

ABSTRAK

Analisis Pengaruh *Thermal Management* Terhadap Kinerja Radio Frekuensi Power Amplifier Pada Sistem *Software Defined Radio* Berbasis *Universal Software Radio Peripheral*
(2026:XIV + 83 halaman + 26 gambar + 10 tabel)

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Keterbatasan daya keluaran pada Software Defined Radio (SDR) USRP B210 menyebabkan diperlukan RF Power Amplifier (RF PA) untuk meningkatkan daya pancar sistem. Namun, RF Power Amplifier menghasilkan panas yang dapat mempengaruhi karakteristik elektriknya. Penelitian ini bertujuan untuk menganalisis pengaruh penggunaan heatsink sebagai *manajemen termal* terhadap kinerja RF Power Amplifier TQP7M9102 pada frekuensi 3,5 GHz serta menghasilkan peningkatan daya pancar sistem SDR. Metode penelitian dilakukan dengan mengimplementasikan RF Power Amplifier TQP7M9102 pada sistem SDR berbasis USRP B210 dan melakukan pengujian pada dua kondisi, yaitu tanpa heatsink dan menggunakan heatsink. Parameter yang diukur meliputi temperatur, daya keluaran (*Output Power*), gain, daya DC (*Direct Current Power*), *Power Added Efficiency* (PAE), serta daya sinyal menggunakan Spectrum Analyzer. Hasil penelitian menunjukkan bahwa penggunaan heatsink mampu menurunkan suhu kerja RF Power Amplifier dari 69,0°C menjadi 40,8°. Selain itu, gain dapat dipertahankan hingga 23,92 dB, daya DC menurun dari 0,796 W menjadi 0,738 W, dan nilai PAE meningkat dari 0,67% menjadi 0,94% dibandingkan kondisi tanpa heatsink. Implementasi RF Power Amplifier juga meningkatkan level daya sinyal yang diterima dari -45,00 dBm menjadi -18,50 dBm, atau sebesar 26,50 dB. Berdasarkan hasil penelitian, penerapan heatsink sebagai *manajemen termal* mampu menjaga kestabilan suhu kerja sehingga meningkatkan kestabilan kinerja RF Power Amplifier. Selain itu, implementasi RF Power Amplifier TQP7M9102 berhasil meningkatkan kinerja sistem Software Defined Radio (SDR) pada frekuensi 3,5 GHz.

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Kata Kunci: 5G, RF Power Amplifier, TQP7M9102, Software-Defined Radio, USRP B210, Thermal Management, Self-Heating, Heatsink.

ABSTRACT

Analysis of the Effect of Thermal Management on the Performance of Radio Frequency Power Amplifiers in Software Defined Radio Systems Based on Universal Software Radio Peripherals
(2026:XIV + 83 pages + 26 pictures + 10 tables)

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The limited output power of the USRP B210 Software Defined Radio (SDR) requires an RF Power Amplifier (RF PA) to increase the system's transmit power. However, RF Power Amplifiers generate heat that can affect their electrical characteristics. This study aims to analyze the effect of using a heatsink as thermal management on the performance of the TQP7M9102 RF Power Amplifier at a frequency of 3.5 GHz and to increase the transmit power of the SDR system. The research method is carried out by implementing the TQP7M9102 RF Power Amplifier on a USRP B210-based SDR system and testing in two conditions, namely without a heatsink and using a heatsink. The parameters measured include temperature, output power, gain, DC power (Direct Current Power), Power Added Efficiency (PAE), and signal power using a Spectrum Analyzer. The results show that the use of a heatsink can reduce the working temperature of the RF Power Amplifier from 69.0°C to 40.8°C. In addition, the gain can be maintained up to 23.92 dB, the DC power decreases from 0.796 W to 0.738 W, and the PAE value increases from 0.67% to 0.94% compared to the condition without a heatsink. The implementation of the RF Power Amplifier also increases the received signal power level from -45.00 dBm to -18.50 dBm, or by 26.50 dB. Based on the research results, the application of a heatsink as thermal management is able to maintain the stability of the working temperature thereby increasing the stability of the RF Power Amplifier performance. In addition, the implementation of the RF Power Amplifier TQP7M9102 successfully improves the performance of the Software Defined Radio (SDR) system at a frequency of 3.5 GHz.

Keywords: 5G, RF Power Amplifier, TQP7M9102, Software-Defined Radio, USRP B210, Thermal Management, Self-Heating, Heatsink.