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OFDM-based Underwater Visible Light Communication: system construction and performance analysis

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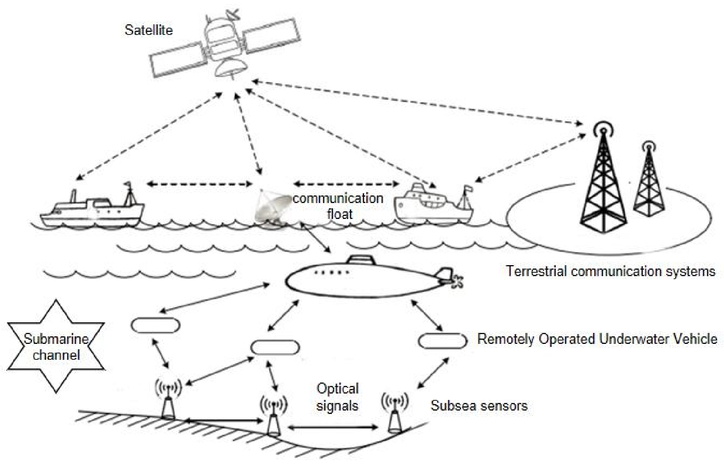
Abstract: Underwater visible light communication system (UVLC) based on OFDM modulation is proposed and the constellation diagram as well as transceiver signal waveforms was obtained by simulation to evaluate the system performance.

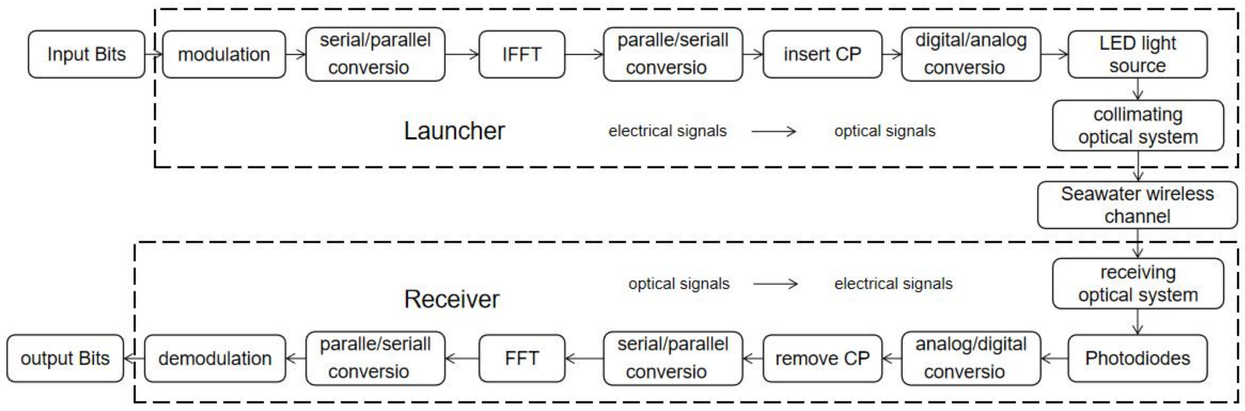
1. Introduction

- As a huge treasure trove of resources, people never stop exploring the ocean. Facing the acquisition and exploration of ocean information, Underwater Visible Light Communication (UVLC) shows unique advantages. UVLC can achieve high-capacity transmission, which can well compensate for the drawbacks of contemporary hydroacoustic communication in the short and medium range, and truly transmit broadband signals at high rates and low delays.

2. Experiment



▲ Underwater visible light communication system stcructure diagram

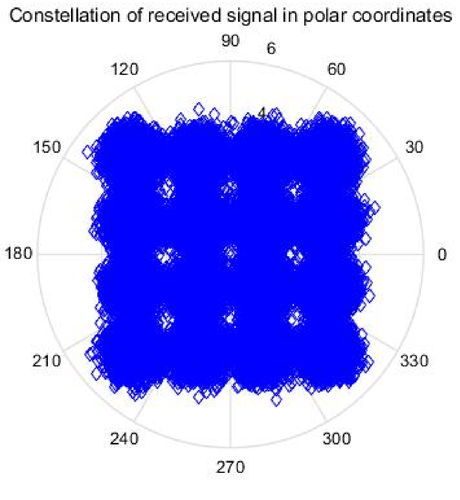


▲ Process of underwater visible light communication

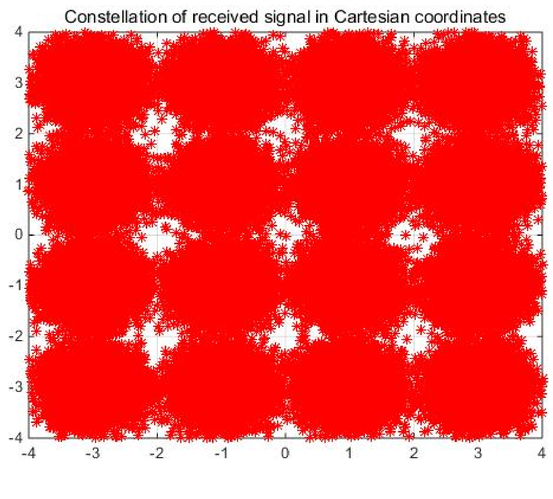
- The diagram shows the system composition of underwater visible light communication(UVLC), where the terrestrial communication system communicates with the seawater vessel via satellite relay, and the vessel in turn interconnects with the subsea devices using communication floats. Individual devices use LED light sources and receiving devices to achieve high-speed UVLC.
- At the transmitter, the input signal is encoded and modulated, driven by current, and then loaded directly onto the LED light source and emitted, completing the electrical-optical signal conversion. Then it is sent out after collimation processing.
- At the receiver, the optical collimation system converges the light beam to the PD, and then completes the optical-electrical signal conversion through the photodetector. Subsequently, the electrical signal is amplified and processed, and finally the original signal is recovered through demodulation and decoding.

3. Results and discussion

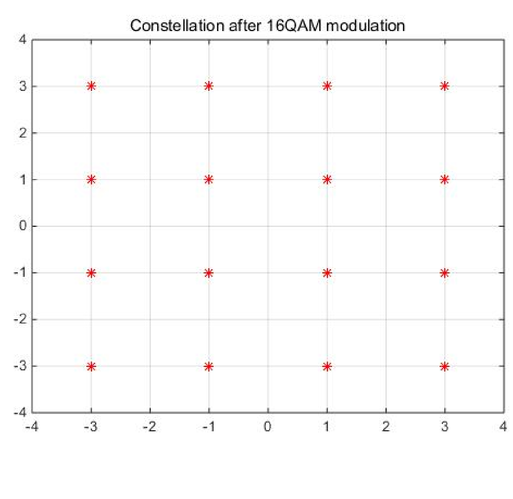
The constellation diagram in the right-angle system ▼



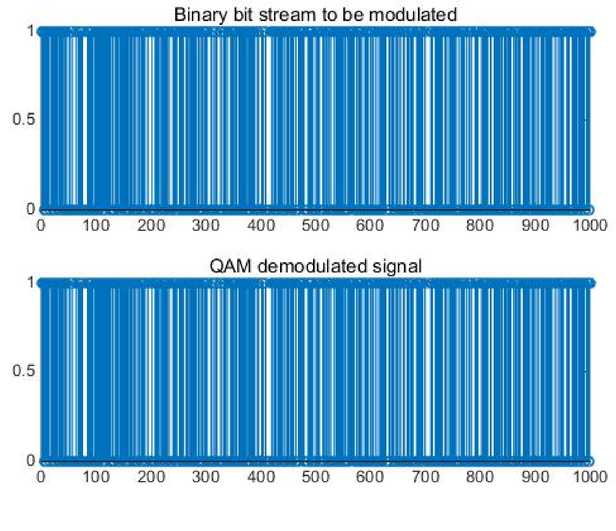
The constellation diagram in the polar coordinate system ▼



The constellation diagram after 16QAM modulation ▼



The waveforms of the signal to be modulated and the received signal ▼



4. Conclusion

A model of underwater visible light system is proposed and OFDM technique is used to improve the anti-interference capability. The whole system is simulated and achieves good performance with small enough BER and basically no distortion in the transceiver signal.

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