

Design and Implementation of Three Feet Three Element VHF Antenna for ICOM 2300h

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Abstract – In this paper design and implementation of three feet three element vhf antenna for ICOM 2300h is proposed. Most fisherman uses analog wireless trans-receiver set which are flexible enough to handle many frequencies. But it is having their own drawbacks like heavy must, large power consumption etc. now in fishing industry ICOM 2300 trans-receiver is popular due to its digital nature and features.

When boat is near to port (around 5km distance) traffic is heavy on frequency. So generally people try to communicate near by higher frequencies. As ICOM 2300 trans-receiver is designed for allocated frequencies only with this change in frequencies action, due to reverse current & heavy SWR, it gets damaged. So we developed one protestation coil which is put just above the connector connection. Which help to nullify reverse current and help to reduce SWR

The simulation results have been obtained using ANSYS FHSS software and field trial satisfying the required application. Communication using three feet three element vhf antenna is very prominent.

Key Words: Rustproof antenna, long distance communication, Emergency services, icom2300h, reverse current;

1. INTRODUCTION

This paper focuses on the hardware fabrication and software simulation of three feet three element vhf antenna. 3-elements printed Yagi-Uda antenna, which has been designed for 1 GHz. The tested parameters have been in particular voltage standing wave ratio (VSWR), bandwidth, directivity, gain and efficiency of the antenna. First describes Yagi-Uda antenna and subsequently the measurement methods and calculations of single parameters. For gain measurement has been used gain-comparison method. It has been necessary to design impedance matching for improvement of implemented antenna. The comparing of measured parameters with and without impedance matching has shown improvement of requiring parameters of implemented antenna by impedance matching.

The Yagi-Uda antenna is actually planar antenna array, which is consisting of one driven element and several passive elements (parasitic elements). The passive

elements are divided into two types. The first type of passive elements causes focusing of the electromagnetic wave radiated from driven element. These elements are called as directors. The second one of passive elements causes reflection of the electromagnetic wave radiated from driven element. These elements are called as reflectors. Different features of directors and reflectors are given by distance from driven element and length of particular elements. The number of directors determines the features of radiation. The more directors cause improvement of directivity and gain. The simplest Yagi-Uda antenna consists of three elements, one driven element, one reflector and one director. The maximum directivity obtainable from this antenna is about 9 dBi.

The tested antenna has been designed as three elements Yagi-Uda antenna for 1 GHz and was printed on printed circuit board because of used frequency. The Yagi-Uda antenna, which has been implemented.

As ICOM 2300 trans-receiver is designed for allocated frequencies only with this change in frequencies action, due to reverse current & heavy SWR, it get damaged. So developed one protestation coil which put just above the connector connection. Which help to nullify reverse current and help to reduce SWR.

1.1 Literature Survey:

Theoretical designing of three feet three element vhf antenna.

Calculation:-

Directivity

Directivity is fundamental antenna parameter. It is a measure of how 'directional' an antenna is. An antenna that radiates equally in all directions would have effectively zero directionality, and the directivity of this type of antenna would be one (or 0 dB). It is mathematically defined as,

$$d = \frac{\text{maximum radiation intensity}}{\text{average radiation intensity}}$$

Antenna Gain

Gain is a measure of the ability of the antenna to direct the input power into radiation in a particular direction and is measured at the peak radiation intensity. Consider the

power density radiated by an isotropic antenna with input power P_0 at a distance R which is given by $S = P_0 / 4\pi R^2$. An isotropic antenna radiates equally in all directions, and its radiated power density S is found by dividing the radiated power by the area of the sphere $4\pi R^2$. An isotropic radiator is considered to be 100% efficient. The gain of an actual antenna increases the power density in the direction of the peak radiation:

$$s = \frac{P_0 G}{4\pi R^2} = \frac{|E|^2}{\eta}$$

Antenna Efficiency:-

The surface integral of the radiation intensity over the radiation sphere divided by the input power P_0 is a measure of the relative power radiated by the antenna, or the antenna efficiency.

$$\frac{P_r}{P_0} = \int_0^{2\pi} \int_0^\pi \frac{G(\theta, \phi)}{4\pi} \sin\theta d\theta d\phi = \eta_e$$

Block Diagram:

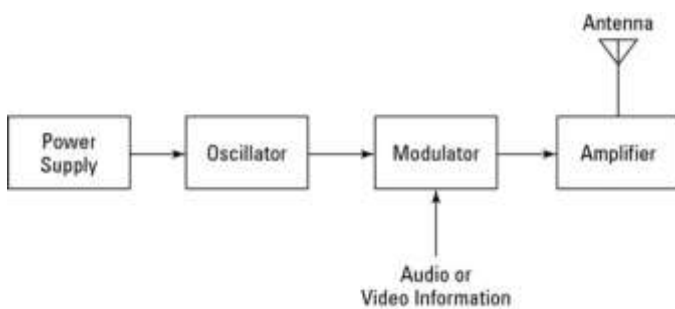


Figure Transmitting antenna

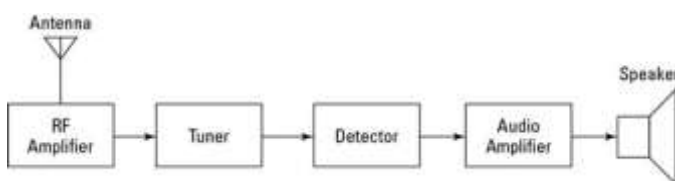


Figure Receiving antenna

Power Supply:-

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. All power supplies have a *power input* connection, which receives energy in the form of electric current from a source, and one or more *power output* connections that deliver current to the load. The

source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells, generators or alternators, solar power converters, or another power supply. The input and output are usually hardwired circuit connections, though some power supplies employ wireless energy transfer to power their loads without wired connections. Some power supplies have other types of inputs and outputs as well, for functions such as external monitoring and control.

Transreceiver:-

A transceiver is a device comprising both a transmitter and a receiver that are combined and share common circuitry or a single housing. When no circuitry is common between transmit and receive functions, the device is a transmitter-receiver.

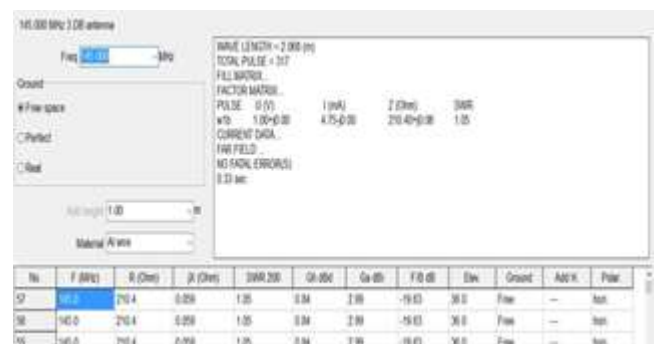
Co-axial Cable:-

Coaxial cable, is a type of electrical cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield. Many coaxial cables also have an insulating outer sheath or jacket. The term coaxial comes from the inner conductor and the outer shield sharing a geometric axis. Coaxial cable is a type of transmission line, used to carry high frequency electrical signals with low losses. It is used in such applications as telephone trunk lines, broadband internet networking cables, high speed computer data busses, carrying cable television signals, and connecting radio transmitters and receivers to their antennas. It differs from other shielded cables because the dimensions of the cable and connectors are controlled to give a precise, constant conductor spacing, which is needed for it to function efficiently as a transmission line.

Antenna:-

An antenna or aerial is a metal device made to send or receive radio waves. Many electronic devices like radio, television, radar, wireless LAN, cell phone, and GPS need antennas to do their job. Antennas work both in air and outer space.

1.2) Simulation result:



1) Tabular table :

Sr no	parameters	57	56	55
1	F(MHz)	145.0	145.0	145.0
2	R(ohms)	210.4	210.4	210.4
3	Jx(ohm)	0.059	0.059	0.059
4	SWR 200	1.05	1.05	1.05
5	Gh dBd	0.84	0.84	0.84
6	Ga dBi	2.99	2.99	2.99
7	F/B dB	-19.63	-19.63	-19.63
8	Elev	36.0	36.0	36.0
9	ground	Free	free	free
10	Add.H.
11	polar	Hori.	Hori.	Hori.



2. Software Analysis

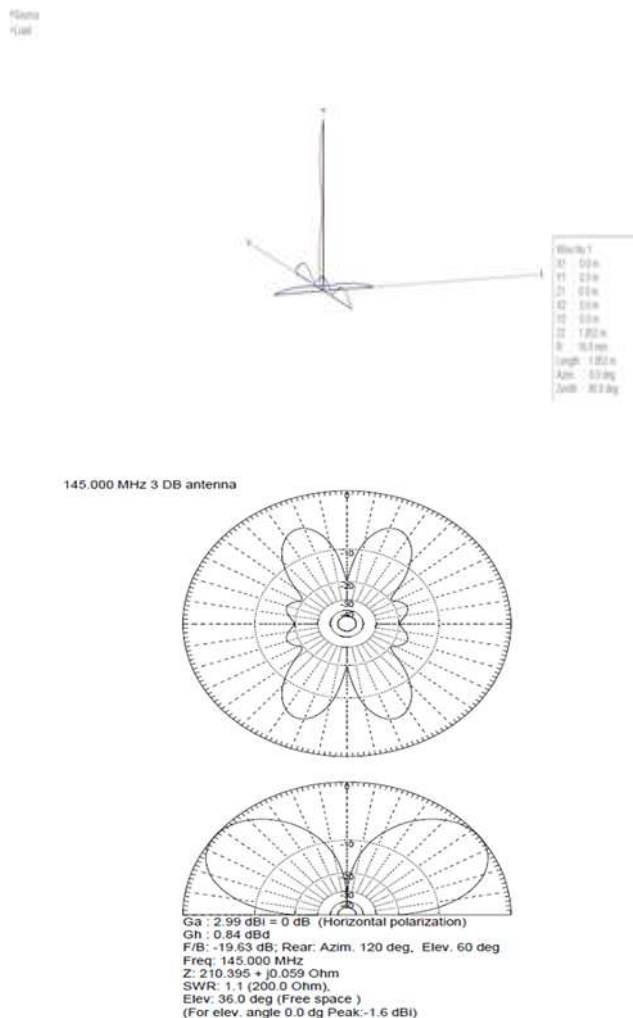
We use ANSYS HFSS software for simulation purpose. ANSYS HFSS is a 3D electromagnetic (EM) simulation software for designing and simulating high-frequency electronic products such as antennas, antenna arrays, RF or microwave components, high-speed interconnects, filters, connectors, IC packages and printed circuit boards. Engineers worldwide use ANSYS HFSS to design high-frequency, high-speed electronics found in communications systems, radar systems, advanced driver assistance systems (ADAS), satellites, internet-of-things (IoT) products and other high-speed RF and digital devices.

HFSS (High Frequency Structure Simulator) employs versatile solvers and an intuitive GUI to give you unparalleled performance plus deep insight into all your 3D EM problems. Through integration with ANSYS thermal, structural and fluid dynamics tools, HFSS provides a powerful and complete multi physics analysis of electronic products, ensuring their thermal and structural reliability. HFSS is synonymous with gold standard accuracy and reliability for tackling 3D EM challenges by virtue of its automatic adaptive meshing technique and sophisticated solvers, which can be accelerated through high performance computing (HPC) technology.

3. CONCLUSIONS

The measured and simulated results show that the VSWR of this antenna is within 2.5:1 over the operating band and has an average power gain of 13dBi. In virtue of a single, stable and narrow main beam, this antenna is suitable for point to point communication circuit or narrow sector coverage application.

This paper design antenna to establish undisturbed communication with maintaining standard parameters. With simple and rustproof hardware.



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