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A Review Study for the basic TEM Horn Antenna

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Abstract- In this paper, a plan study was performed for the fundamental TEM horn radio wire. In the hypothetical model, care was taken to stay away from the issues related with the utilization of whole sources while ascertaining the reflection coefficient and info impedance of the radio wire. All mathematical estimations were made with a program dependent on the strategy for minutes, and the precision of the mathematical computations was set up with estimated results for chosen radio wires. The cross over electromagnetic (TEM) horn receiving wire is a famous broadband radio wire. The essential receiving wire has a basic plan comprising of two three-sided plates and a taking care of design. The horn is portrayed totally by just three factors: α, β, and s. α is the rakish width of each plate, β is the precise division between the two plates, and s is the length, estimated from the drive highlight the edge of the plate. The calculation of the essential TEM horn receiving wire doesn't need a specific decision of a taking care of technique.

I. INTRODUCTION

Ground penetrating radar techniques are increasingly being used to detect and find location of buried objects and structures remotely that are hidden beneath the earth's surface. Ground penetrating radar technique is also known as Ground probing radar, subsurface radar, and surface penetrating radar (SPR).The first use of electromagnetic signals to determine the presence of remote terrestrial metal objects is generally attributed to Hiilsmeyer in 1904, but the first description of their use for location of buried objects appeared six years later in a German patent by Leimbach and Low Their technique consisted of burying dipole antennas in an array of vertical boreholes and comparing the magnitude of signals received when successive pairs were used to transmit and receive.

In this way, a crude image could be formed of any region. These authors described an alternative technique, which used separate, surface-mounted antennas to detect the reflection from a sub-surface interface. An extension of the technique led to an indication of the depth of a buried interface, through an examination of the interference between the reflected wave and that which leaked directly between the antennas over the ground surface. The main feature of this work is continuous wave (CW) operation.

II. PREVIOUS WORK

A. S. Turk; D. A. Sahinkaya M. Sezgin H. Nazli [2020] this paper proposes the planar and 3-dimensional ultra-wide band (UWB) antenna types suitable for hand-held and vehicle mounted impulse GPR systems. On this scope, bow-tie, spiral, TEM horn, dielectric-loaded Vivaldi, multi-sensor adaptive and array model antenna configurations are designed, simulated and measured. The numerical and experimental results are presented with performance comparisons.

A. Turk and B. Sen [2019] This paper deals with ultra-wide band (UWB) TEM horn antenna types, which are suitable for hand-held and vehicle mounted impulse GPR systems. On this scope, conventional, dielectric loaded, Vivaldi form, multi-sensor adaptive and array configurations of the TEM horn structure are designed, simulated and measured. Vivaldi shaped TEM horn fed ridged horn and parabolic reflector antenna prototypes are proposed to reach hyper-wide band impulse radiation performances from 300 MHz up to 20 GHz for multi-band GPR operation that can provide high resolution imaging. The gain and input reflection performances are demonstrated with measurement results.

D.A. Kolokotronis; Y. Huang; J.T. Zhang [2019] As it is well known, TEM horns are antennas that can achieve wideband characteristics over multiple decades. This special characteristic of these antennas makes them really attractive for wideband radar/communication systems, where short time-domain pulses of a very wide frequency range are employed. Although these antennas have been investigated by a number of researchers over the last 25 years, as far as we known, there is very limited analysis and design guidelines available. In this paper, the TEM horn antenna has been investigated using the multiple quarter-wavelength transformer technique, which can be served as a design guideline. Antennas have been designed, made and tested. Good measurement results have demonstrated the usefulness of this technique.

Ahmet Serdar Turk; Ahmet Kenan Keskin [2017] This paper deals with ultra-wide band (UWB) TEM horn antenna types, which are suitable for hand-held and vehicle mounted impulse GPR systems. On this scope, conventional, dielectric loaded, Vivaldi form, multi-sensor adaptive and array configurations of the TEM horn structure are designed, simulated and measured. Vivaldi shaped TEM horn fed ridged horn and parabolic reflector antenna prototypes are proposed to reach hyper-wide band impulse radiation performances from 300 MHz up to 20 GHz for multi-band GPR operation that can provide high resolution imaging. The gain and input reflection performances are demonstrated with measurement results.

III. PROBLEM IDENTIFICATION

- The main objective of the thesis is to design (or improve) the high performance Tx antenna for this GPR system such that the radiated impulse on the ground correlates to the radiated pulse highly and without late time ringing.
- The operating frequency range of the antenna should be specified.

To meet the depth and the resolution requirements at the same time, the antenna should operate from a lower frequency 0.5 GHz to a higher frequency 6 GHz and greater.

IV. EXPECTED OUTCOMES

The compact TEM Double ridged horn antenna is appropriate for ground-plane based measurements. The stub design and resistive taper design are important for proper impedance matching, and each design is unique to the antenna, although standardization is possible. Pattern measurements and design modifications have been simulated in a finite element modeling CST microwave studio environment and have provided insight into measurements and pattern behavior. Finally, various applications were presented showing how these antennas are used in GPR measurements. Because of the favorable characteristics of these types of antennas, we are able to measure in a wide variety of measurement environments.

REFERENCES

[1] D. J. Daniels, Ground penetrating radar. Wiley Online Library, 2005.

[2] H. M. Jol, Ground penetrating radar theory and applications. Elsevier, 2008.

[3] \How gpr works," http://www.global-gpr.com/gpr-technology/how-gpr- works.html.

[4] \Gpr system parameters," http://www.sic.rma.ac.be.

[5] D. J. Daniels, EM detection of concealed targets. John Wiley & Sons, 2009, vol. 196.

[6] A. S. Turk, D. A. Sahinkaya, M. Sezgin, and H. Nazli, \Investigation of convenient antenna designs for ultra-wide band gpr systems," in Advanced Ground Penetrating Radar, 2007 4th International Workshop on. IEEE, 2007, pp. 192{196.

[7] A. Turk and B. Sen, \Ultra wide band antenna designs for ground pen- etrating impulse radar systems," in Electromagnetic Compatibility, 2003. EMC'03. 2003 IEEE International Symposium on, vol. 2. IEEE, 2003, pp. 888{891.

[8] F. Congedo, G. Monti, and L. Tarricone, \Modi_ed bowtie antenna for gpr applications," in Ground Penetrating Radar (GPR), 2010 13th International Conference on. IEEE, 2010, pp. 1-5.

[9] D. Kolokotronis, Y. Huang, and J. Zhang, \Design of tem horn antennas for impulse radar," in High Frequency Postgraduate Student Colloquium, 1999. IEEE, 1999, pp. 120{126.

[10] H. Amjadi and F. T. Hamedani, \A novel 2-18ghz tem double-ridged horn antenna for wideband applications," in Cross Strait Quad-Regional Radio Science and Wireless Technology Conference (CSQRWC), 2011, vol. 1. IEEE, 2011, pp. 341{344.