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CAWANGAN PULAU PINANG

HOLLOW PYRAMIDAL IN PLASTIC COMPOSITE BRICK

NURUL ATHIRAH BINTI IMAM

BACHELOR OF ENGINEERING (HONS)
ELECTRICAL AND ELECTRONIC ENGINEERING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Nurul Athirah binti Imam
Student I.D. No.	:	202292
Programme	:	Bachelor Of Engineering (Hons) Electrical and Electronic Engineering (CEEE200)
Faculty	:	Electrical Engineering Studies
Thesis	:	Hollow Pyramidal in Plastic Composite Brick
Signature of Student	:	.....
Date	:	February 2025

ABSTRACT

The rapid growth of wireless technologies, including 5G, mobile communication systems, and Wi-Fi, has resulted in increased electromagnetic wave (EMW) emissions, raising concerns over their impact on communication systems, electronic devices, and human health. The need for efficient and sustainable EMW absorbers has become critical, especially in addressing environmental health concerns. This study aims to design and develop plastic composite bricks with surface modifications using Palm Oil Fuel Ash (POFA) and PET, analysing their EMW absorption performance across frequencies of 1 GHz to 12 GHz. The methodology involved resistivity and dielectric testing, simulations using CST software, and validation through the NRL Arch Measurement setup. Results indicate that surface modifications enhance EMW absorption significantly. SM1, with a single large pyramidal surface, excelled in the X-band, optimized for high-frequency absorption, while SM2, featuring an array of smaller pyramids, exhibited consistent broadband performance across the L-, S-, and C-bands. Horizontal orientation produced results aligned with theoretical predictions, while vertical orientation showed some inconsistencies, likely due to partial obstruction of the hollow structure. Performance decreased at steeper angles, with 60° showing reduced interaction with the modified surfaces. These findings underscore the potential of surface-modified plastic composite bricks as versatile EMW absorbers, suitable for applications in communication and shielding technologies, while highlighting opportunities for further enhancements in design and frequency range coverage.

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