Design and Simulate 60 GHz Transmitter and Enhanced Data Rate Using QAM Modulation Technique.

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ABSTRACT: - This paper presents the process of designing and simulation of 1 Gbps wireless data link transmitter system. A high frequency is required to provide a large bandwidth for this high data rate Since the Federal Communications Commission (FCC) allocates 57–64 GHz for unlicensed operation. In the past few years, the interest in the millimeter-wave spectrum at 30 to 300 GHz has drastically increased. The transmitter used QAM modulation technique and Advanced Design System software used.

Keywords: - 60 GHz Frequency, Millimeter Wave Communication, Advanced Design System, Quadrature Amplitude Modulation, EVM.

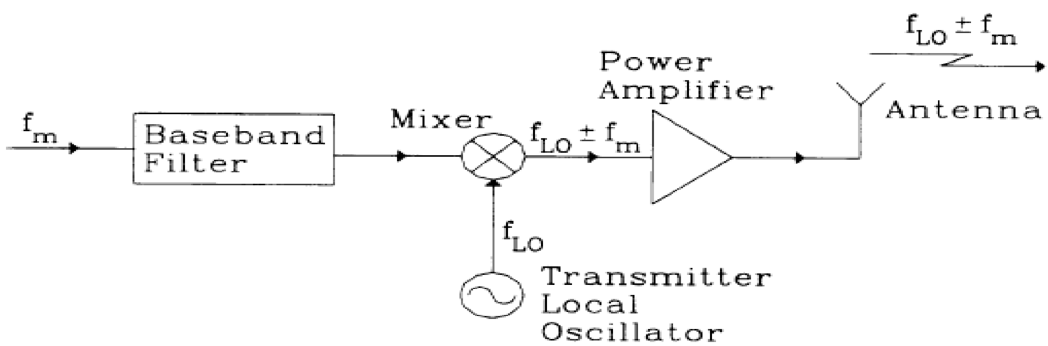
I. INTRODUCTION

The wireless communications systems have become an integral part of daily life and continue to evolve in providing better quality and user experience. One of the recent emerging wireless technologies is millimeter wave (mm-wave) technology. It is important to note that mm-wave technology has been known for many decades, but has mainly been deployed for military applications. Over the past 5–6 years, advances in process technologies and low cost integration solutions have made mm-wave a technology to watch and begun to attract a great deal of interest from academia, industry and standardization bodies. In very broad terms, mm-wave technology is concerned with that part of the electromagnetic spectrum between 30 and 300 GHz, corresponding to wavelengths from10mm to 1mm [1]. The FCC allocates frequency ranges and specification for different applications in United States including television, radios, satellites communication, cellular phones, police radars, burglar alarms and navigation beacons. The performance of each application is strongly affected by atmospheric absorption. The satellite uses a broadband high frequency system that can simultaneously support thousands of telephone users, tens or hundreds of T.V channel, and many data links. The operating frequencies are in the GHz range. After 1980 cordless phone and cellular phones became popular and have enjoyed very rapid growth in the past two decades. Today Personal Communication system (PCS) operating at higher frequency with wider bandwidth are emerging with a combination of various services such as voice mail video and or communication anywhere in the world, even in the most remote region of the globe. 60 GHz is a resonant frequency of oxygen. Oxygen absorbs 60 GHz electromagnetic radiation. The 60 GHz is used for high security communication and satellite to satellite communication has used while terrestrial base station cannot listen. The advantage of oxygen absorption is that a 60 GHz signal is quickly reduced to a level that will not interfere with other 60 GHz links operating simultaneously in a close region. This enables easier frequency reuse.

II. ARCHITECTURE AND SYSTEM SPECIFICATIONS

Architecture used in wireless communication transmitter. It is based on the heterodyne process of mixing an incoming signal with an offset frequency local oscillator (LO) in a nonlinear device to generate an intermediate frequency (IF) signal in the receiver or to produce an RF signal from its IF version in the transmitter. The nonlinear device executing the heterodyne process is called a frequency mixer or frequency converter. In a superheterodyne transmitter, the frequency translation processes may be performed more than once and thus it may have multiple intermediate frequencies and multiple IF blocks.

The transmitter operating at 60GHz uses a QAM modulation scheme for transmitting bits. In the QAM modulation, it has a bandwidth efficiency to transmit two signals and requires coherent demodulation with exact phase and frequency. Because the orthogonal carriers occupy the same frequency band and differ by a 90 degree phase shift, each can be modulated independently, transmitted over the same frequency band, and separated by demodulation at the receiver.



(a) Transmitter

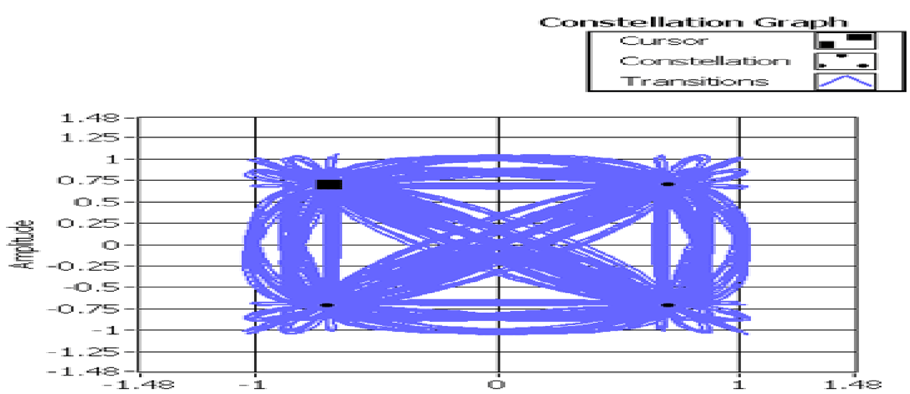


Figure (b) QAM constellation diagram (connected)

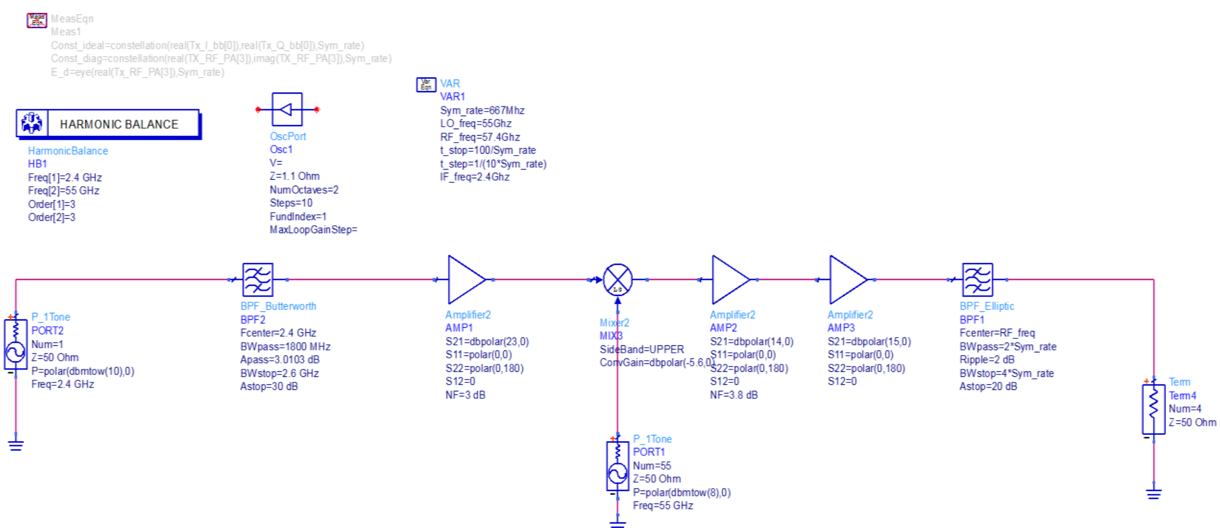
Constellation diagram shows different position for the states,with in different forms of QAM. QAM is both an analog and digital modulation scheme.it conveys two analog message signals or two digital bit stream by changing the amplitude of two carriers waves using the ASK digital modulation scheme or amplitude modulation analog modulation scheme. QAM is used extremely as a modulation schemes, for digital telecommunication system.

TABLE I

TRANSMITTER SPECIFICATIONS

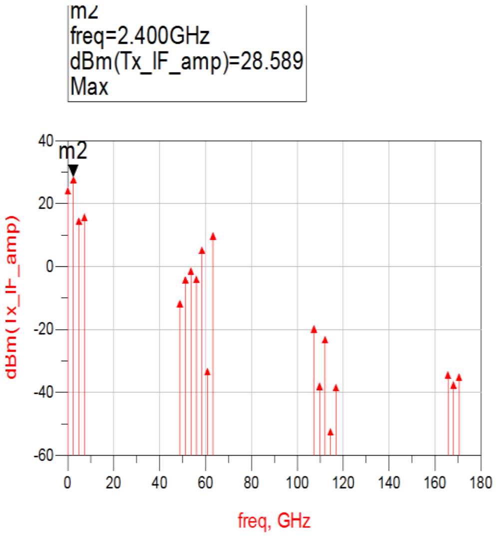
PARAMETERS	VALUES
IF Frequency	2.4GHz
RF frequency	55GHz
Channel bandwidth	7GHz
Modulation	QAM
Data rate	1Gbit/sec

III. TRANSMITTER DESIGN



The transmitter which has been designed based on superheterodyne architecture, an intermediate frequency of 2.4GHz, a 55GHz frequency is introduced using a LO (local oscillator) is up converted to get the RF frequency and QAM modulation has been used in the transmitter.

Butterworth filter is used at the transmitter side for filtering out the required frequencies. And the PA (power amplifier) is used at the transmitter end to amplify the low power radio frequency to large signals of significant power, typically for driving the antenna of the transmitter.



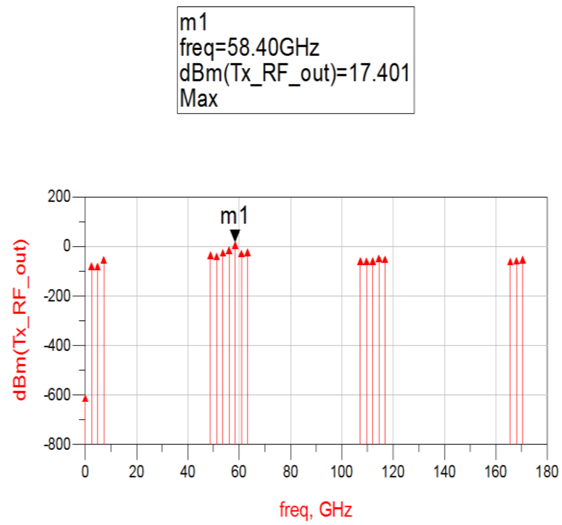
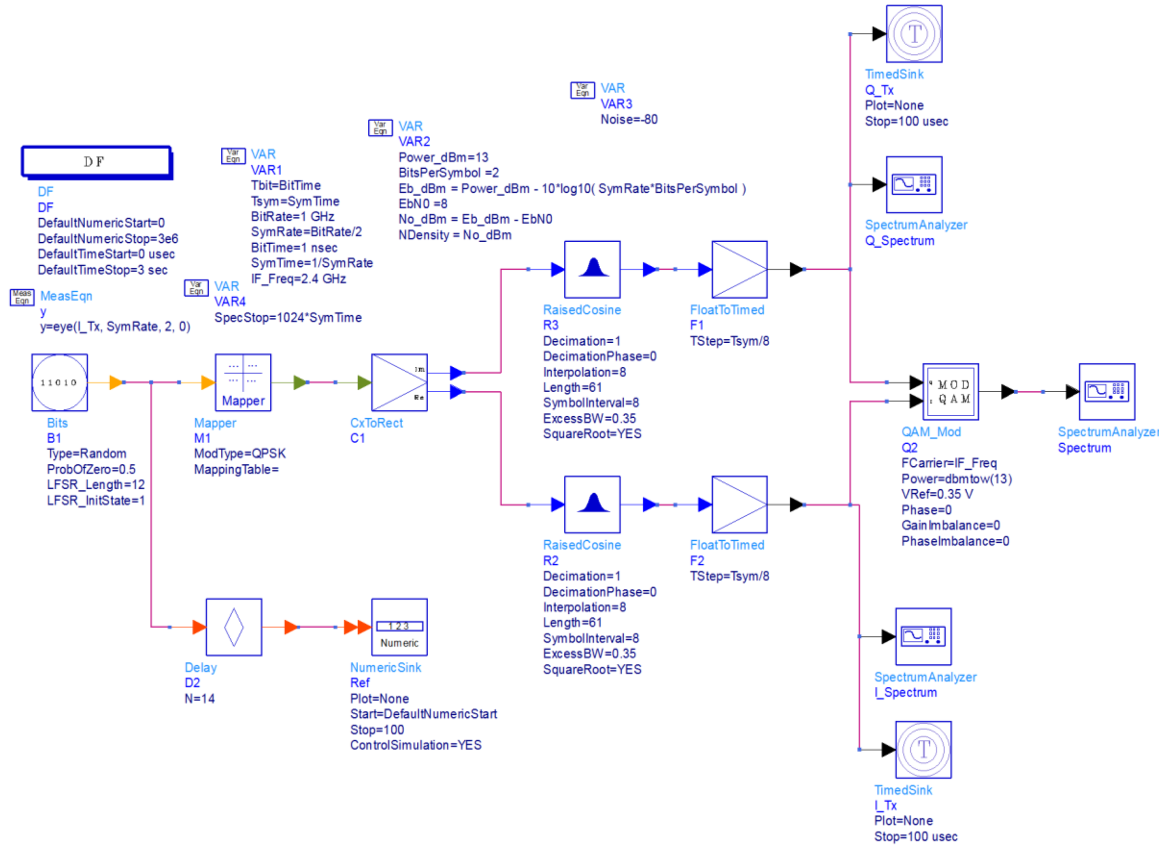


Fig shows IF power spectrum of transmitter in which the intermediate frequency is to be taken at 2.4 GHz of frequency input, it will provide a output power spectrum of 4.329 dBm. Next fig shows RF Output power spectrum of transmitter in which the intermediate frequency is to be taken at 2.4 GHz of frequency ay input, and local oscillator frequency is taken at 55 GHz of frequency. Both these frequencies is combined in mixer, it will provide a output power RF spectrum of 17.401dBm.

TRANSMITTER BLOCK DIAGRAM



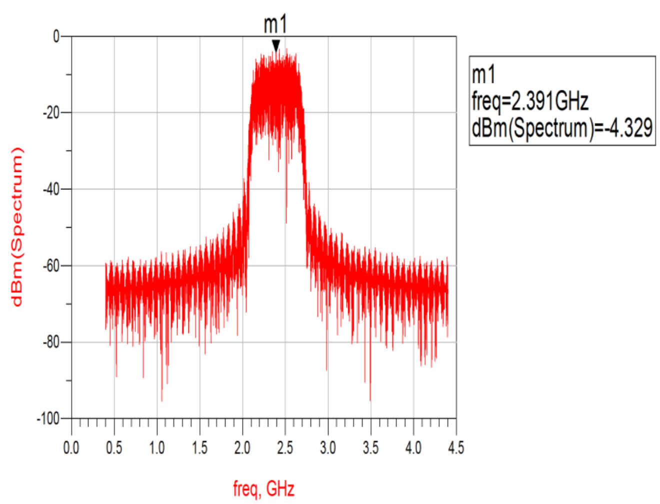


Figure (c) TX IF Power Spectrum

Fig c shows IF power spectrum of transmitter in which the intermediate frequency is to be taken at 2.4 GHz of frequency ay input, it will provide a output power spectrum of 4.329 dBm

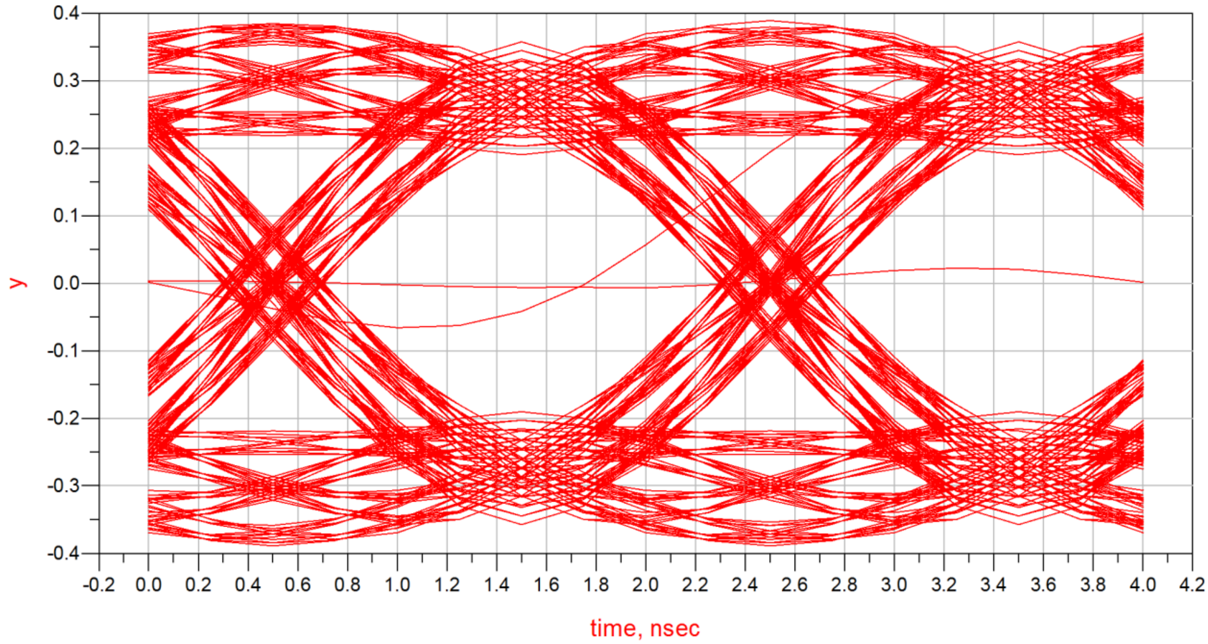


Fig (d) EYE DIAGRAM

Eye pattern shows a measured of distortion in a signal. It slope indicates the sensitivity to timing errors, smaller is better mid-point across the threshold voltage shows amount of distortion or variation where zero crossing occurs. When the eye is fully open then it is best to sample the data. Opening of eye time over which we can successfully sample waveform.

IV.CONCLUSION

In this paper, a radio transmitter design at 60 GHz has been designed and simulated, using QAM modulation using Agilent ADS software. The system has an output transmitter power of 17.40 dBm, and EVM of 14.4%.

V. ACKNOWLEGEMENT

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