

ABSTRAK

RANCANG BANGUN *RADIO FREQUENCY POWER AMPLIFIER* UNTUK EKSTENSI JANGKAUAN JARINGAN PRIVATE 4G LTE BERBASIS USRP B210

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USRP B210 sebagai perangkat *Software Defined Radio* (SDR) memiliki keterbatasan daya pancar hanya 10–20 dBm, sehingga jangkauan jaringan *private* 4G LTE yang dihasilkan sangat terbatas. Penelitian ini merancang dan mengimplementasikan RF *power amplifier* berbasis MMIC TQP7M9102 pada frekuensi 1.800 MHz (LTE Band 3) menggunakan pendekatan kelas operasi C dengan jaringan pencocokan impedansi L-Network pada substrat PCB FR-4, yang dioptimasi menggunakan Keysight ADS. Pengujian dilakukan dengan membandingkan kondisi tanpa dan dengan RF PA, meliputi parameter kinerja (Gain, PAE, P1dB, IP3) dan parameter kualitas sinyal (RSRP, RSRQ, RSSI). Hasil pengujian menunjukkan RF PA menghasilkan Gain terukur sebesar 4,50 dB dengan estimasi P1dB +21,47 dBm dan OIP3 +31,47 dBm. Integrasi RF PA meningkatkan RSRP rata-rata dari -93,4 dBm menjadi -74,1 dBm ($\pm 19,3$ dB), RSRQ dari -20,9 dB (Sangat Buruk) menjadi -5,4 dB (Sangat Baik), dan RSSI dari -71,0 dBm menjadi -53,0 dBm (± 18 dB). Seluruh titik pengukuran pada jarak 1–7 meter berhasil mencapai kategori Sangat Baik setelah integrasi RF PA, membuktikan bahwa RF *power amplifier* secara efektif memperluas jangkauan jaringan *private* 4G LTE berbasis USRP B210.

Kata Kunci: RF *Power Amplifier*, MMIC TQP7M9102, USRP B210, 4G LTE, RSRP, RSRQ, RSSI

ABSTRACT

DESIGN AND IMPLEMENTATION OF RADIO FREQUENCY POWER AMPLIFIER FOR RANGE EXTENSION OF PRIVATE 4G LTE NETWORK BASED ON USRP B210

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USRP B210 as a Software Defined Radio (SDR) device has a limited transmit power of only 10–20 dBm, resulting in restricted coverage of the private 4G LTE network. This study designs and implements an RF power amplifier based on MMIC TQP7M9102 at 1,800 MHz (LTE Band 3) using a Class C operating approach with an L-Network impedance matching network on an FR-4 PCB substrate, optimized through Keysight ADS simulation. Testing was conducted by comparing conditions without and with RF PA integration, evaluating performance parameters (Gain, PAE, P1dB, IP3) and signal quality parameters (RSRP, RSRQ, RSSI). Results show the RF PA achieves a measured Gain of 4.50 dB with an estimated P1dB of +21.47 dBm and OIP3 of +31.47 dBm. RF PA integration improved average RSRP from -93.4 dBm to -74.1 dBm (± 19.3 dB), RSRQ from -20.9 dB (Very Poor) to -5.4 dB (Very Good), and RSSI from -71.0 dBm to -53.0 dBm (± 18 dB). All measurement points at 1–7 meters achieved the Very Good category after RF PA integration, confirming that the RF power amplifier effectively extends the coverage of the USRP B210-based private 4G LTE network.

Keywords : RF Power Amplifier, MMIC TQP7M9102, USRP B210, 4G LTE, RSRP, RSRQ, RSSI