Such as, rectangle, square, circle, triangle, roundabout ring. Be that as it may, Rectangular patch is generally utilized in light of the fact that it is anything but difficult to utilize simplicity of examination, create appealing radiation attributes, particularly low cross polarization radiation and shoddy. So we are using rectangular patch in this project. The array increases the gain and performance of microstrip antenna.

II. DIAGRAM

Fig-1: Structure of Microstrip Patch Antenna

For a rectangular patch, the length L of the component is generally $\lambda_0/3 < L < \lambda_0/2$, where $\lambda_0$ is the free space wavelength. The patch is chosen to be thin such that $t << \lambda_0$ (where $t$ is the patch thickness). The tallness $h$ of the dielectric substrate is typically 0.003 $\lambda_0 \leq h \leq 0.05 \lambda_0$. 
There are various substrates that can be used for outline of microstrip reception apparatuses, and their dielectric constants are as a rule in the scope of $2.2 \leq \varepsilon_r \leq 12$.

### III. DESIGN

The U-slot is composed of two paralleled vertical rectangular slots and a horizontal rectangular slot. U-opening assumes a critical part to control the wideband conduct of the coupled patch reception apparatus. There are three parameters to portray the openings, specifically space length, opening position, and opening width.

#### A. Theoretical design

Step 1: Calculation of the Width ($W$):
The width of the Microstrip patch antenna is given as:

$$W = \frac{c}{2f_r \sqrt{\left(\frac{\varepsilon_r + 1}{2}\right)}}$$

Where:
- $c$ - Free space velocity of light, $3 \times 10^8$ m/s
- $f_r$ - Frequency of operation
- $\varepsilon_r$ - Dielectric constant

Step 2: Calculation of Effective dielectric constant ($\varepsilon_{\text{reff}}$):
The effective dielectric constant is:

$$\varepsilon_{\text{reff}} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2} \left(1 + \frac{12h}{W}\right)^{-\frac{\varepsilon_r}{2}}$$

Where:
- $\varepsilon_r$ - Dielectric constant
- $h$ - Height of dielectric substrate
- $W$ - Width of the patch

Step 3: Calculation of the Effective length ($L_{\text{eff}}$):
The effective length is:

$$L_{\text{eff}} = \frac{c}{2f_r \sqrt{\varepsilon_{\text{reff}}}}$$

Where:
- $c$ - Free space velocity of light, $3 \times 10^8$ m/s
- $f_r$ - Frequency of operation
- $\varepsilon_{\text{reff}}$ - Effective dielectric constant

Step 4: Calculation of actual length of patch ($L$):
The actual length is obtained by:

$$L = L_{\text{eff}} - 2\Delta L$$

Where,
- $L$ - Actual length of patch.
- $L_{\text{eff}}$ - Effective length.
- $\Delta L$ - Small difference between length.
B. Design Values

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch Shape</td>
<td>Rectangular</td>
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<tr>
<td>Frequency</td>
<td>8GHz-12GHz</td>
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<tr>
<td>Dielectric constant of</td>
<td>4.4</td>
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<tr>
<td>Height of substrate</td>
<td>1.6mm</td>
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<tr>
<td>Feeding method</td>
<td>Corporate Feed</td>
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<tr>
<td>Polarization</td>
<td>Linear</td>
</tr>
</tbody>
</table>

IV. SIMULATION RESULTS

The simulated results of antenna are measured using CAD-FEKO version 7.0. As we know for proper transmission of signal by antenna, the S11 parameter of antenna should be less than -10dB and VSWR Should be less than 2.

A. Reflection Coefficient-1

![Fig.3: Reflection Coefficient of Single-Element MSA](image)

B. Reflection Coefficient-2

![Fig.4: Reflection Coefficient of 2-Element MSA](image)

C. Reflection Coefficient-3

![Fig.5: Reflection Coefficient of 4-Element MSA](image)

D. VSWR-4

![Fig.6: VSWR of Single-Element MSA](image)
VI. APPLICATION

The MSA used for GPS as well as RADAR. It is also useful in RFID, Wi-Max applications. In satellite and aircraft communication it is widely used. It also used in the WLAN as well as Bluetooth communication. And also in 3G communication system and for mobile communication this antenna is widely used.
VII. CONCLUSION
The MSA is simulated by using CAD-FEKO simulation software. The simulated antenna can be operated in dual and triple frequency band. A wide operating bandwidth can be obtained by cutting a U-shaped slot on the patch. By utilizing U space on the patch reception apparatus can be worked in a few groups at various recurrence. There are distinctive parameters like measurements, determination of the substrate, sustain method furthermore the working recurrence that influence the execution of antenna. The parameters like transmission capacity and addition of microstrip reception apparatus can be enhanced by utilizing U-opening and number of components in the exhibit.

REFERENCES