# The Performance of Tapered Feed Network and Quarter-Wavelength Transformer Feed Network at KU-Band

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***Abstract*-This paper presents the performance of 4×4 array tapered microstrip feed network and quarter-wavelength transformer feed network at KU-Band. The paper shows the comparison of $S_{11}$ and VSWR parameters between two feed networks at 15GHz. ADS2008 simulation software was used to present the useful results on both the networks at 15GHz.**

## I. INTRODUCTION

Microstrip feed networks are very popular in patch array antennas [1]. The main function of microstrip feed network is to distribute power equally to all the elements in the array of antenna. Not only that, the feed network also provide impedance matching from each and every single element to the input port of the array antenna. Without proper impedance matching, non-uniform power distribution may happen in the array and hence resulting input power loss.

In the array of patches antenna, the elements can be fed by a single line or by multiple lines in a feed network arrangement [2]. The first is called series feed network while the second is called corporate feed network [3]. Corporate feed network is the widely used in most of the complicated array antennas. This type of feed network provides power distribution of $2^n$ (i.e., n=2, 4, 8, 16, 32, etc.) [4]. This can be accomplished by using either tapered lines as shown in Fig.1 or using quarter-wavelength impedance transformers as shown in Fig.2.

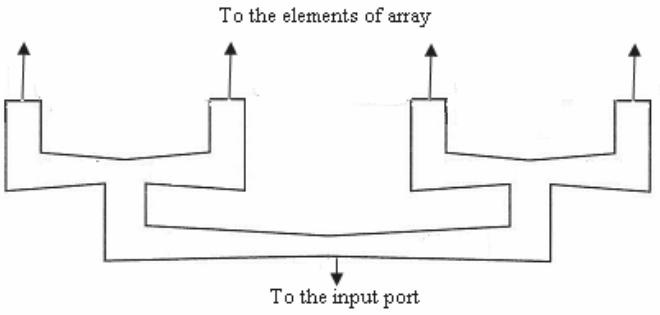


Figure 1. Tapered microstrip feed network.

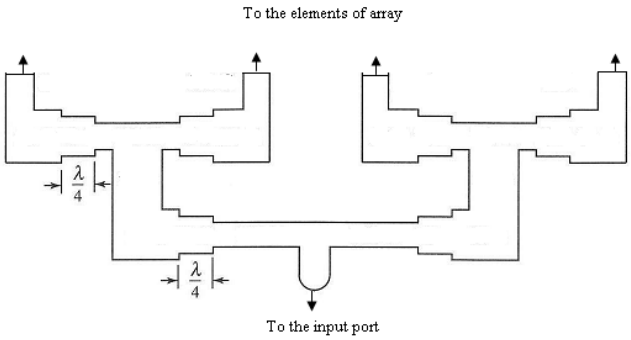


Figure 2. Quarter-wavelength microstrip feed network.

Notice that on both of the Figs, the top parts of the lines are connected to the elements of an array antenna and this antenna can be circular, rectangular or even coaxial probes. The bottoms of the feed networks as shown in both the Figs are usually connected to the port which has 50Ω impedances. The impedances appear at the input of feed array networks that connected to elements of array are varies. The impedances are highly dependent on the frequency of operation. The design issues about these two feed networks will be presented in the next section.

## II. TAPERED MICROSTRIP FEED NETWORK

### *A. Design Issues*

In the design of tapered line of microstrip feed network, the theory of small reflections to predict the reflection coefficient ($S_{11}$) response as a function of the impedance taper, Z(z) are important [4].

Consider the continuously tapered line of Fig.3 as being made up of a number of incremental sections of length Δz, with an impedance change Δ*Z*(z) from one section to the next, as shown in Fig.4. Then the incremental reflection coefficient from the step at z is [5]

$$\Delta\Gamma = \frac{\Delta Z}{2Z} \tag{1}$$