Perancangan Sistem WDM Radio over Fiber Menggunakan Gelombang Milimeter untuk Aplikasi 5G Fronthaul = Design of a Radio over Fiber System Using Millimeter Waves for 5G Fronthaul Applications

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Abstrak

Teknologi mengalami banyak perkembangan dalam 10 tahun terakhir ini salah satunya adalah dalam bidang telekomunikasi. Kebutuhan ini mendorong lahirnya 5G yang diharapkan dapat mendukung Massive Machine Type Communication (mMTC), Enhanced Mobile Broadband (eMBB), dan Ultra-Reliable and Low Latency Communication (uRLLC). Dalam mendukung aplikasi ini dibutuhkan kecepatan pengiriman data yang tinggi terutama pada jaringan fronthaul untuk mendukung akses radio ke pengguna. Gelombang milimeter (mmWave) dapat mengakomodasi radio dengan kecepatan tinggi dan latensi yang rendah sehingga dapat digunakan untuk aplikasi fronthaul 5G di daerah padat penduduk. Penelitian ini merancang sistem Wavelength Division Multiplexing (WDM) Radio over Fiber (RoF) berbasis gelombang milimeter dan melakukan optimasi sistem dengan fiber bragg grating (FBG). Hasil penelitian menunjukkan rancangan sistem WDM-Radio over Fiber telah memenuhi standar untuk skema downstream pada jarak 20 km dengan peak bit rate 20 Gbps, sedangkan skema upstream dengan peak bit rate 10 Gbps. Rancangan sistem WDM Radio over Fiber berbasis gelombang milimeter tersebut berhasil dicapai karena adanya pengaruh dari penambahan Fiber Bragg Grating (FBG) dan Semiconductor Optical Amplifier (SOA). SNR rangkaian final mengalami penurunan sebesar 5,55% untuk downstream dan 4,4% untuk upstream akibat penambahan komponen seperti penguat sinyal dan kompensator pada rangkaian.
.....Technology has undergone many developments in the past 10 years, one of which is in the field of telecommunications. This need has driven the emergence of 5G, which is expected to support Massive Machine Type Communication (mMTC), Enhanced Mobile Broadband (eMBB), and Ultra-Reliable and Low Latency Communication (uRLLC). Supporting these applications requires high-speed data delivery, especially in fronthaul networks to support radio access to users. Millimeter waves (mmWave) are capable of providing high-speed radio transmission with low latency, making them suitable for 5G fronthaul applications in densely populated areas. This research designs a Wavelength Division Multiplexing (WDM) Radio over Fiber (RoF) system based on millimeter waves and optimizes the system with fiber Bragg grating (FBG). The research results show that the WDM-Radio over Fiber system design has met the standards for downstream schemes at a distance of 20 km with a peak bit rate of 20 Gbps, while the upstream scheme with a peak bit rate of 10 Gbps. The WDM Radio over Fiber system design based on millimeter waves was successfully achieved due to the influence of the addition of Fiber Bragg Grating (FBG) and Semiconductor Optical Amplifier (SOA). The SNR of the final circuit decreased by 5.55% for downstream and 4.4% for upstream due to the addition of components such as signal amplifiers and compensators in the design.