

## Development and Evaluation of Broadband ESPAR-8 Antenna<sup>\*</sup>

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### Abstract

This paper presents the development and evaluation of BroadBand Electrically Steerable Parasitic Array Radiator antenna by using eight parasitic radiators BB-ESPAR-8 .

The antenna has a symmetrical structure that consists of: i- one active element as a broad band shuttle antenna, ii- eight wideband parasitic radiators, iii- cylindrical ground plane, iv- set of reactances.

The active one is fixed at the center of cylindrical ground, and the parasitics are fixed at a circle around the active one and connected to the reactances.

The design of BB-ESPAR-8 was done by using the modelling software Computer Simulation Technology CST to work in the frequency bandwidth [500-700] MHz.

Simulation results showed that the BB-ESPAR-8 antenna has a VSWR less than 3.1:1 in the frequency bandwidth [500-700] MHz, and has the same radiation pattern for all frequencies in the band by connecting the same set of reactances to the parasitic radiators.

A signal model of the BB-ESPAR-8 was formulated in order to use it in a direction of arrival algorithm.

**Keywords-** Smart antennas, ESPAR antenna, broadband antenna, DOA

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**References :**

- Bashir ALSHAMI, Hassan ABOUNOUR, Mouhammad DIB, "Design of a Broadband ESPAR Antenna," Proc.2009 IEEE Mediterranean Microwave Symposium MMS 2009 .
- Gyoda, K. and T. Ohira, "Electronically Steerable Passive Array Radiator Antennas For Low-Cost Analog Adaptive Beamforming," Proc. 2000 IEEE International Conference on Phased Array Systems and Technology, 2000.
- V. G. Tsiafakis, A. I. Sotiriou, Y. I. Petropoulos E. S. Psarropoulos, E. D. Nanou, and C. N. Capsalis, "Design Of A Wideband ESPAR Antenna For DVB-T Reception," Progress In electromagnetics Research B, Vol. 12, 183–199, 2009.
- Sathish Chandran, "advance in direction-of-arrival estimation," artech house 2006.
- Chen Sun and Nemai Chandra Karmakar, " Direction Of Arrival Estimation Based On A Single Port Smart Antenna Using MUSIC Algorithm With Periodic Signals," International Journal Of Signal Processing Volume 1 Number 2 2004 Issn:1304-4494.
- Dola Saha<sup>1</sup>, Siuli Roy<sup>1</sup>, Somprakash Bandyopadhyay<sup>1</sup>, Tetsuro Ueda<sup>2</sup>, Shinsuke Tanaka<sup>2</sup>, "A Power-Efficient MAC Protocol with Two-Level Transmit Power Control in Ad Hoc Network Using Directional Antenna," 1 Indian Institute of Management Calcutta Diamond Harbour ,<sup>2</sup> ATR Adaptive Communications Research Laboratories 2-2-2 Hikaridai, Keihanna Science City, Kyoto, Japan.
- Panagiotou, S.C.; Dimousios, T.D.; Capsalis, C.N. "Development of a Broadband ESPAR Antenna Utilizing the Genetic Algorithms Technique," Antennas and Propagation, 2007. EuCAP 2007. Volume , Issue , 11-16 Nov. 2007.
- (hulgyun PARK, 2001)hulgyun PARK, Jun-ich TAKADA, Kei SAKAGUCHI, and Takashi OHIRA, "Analysis of a Radial-Cavity-Excited ESPAR Antenna, "Tokyo Institute of Technology 2-12-1, O-okayama, Meguro, Tokyo, Japan, ATR Adaptive Communications Research Labs. 2-2-2, Hikaridai, Keihanna Science City, Kyoto, Japan.
- Junwei Lu, "Smart Antennas for Mobile Wireless Communications,". Microelectronic Engineering Research Conference 2001.
- L. Ortolan, T. L. S. Santos, M. C. F. DeCastro and F. C. C. DeCastro,"A Reactance-Domain Concurrent Blind Beam former," journal of communication and information systems, vol. 21, no. 3, 2006.
- Sean Winfree, "Angle of Arrival Estimation using Received Signal Strength with Directional Antennas" The Ohio State University 2007.
- Junwei Lu, David Ireland, and Robert Schlub," Dielectric Embedded ESPAR (DE-ESPAR) Antenna Array for Wireless Communications," IEEE transactions on antennas and propagation, vol. 53, no. 8, august 2005.
- Robert Schlub, Junwei Lu, and Takashi Ohira." Seven-Element Ground Skirt Monopole ESPAR Antenna Design From a Genetic Algorithm and the Finite Element Method," IEEE transactions on antennas and propagation, vol. 51, no. 11, november 2003.
- Kyouichi Iigusa Takashi Ohira ."A Simple and Accurate Mathematical Model of Electronically Steerable Parasitic Array Radiator Antennas," ATR Adaptive Communications Research Laboratories, Hikari-dai, Keihanna Science City, Kyoto, Japan 2002.
- A. Balanis, "Antenna Theory Analysis and Design," New York: Harper & Row, 1982.
- Bashir ALSHAMI, Hassan ABOUNOUR, Mohamad DIB. "Implementation and field test of a Broadband ESPAR Antenna," Proc.2010 IEEE Mediterranean Microwave Symposium MMS 2010 .