A Novel Implementation of Rectangular Waveguide in Ku – Band for Varying Magnetic Field

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Abstract

There's presently an urgent and important need for very high power radiation sources in modern technology. Here we study the input behavior of high power microwave antenna to achieve high output efficiency in Ku – Band.

1. Introduction

A hollow waveguide supports TE and TM but not the TEM The author here primarily focuses on 2 methods of microwave frequency generation i.e. By SSDs and by vacuum based devices. We are working under Ku-band, in order to achieve high power (MW-GW) wherein current is in kA range and voltage is in kV range. Particularly in this project we are using Ku band in the frequency range from 12GHz – 18GHz. The cross sectional area of rectangular waveguide is less. So the density is less. So the current density J of rectangular waveguide is more.

2. Layout

The Ku band is the 12–18 GHz portion of the electromagnetic spectrum in the microwave range of frequencies. This symbol refers to "K-under" in other words, the band directly below the K band. In radar applications, it ranges from 12-18 GHz.

The Difficulties in Ku – Band: When frequencies higher than 10 GHz are transmitted and received in a heavy rain fall area, a noticeable degradation occurs, due to the problems caused by and proportional to the amount of rain fall (commonly known as known as "rain fade"). This problem can be combated, however, by deploying an appropriate link budget strategy when designing the satellite network and allocating a higher power consumption to overcome rain fade loss. The Ku band's higher frequency spectrum is particularly susceptible to signal degradation. A similar phenomena called "snow fade" (when snow accumulation significantly alters the dish's focal point) can also occur during Winter Season. Also, the Ku band satellites typically require considerably more power to transmit than the C band satellites.

3. Requirements for the Implementation

The author here uses the CST Particle Studio (Computer Simulation Technology) software as it provides accurate 3D simulation of high frequency devices

4. Proposed System and Results

P (ms)	H (mm)	Mode	Freq. (GHz)
5.2	**3.2**	**1**	**9.36**
		2	**13.51**
		3	**16.42**

Table No. 1: Table of SWS Dimensions
*Similar reading taken for P (ms) at 5 and P (ms) at 4.8

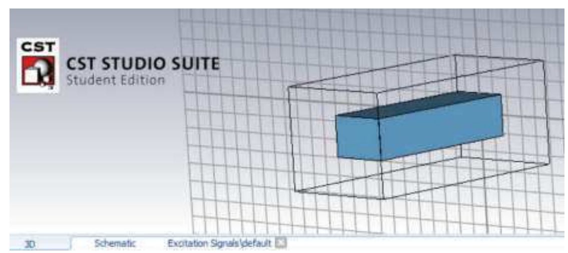

Figure No. 1: Rectangular WG without SWS

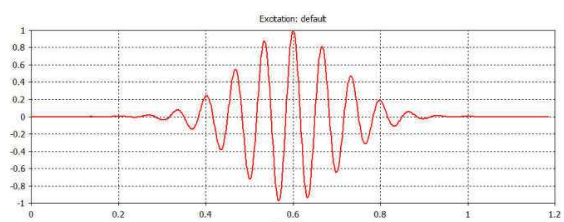

Figure No. 2: Results of Excitation Signal

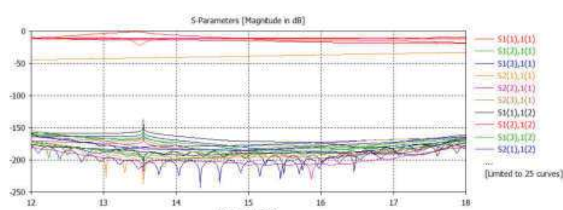

Figure No. 3: Results of S – Parameters without SWS

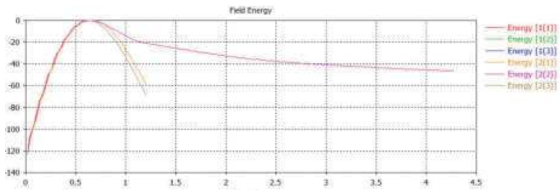

Figure No. 4: VSWR

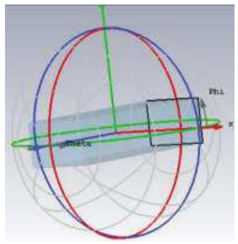

Figure No. 5: Far Field without SWS

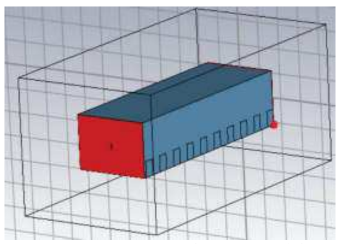

Figure No. 6: Rectangular WG with SWS

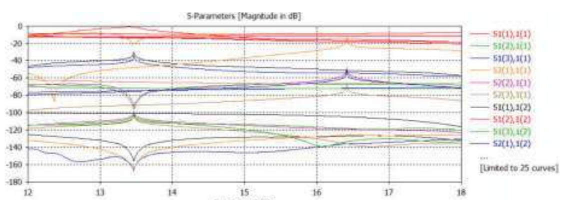

Figure No. 7: Results of S – Parameters with SWS

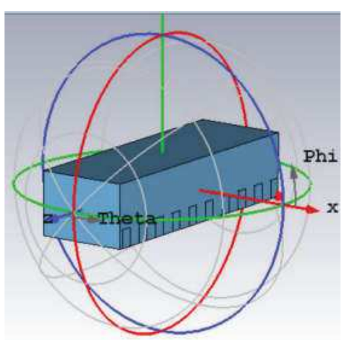

Figure No. 8: Far Field with SWS

5. Conclusion

The authors have observed the wave pattern from the dispersion graph, when the Input voltage is applied and then the energy is transferred from beam to the waveguide.

The input parameters are: Beam voltage=160KV, the Beam current=1.4KA, Frequency=12-18GHz. The changes are observed minutely for the experiment when we vary the magnetic field at different locations.

7. References

1. Banerjee TS, Reddy KTV, Hadap A (2014) Review on Microwave Generation Using Backward Wave Oscillator. Scholars Research Library Archives of Applied Science Research.
2. Banerjee TS (2016) Understanding the focusing of charged particle for 2D sheet beam in a cusped magnetic field.