

EVALUATING PERFORMANCE OVER UHF AND RESEARCHING FOR HIGH GAIN TV ANTENNA

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ABSTRACT

Ultra high frequency (UHF) is the ITU (International Telecommunication Union) designation for radio frequencies in the range between 300 MHz and 3 GHz, also known as the decimeter band as the wavelengths range from one to ten decimeters. Radio waves with frequencies above the UHF band fall into the SHF (super-high frequency) or microwave frequency range. A television antenna is an antenna specifically designed for the reception of over-the-air broadcast television signals, which are transmitted at frequencies from about 41 to 250 MHz in the VHF band, and 470 to 960 MHz in the UHF band in different countries. This antenna design is for UHF TV band. Main purpose of this design is to give good UHF reception for the users. This is an out-door antenna which can be modified to use as indoor antenna as well. The materials that need to build the antenna are cheaper and easy to find in local market. The constructed antenna with new design could be used to obtain high gain with low cost (unlike boosters with high power consumption) as well the HVS (Human Visual System) measurement verifying the clear and increased resolution on the TV screen. The clarity in reception for our constructed antenna is 75% (using 5 viewers) than obtain by using commercially available UHF antennas.

Keywords: *Modified high gain antenna UHF Antenna, Human Visual System (HVS)*

1. INTRODUCTION

In Sri Lanka people tends to use many type of antenna. They appeared differently but technology behind is the same. The concept of Yagi¹ Antenna design and Loop antenna designs are widely used (Shown in Figure 1). But original Yagi antenna design not equipped with high gain. The signal to noise ratio is very high. But in my design it is high gain when comparing to the ordinary UHF antenna designs. Technically our design have vertically polarized, 7-10dB gain and 75 ohm co-axial cable.

UHF is the most commonly used frequency bands for transmission of television signals. Modern mobile phones also transmit and receive within the UHF spectrum. UHF is widely used by public service agencies for two-way radio communication, usually using narrowband frequency modulation, but digital services are on the rise. Narrowband radio modems use UHF and VHF frequencies for long range data communications; e.g. for supervision and control of power distribution networks and other SCADA and automation applications. There has traditionally been very little radio broadcasting in this band until recently. The Global Positioning System also uses UHF.

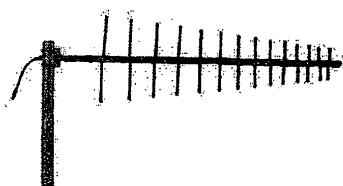


Figure 1: Yagi Antenna¹

2. METHODOLOGY

When considering material and components used in implementation of this project, we have to consider five categories. They are PVC frame, wire mesh, PCB, metallic element, co-axial cable. It uses very cost effective materials to implement. Frame is constructed using PVC water pipes. 0.5'' gauge PVC pipes are used with to construct antenna elements. Theoretically, in each and every antenna design there should be a good reflector to get good reception. But, without a reflector some designs have good reception. As an example, Yagi design doesn't have a reflector¹. But in this case we have used a wire mesh as a reflector but with a Aluminium foil inorder to get a better reception. This proposed design is a vertically polarized antenna, due to the direction of the wind, the structure with all covered reflector has no stability. Therefore, the wire mech is a good reflector for an antenna. A PCB is designed to connect the co-axial cable to the antenna and added some extra port to connect to co-axial cabel to the same PCB. So that antenna can connect two TVs at the same antenna. Also added series inductor to match the impedance to 75 ohms.

The copper elements will absorb the signals reflect from the wire mesh and then they will transport to the PCB. In every antenna design elements are the signal absorbers with or without the reflector. In the proposed design we have used gauge 8mm copper wire folded as below (figure 3) as the driven element.

The coaxial cable is used as a transmission line for radio frequency signals. It is connecting radio transmitters and receivers with the antennas and distributing the cable television signals. One advantage of coaxial over other types of radio transmission line is that in an ideal coaxial cable the electromagnetic field carrying signal exists only in the space between the inner and outer conductors². In our design we have used RG59B/U type cable³.

For most of TV antennas this cable is used. Since it has normal impedance matching as at 75 ohms and nominal attenuation is much low⁴.

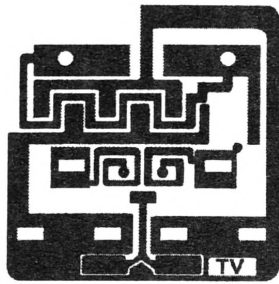


Figure 2: PCB Design

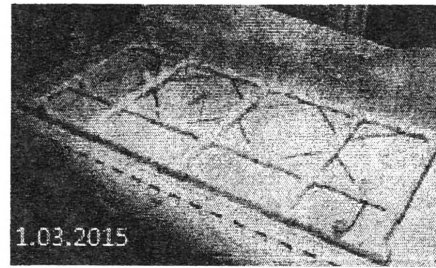


Figure 3: PVC Frame

3. RESULTS AND DISCUSSION

The proposed UHF antenna is designed to work as high gain antenna. Typically the gain is in between 7dB-10dB. Despite of the location the receptions were good.

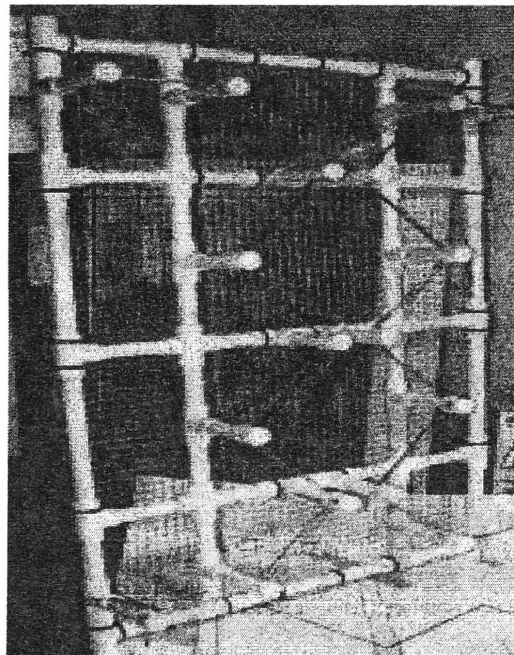


Figure 4: The constructed proposed antenna

The antenna was tested in both Pandura and Gampola areas for reception. For capturing images a TV card was used. Components used in this project cost are Rs.1500.00. Considering cost with gain of this design 75% effective than compared to a commercially available antenna.

Further, Development of this antenna can be done using the following ideas,

- The gain can be increased by using a booster circuit.
- With the use of loop antenna design easily upgradable for UHF/VHF antenna
- By using a UHF signal filter circuit the noises can be removed

- This proposed antenna design will be commercialized as a new antenna design by Sri Lanka's well known antenna manufacture; IE Technics Pvt Ltd.

The Primary advantages of our antenna are low cost design, high gain, easily upgradable and can also upgradable to receive any type of UHF/VHF signals. The disadvantages are larger in size, wind is an obstacle for holding it upright. Because of vertical polarization effects the Design is rather complex.

4. CONCLUSION

The high gain UHF antenna can be used in UHF TV band. This antenna design can be improved by adding much sensitive signal boosting circuit. The design uses low cost components and available in local hardware stores.

Most of the UHF antennas built for single purpose. But this design can easily modified for other applications such as radio communication transceiver, radio beacons (tsunami boyars) captures and receiver for radio tagged devices (wild elephant tagging).

With some miner modification to the antenna design this model can be used as indoor UHF TV antenna, and also can be used as UHF receiving antenna for other applications. According to this study, this antenna can be used as radio frequency capture for small RF signals.

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