

Brought to you by [INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA](#)



Scopus



[Back](#)

# Investigation of Intelligent Reflecting Surfaces Using Lumped Elements for 5G Wireless Communication Networks

[2024 IEEE Asia-Pacific Conference on Applied Electromagnetics, APACE 2024](#) • Conference Paper • 2024 •

DOI: [10.1109/APACE62360.2024.10877338](#)

[Alias, Nur Asyiqin Binti](#)<sup>a</sup>; [Malek, Norun Fariah Abdul](#)<sup>a</sup> ; [Bashri, Mohd Saiful Riza](#)<sup>a</sup>; [Rahman, Farah Diyana Abdul](#)<sup>a</sup>; [Ramli, Huda Adibah Mohd](#)<sup>a</sup>; [+2 authors](#)

<sup>a</sup>International Islamic University Malaysia, Microwave, Communication and Information System Engineering (MCISE) Research Group, Kuala Lumpur, Malaysia

[Show all information](#)

0

Citations

[Full text](#) [Export](#) [Save to list](#)

[Document](#)

[Impact](#)

[Cited by \(0\)](#)

[References \(11\)](#)

[Similar documents](#)

## Abstract

In this study, an Intelligent Reflecting Surface (IRS) has been designed to operate at 3.5 GHz, featuring a compact unit cell measuring 42 mm x 42 mm with a Circular Patch and Ring configuration. The metasurface utilizes an FR-4 substrate with a dielectric constant of 4.3, a loss tangent of 0.008, and copper as the ground plane. A lumped element is incorporated into the unit cell to function as a switch in both ON (1) and OFF (0) states. Four positions have been identified for the ON OFF resulting to 16 bits configurations. The S-Parameter is the primary focus of the analysis. At 3.5 GHz, for a unit cell using Floquet port simulation indicated that the 0000-bit configuration exhibited the highest reflection efficiency with an S<sub>11</sub> magnitude of -0.7534 dB and a phase shift of -16.7°. This result suggests that the unit cell design with lumped elements perform well as a reflector, with the S<sub>11</sub> magnitude approaching 0 dB indicating effective gain. © 2024 IEEE.

## Author keywords

Intelligent Reflective Surfaces; Lumped Element; Metamaterial; PIN Diode; Reconfigurable Intelligent Surfaces

## Indexed keywords

### Engineering controlled terms

4G mobile communication systems; Clutter (information theory); Lumped parameter networks; Metamaterials; PIN diodes; Power semiconductor diodes; Ring gages

### Engineering uncontrolled terms

Circular Patch; Compact unit; Intelligent reflective surface; Lumped element; Reconfigurable; Reconfigurable intelligent surface; Reflecting surface; Reflective surfaces; Unit cells; Wireless communications networks

### Engineering main heading

5G mobile communication systems

## Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
Ministry of Higher Education, Malaysia <a href="#">See opportunities by MOHE</a> ↗		MOHE
International Islamic University Malaysia <a href="#">See opportunities by IIUM</a> ↗	FRGS/1/2024/TK08/UIAM/02/1	IIUM
International Islamic University Malaysia <a href="#">See opportunities by IIUM</a> ↗		IIUM

### Funding text

The authors would like to acknowledge the Ministry of Higher Education (MoE) Malaysia and Department of Electrical and Computer Engineering, Kulliyah of Engineering, International Islamic University Malaysia (IIUM) for supporting this work. This research is supported under grant FRGS/1/2024/TK08/UIAM/02/1.

## Corresponding authors

Corresponding author	N.F.A. Malek
----------------------	--------------