A Review Comparison of Different Qam In OFDM System

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Abstract— To research is done on OFDM using different modulation. In this review paper we study the different level of QAM in OFDM system. In the paper (QAM4), QAM16, QAM64, QAM256 level of QAM I studied. The constellation diagram of different QAM is shown in this paper. From this constellation diagram we can estimate that lower level of QAM having low BER and higher level of QAM having higher level of BER**.**

Key words: OFDM, QAM, BER, OADM, Fast Fourier Transform

I. INTRODUCTION

There are two trends which are ever evident in today's optical networks: (1) the transmission data rate per channel has been fast increasing and rapidly approaching 100 Gb/s, and (2) the dynamically reconfigurable network has gradually become a reality thanks to deployment of optical Add/Drop Multiplexers (OADM). These trends place significant challenges to the high-speed transmission link for the optical networks. In particular, as the transmission rate approaches 100 Gb/s, conventional meticulous per-span optical dispersion compensation becomes too costly and time-consuming if not possible, as the dispersion compensation requires precise fiber dispersion measurement and precise matching of the dispersion compensation cross broad wavelength range. Most importantly, a dynamically reconfigurable network mandates a fast link setup and leaves the manual optical dispersion compensation impractical. Coherent optical orthogonal frequency-division multiplexing (CO-OFDM) has been recently proposed in response to the above-mentioned challenges. OFDM[2] is a multicarrier transmission technique where a data stream is carried with many lower-rate subcarrier ones. It has emerged as the leading physical-layer interface in wireless communications in the last decade. OFDM has been widely studied in mobile communications to combat hostile frequency-selective fading and has been incorporated into wireless network standards (802.11a/g Wi-Fi, HiperLAN2, 802.16 WiMAX) and digital audio and video broadcasting (DAB and DVB-T) in Europe, Asia, Australia, and other parts of the world. CO-OFDM combines the advantages of 'coherent detection' and 'OFDM modulation' and posses many merits that are critical for future high-speed fiber transmission systems. First, the chromatic dispersion and polarization mode dispersion (PMD) of the transmission system can be effectively estimated and mitigated. Second, the spectra of OFDM subcarriers are partially overlapped, resulting in high optical spectral efficiency. Third, by using direct up/down conversion, the electrical bandwidth requirement can be greatly reduced for the CO-OFDM transceiver, which is extremely attractive for the high-speed circuit design, where electrical signal bandwidth dictates the cost. At last, the signal processing in the OFDM transceiver can take advantage of the efficient algorithm of Fast Fourier Transform (FFT)/Inverse Fast Fourier Transform (IFFT), which suggests that OFDM has superior scalability over the channel dispersion and data rate. CO-OFDM was first proposed to combat chromatic dispersion. It was soon extended to polarization-diversity detection, and has been shown to be resilient to fiber PMD. The first CO-OFDM transmission experiment has been reported for 1000 km SSMF transmission at 8 Gb/s, and more CO-OFDM transmission experiment has quickly been reported for 4160 km SSMF transmission at 20 Gb/s. The first COOFDM transmission with polarization-diversity has recently been demonstrated showing record PMD tolerance. In the same report, the first experiment of nonlinearity mitigation has also been reported for CO-OFDM systems. Although this paper places a focus on the coherent flavor of optical OFDM, we would like to stress that the direct detection flavor of optical OFDM has also been actively pursued by other groups, with applications including multimode fiber transmission, short-haul single-mode transmission, and long haul transmission.[6]

II. QAM (QUARDRATURE AMPLITUDE MODULATION)

Quardrature Amplitude Modulation QAM[1] is a form of modulation which is widely used for modulating data signal onto a carrier used for radio communication.

QAM is a signal in which two carriers shifted in phase by 90 degrees are modulated and the resultant output consists of both amplitude and phase variations. In view of the fact that both amplitude and phase variations are present it may also be considered as a mixture of amplitude and phase modulation.

A. *QAM Sequence Generator:*

It generates two parallel M-ary symbol sequences from binary signals using quadrature amplitude modulation (QAM). With the QAM sequence generator, the bit sequence is split into two parallel subsequences, each can be transmitted in two quadrature carriers when building a QAM modulator. This is achieved by using a serial to parallel converter.

M is the number of possible sequence of binary digits, calculated according to:

$$M = 2^{\frac{h}{2}}$$

where h is the number of bits per symbol. The equivalent QAM set is given by the square of M.

This means:

If h=2, M=2, then we have a 4-QAM.
If h=4, M=4 , then we have a 16-QAM.
If h=6, M=8, then we have a 64-QAM.
If h=8, M=16, then we have a 256-QAM.

III. TYPES OF QAM

QAM is widely used in many digital data radio communication and data communication applications. A variety of forms of QAM are available and some of the more common forms includes, 4QAM, 16 QAM, 64QAM and 256QAM.

A. Constellation diagram for QAM:

The constellation diagrams show the different positions for the states within different forms of QAM.As the order of modulation increase so does the number of points on the QAM constellation diagram.

The diagram below show constellation diagram for a variety of formats of modulation:-

B. 4-QAM:

Initially, number of bits is set to 2 in QAM sequence generator and system is analysed. Constellation diagram for 4 QAM is shown in graph. If h=2, M=2, then we have a 4-QAM.

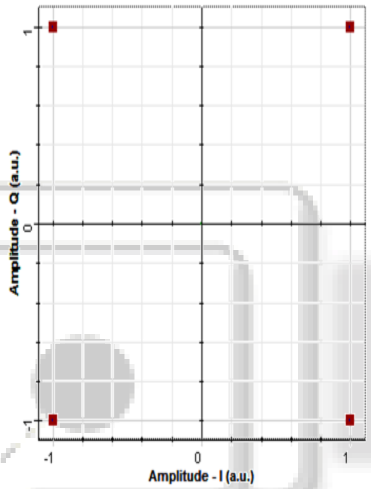

Fig. 1: 4-QAM

C. 16-QAM:-

Initially, number of bits is set to 4 in QAM sequence generator and system is analysed. Constellation diagram for 16 QAM is shown in graph. If h=4, M=4 ,then we have a. 1 16-QAM

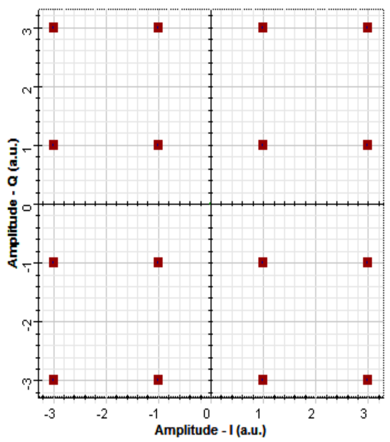

Fig. 2: 16-QAM

D. 64-QAM:-

Initially, number of bits is set to 6 in QAM sequence generator and system is analysed. Constellation diagram for 64 QAM is shown in graph. If h=6,M=8, then we have a 64-QAM

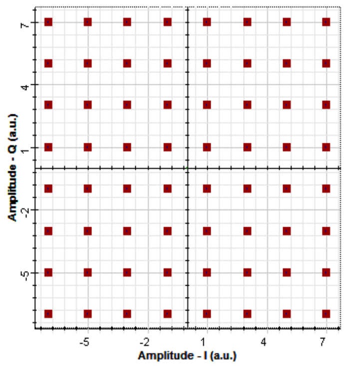

Fig. 3: 64-QAM

E. 256-QAM:-

Initially, number of bits is set to 8 in QAM sequence generator and system is analysed. Constellation diagram for 256 QAM is shown in graph. , If h=8, M=16, then we have a 256-QAM.

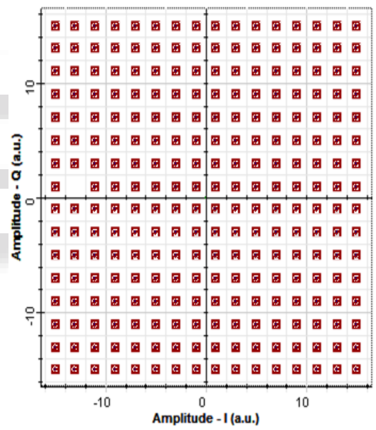

Fig. 4: 256-QAM

IV. DISSCUSION AND CONCLUSION

The first objective of this thesis to design the OFDM i.e. orthogonal frequency division multiplexing in optical fibre. In OFDM we have selected coherent OFDM for optical fibre. Various modulation techniques like QAM4, QAM16, QAM64, QAM256 are implemented in optical fibre. The simulation is done in Optisim tool which provides user a freedom to customize the components also. We have further modified our design for adaptive code modulation. Depending upon the BER at the output, modulation technique switches to minimize the BER. Thus we concluded that if we use 4QAM i.e h=2, m=2, the chances of error is less that is BER[2] is less. If we use 16QAM i.e. h=4, m=4, the chances of error is less that is BER is less. If we use 64QAM i.e. h=6, m=8, the chances of error is more that is BER is more. If we use 256QAM i.e. h=8, m=16, the chances of error is more that is BER is more.

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