

Rancang bangun rangkaian switching sp4t untuk aplikasi sistem beamforming pada frekuensi 2,35 GHz = Design of sp4t switching circuit for beamforming system application at 2 35 GHz frequency

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Abstrak

Teknik beamforming digunakan untuk mengetahui letak suatu objek melalui penyaringan frekuensi sinyal yang dipancarkan objek tersebut. Suatu sistem beamforming dapat terdiri dari antena mikrostrip, rangkaian butler matriks, serta rangkaian switching yang berfungsi untuk mengatur daya yang masuk ke rangkaian antena butler matriks.

Fokus skripsi ini adalah pada rancang bangun rangkaian switching berbentuk SP4T (Single Pole Four Throw) pada frekuensi 2,35 GHz. Perancangan dimulai dari pembuatan rangkaian switching SPDT (Single Pole Double Throw), parameterisasi komponen yang berpengaruh pada rangkaian SPDT, dan membuat rangkaian SP4T yang memiliki komponen sama serta struktur mirip dengan rangkaian SPDT. Parameterisasi telah dilakukan pada komponen pasif kapasitor dan induktor, serta panjang dan lebar rangkaian.

Perancangan simulasi rangkaian SP4T memakai komponen dengan nilai yang terdapat pada pasaran, serta penyesuaian nilai komponen dengan hasil parameterisasi. Di sini performa yang menjadi pertimbangan adalah return loss serta insertion loss rangkaian.

Hasil parameterisasi memberikan informasi bahwa performa rangkaian semakin baik saat nilai kapasitansi serta panjang rangkaian diturunkan, dan nilai induktansi dinaikkan. Hasil simulasi rangkaian switching SP4T akhir memberikan nilai S11 (return loss) sebesar -21,138 dB, nilai S12 dan S15 sebesar -7,179 dB, serta nilai S13 dan S14 sebesar -7,374 dB. Nilai isolation between port mempunyai nilai antara (-18,277 dB) ? (-6,262 dB).

Hasil pengukuran rangkaian switching SP4T menunjukkan nilai S11 sebesar -13,48 dB. Nilai return loss ini menunjukkan kondisi yang cukup matching karena nilainya yang lebih kecil daripada -10 dB. Sementara itu nilai S12, S13, S14, dan S15, berturut-turut sebesar -8,097 dB, -11,403 dB, -5,936 dB, dan -8,537 dB.

Isolation between port mempunyai nilai antara (-27,1 dB) ? (-21,3 dB).

Rangkaian switching SP4T menunjukkan perbedaan level daya output ketika rangkaian diberi maupun tidak diberi tegangan DC. Ketika rangkaian diberikan tegangan DC, maka daya output akan menurun. Ini menunjukkan bahwa rangkaian dalam kondisi tidak aktif. Sementara saat rangkaian dalam kondisi aktif, maka tidak ada tegangan DC yang diberikan pada rangkaian. Selisih daya output dari kondisi on-off rangkaian bervariasi antara 3,56 - 6,18 dB.

.....Beamforming techniques are used to determine the location of an object through filtering the frequency of signal emitted by the object. A beamforming system can consist of microstrip antenna, butler matrix circuit and switching circuit which has a function to adjust the power into the butler matrix antenna circuit. The focus of this skripsi is to design an SP4T (Single Pole Four Throw) switching circuit at 2.35 GHz frequency. The design starts from designing SPDT (Single Pole Double Throw) switching circuit, parameterization of components which affect the SPDT circuit, and designing a SP4T that has the same components and similar structures to SPDT circuit. The parameterization was conducted on passive components capacitors and inductor, as well as the length and the width of the circuit. The design of the

circuit SP4T use components with the value that exist in the market, as well as the adjustment of the value of the component with the results of parameterization. Here the consideration performances are the return loss and insertion loss of the circuit.

Parameterization results provide information that the performances of the circuit show better result when the capacitance value and the length of the circuit are lowered, and the inductance value is increased. The final SP4T switching circuit simulation results have the S11 (return loss) value of -21,138 dB, the S12 and the S15 value of -7,179 dB, the S13 and the S14 value of -7,374 dB. The isolation between port has the values between (-18,277 dB) ? (-6,262 dB).

The SP4T switching circuit measurement results have the S11 value of -13,48 dB. The return loss value shows adequate matching condition because it is smaller than -10 dB. Meanwhile the S12, S13, S14, and S15 values are -8,097 dB, -11,403 dB, -5,936 dB, and -8,537 dB, respectively. The isolation between port have the values between (-27,1 dB) ? (-21,3 dB).

The SP4T switching circuit shows the different levels of output power when the circuit is supplied or not supplied by a DC voltage. When the circuit is supplied by a DC voltage, therefore the output power is decreased. This indicates that the circuit is not active. Meanwhile when the circuit is active, therefore no DC voltage supplied to the circuit. The range of output power difference from the on-off circuit condition varies between 3,56 - 6,18 dB.