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### Protection Status:

US patent 12,261,723B2  
(granted)  
CA application 3,208,642  
(Notice of Allowance received)

### Stage of

### Development:

Concept validated through simulations

### Seeking:

Development Partners  
Licensees

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# Faster-than-Nyquist Signaling Detector

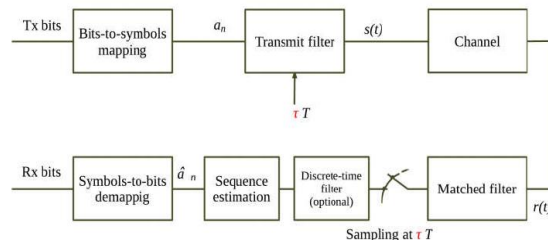
Enabling Data Transmission Beyond the Classical Limit

## Background

The exponential growth of wireless devices coupled with emerging technologies like augmented reality and holographic communications demand high data transmission rates as well as costly bandwidth. Faster-than-Nyquist (FTN) signaling, the transmission of pulses beyond the classical Nyquist rate, can be achieved but introduces inter-symbol interference (ISI) that must be removed at the receiver to avoid errors. Existing FTN signaling detection techniques are not practical due to their prohibitive complexity - particularly with advanced modulation techniques – such as high/ultra order quadrature-amplitude modulation (QAM).

## Description of the Invention

This novel FTN signaling detector is designed for ultra-high-order QAM. By exploiting an alternating directions multiplier method, it effectively removes ISI and reconstructs transmitted data symbols with minimal computational effort compared to existing detectors. It viably achieves higher spectral efficiency without needing more bandwidth or power, and without increasing bit errors.



## Publication:

A. Ibrahim, et al. *IEEE Open Journal of the Communications Society*, vol. 2, pp. 2566-2580, 2021 (<https://ieeexplore.ieee.org/document/9610117>)

## Key Benefits

- **Improved Spectral Efficiency:** Increase of 7.5% - 58% in spectral efficiency compared to conventional techniques
- **No Additional Bandwidth or Power:** Ultra-high QAM data transmission without extra bandwidth or increased power.
- **High Transmission Quality:** Significantly lowers ISI and bit errors, maintaining high transmission quality.

## Applications

This technology can support **data-intensive** communications such as:

- **Cellular Mobile Networks:** ex. in high speed microwave point-to-point connections (ex. RAY3)
- **Internet Service Providers:** compatible with the DOCSIS 3.1 standard
- **Digital Video Broadcasting:** such as satellite digital video broadcasting (ex DVB-S2) or cable-based standards (ex. DVB-C2)