High Gain Microstrip Patch Antenna using Frequency Selective Surface for 5G Energy Harvesting Applications

By Taha, BS (Taha, Bilal Salman) [1] ; Rhazali, ZA (Rhazali, Zeti Akma) [1] ; Sampe, JB (Sampe, Jahariah Binti) [2] ; Malek, NFA (Malek, Norun Farihah Abdul) [3]

View Web of Science ResearcherID and ORCID (provided by Clarivate)

Source JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

View Journal Impact

Volume: 84 Issue: 10 Page: 1076-1087

DOI: 10.56042/jsir.v84i10.12955

Published OCT 2025

Indexed 2025-12-12

Document Type Article

Abstract This study introduces a novel microwave power transmission method designed to wirelessly power electronic devices, addressing the issues associated with energy storage and wired power sources. The antenna, fabricated using Roger's RT/5880 substrate measuring 50 x 50 x 1.575 mm, functions within the 3.4-3.6 GHz C-band frequency range. The design has been tuned for a broad response and improved axial ratio, resonating throughout a bandwidth of 3.2-6.2 GHz, appropriate for WLAN, WiMAX, and 5G applications, with an average gain of 5 dBi. A technique for enhancing the gain of the monopole antenna was employed, utilizing a single-layer 4 x 4 metallic Frequency Selective Surface (FSS) reflector, which produced a band-stop filter response throughout a frequency range of 0.5-7 GHz and attained an antenna gain of 10 dB. Additionally, a rectifier circuit was incorporated to enhance power conversion efficiency and output voltage, employing SMD-Schottky diode type HSMS-2850-TR1 components that optimize the design and minimize its size. The rectifier circuit demonstrates an efficiency of 64.5% at an input power of 12 dBm with a 2 k) resistive load, producing a maximum voltage of 3.5 V with an input power of 13 dBm and a 10 k) load. This design enables the rectenna to operate efficiently in diverse contexts, providing a Power Dynamic Range (PDR) of (-30 to 30) dBm, ensuring a reliable power supply for devices even in low-power conditions. This technique is ideally suited for energizing a range of wireless sensors and other IoT applications

Keywords **Author Keywords:** 5G Communications; Energy harvesting; FSS reflector; MP antenna; Rectifier circuit

Author Information Corresponding Address : Taha, Bilal Salman (corresponding author)
Univ Tenaga Nasl UNITEN, Dept Elect & Elect Engn, Kajang 43000, Selangor, Malaysia
E-mail Addresses :
PE21373@student.uniten.edu.my
Addresses :
[1] Univ Tenaga Nasl UNITEN, Dept Elect & Elect Engn, Kajang 43000, Selangor, Malaysia

Categories/ Classification	Research Areas: Engineering
Web of Science Categories	Engineering, Multidisciplinary

Funding

View funding text

Funding agency	Grant number
University Tenaga National (Uniten)	J510051171

Language	English
Accession Number	WOS:001628233800005
ISSN	0022-4456
eISSN	0975-1084
IDS Number	K1191

See fewer data fields

Journal information

JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

View Journal Impact

0.24
Journal Citation 32

ISSN 0022-4456