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# Advanced Li-Fi system with Green Wavelength Directly Modulated Laser for High-Speed, Scalable and Resilient Communication in 6G Hospitals

## Project brief

Hospitals face communication challenges due to RF interference with sensitive equipment. This project presents an innovative LiFi system using a 500 nm green Directly Modulated Laser (DML) for high-speed, secure, and interference-free communication in 6G hospital environments. It achieves superior performance (Q-factor: 18.84, BER: 1.6e-79, SNR: 74.94 dB) with a 25 m range and 1 Gbps speed. The system supports real-time imaging, telemedicine, and healthcare IoT while reducing electromagnetic pollution

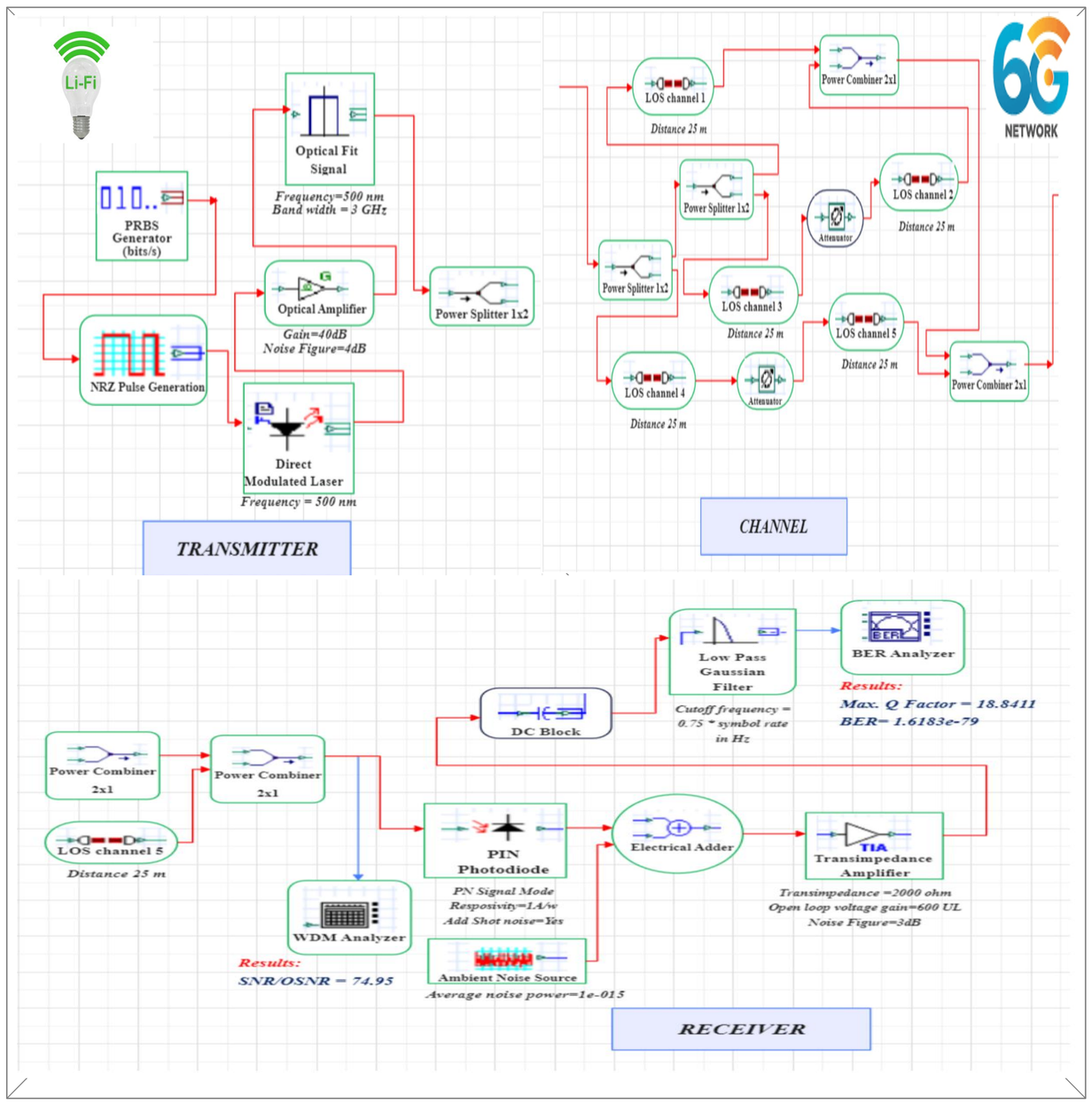

## Methodology

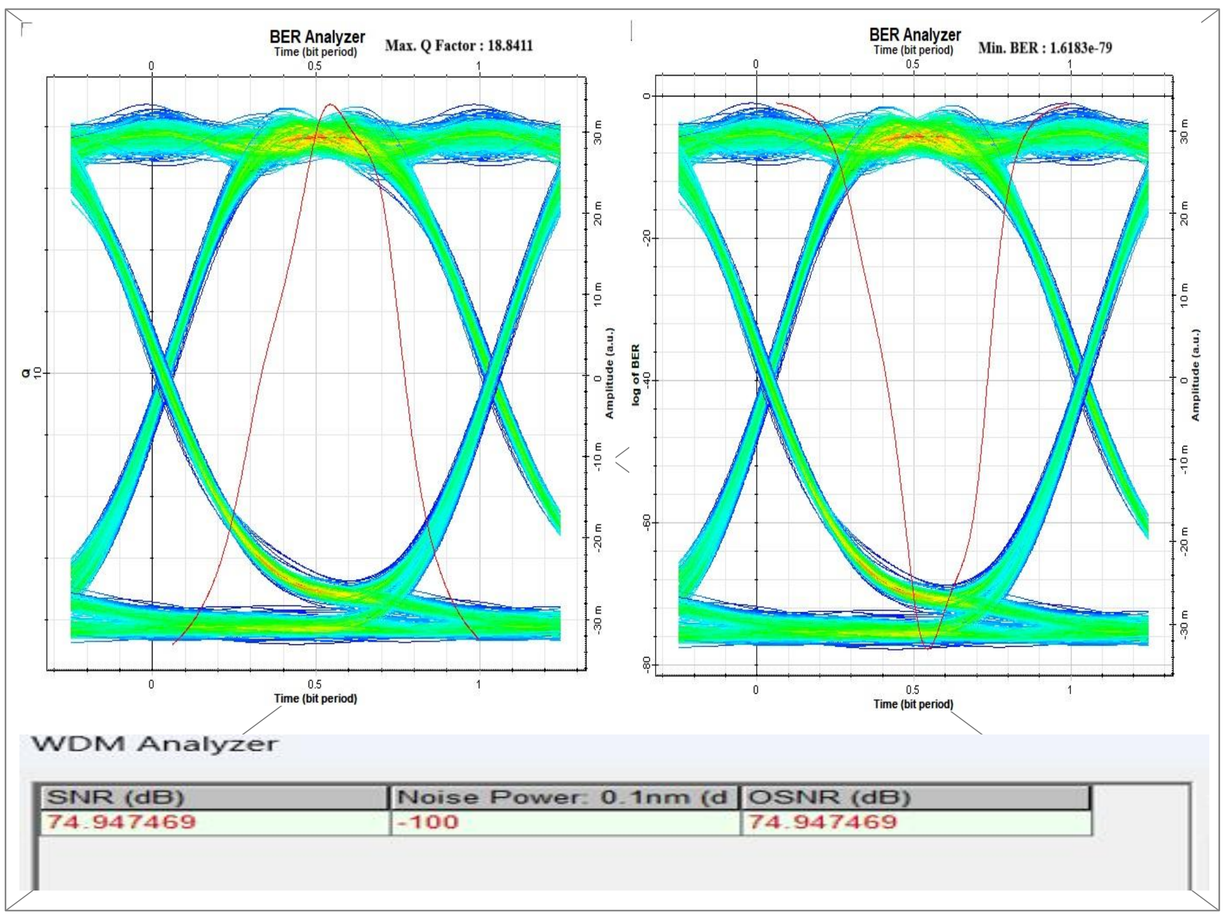
**Aims & Objectives**

- Design a LiFi system using green wavelength DML to overcome RF interference in hospitals.
- Achieve long-range (25 m), high-speed (1 Gbps) communication.
- Ensure low BER, high Q-factor, and excellent SNR.
- Promote green, sustainable, and energy-efficient wireless communication.

**Methodology**

- Simulation Tool: OptiSystem 22.0 for end-to-end modeling.
- Transmitter: 500 nm DML with 40 dB optical amplifier, optical splitters for scalability.
- Channel: LOS optical link, 25 m range, modeled with real-world noise and attenuation.
- Receiver: PIN photodiode (responsivity 1 A/W), Transimpedance amplifier, low-pass filtering.
- Key Metrics: BER, Q-factor, SNR, eye diagrams measured and optimized.




## Results & conclusions

- Q-Factor: 18.84 (Excellent signal quality)
- BER: 1.6e-79 (Ultra-low errors)
- SNR: 74.94 dB (High clarity)
- Eye diagram shows wide-open eye (minimal distortion).
- 25 m reliable range surpasses past LiFi systems (<5 m).
- Green DML offers better penetration and reduced scattering.
- Balanced transmitter power (37.2 dBm) and sensitive receiver (-25 dBm) optimize range.

This LiFi system is ideal for 6G hospital communication—high-speed, interference-free, energy-efficient, and scalable for future healthcare infrastructure.

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