



Performance Analysis of Linear Modulation Techniques with Transceiver in LabVIEW using USRP

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Abstract - This paper presents performance analysis of BPSK, 16PSK and 8PSK modulations using communication system implemented in LabVIEW and transmitted and received using USRP 2921. Spectral efficiencies are achieved by sending Different order modulations sent at more bits per symbol which achieves higher throughputs. Wireless communication system uses linear modulation techniques to enhance bandwidth efficiency. The performance comparison for a real time communication system is developed on the basis of received signal.

Keywords: Binary Phase Shift Keying (BPSK), 8PSK, 16 PSK, USRP 2921.

I. Introduction

The aim is to design a communication system that gives an opportunity to user to adapt different modulation techniques. PSK are linear modulation techniques used as a bandwidth efficient technique providing very attractive use in wireless communication to design a system where there is an exponential increase in demand to accommodate more users in limited spectrum [1]. The basic block diagram of transmitter and receiver of communication system which is implemented in LabVIEW for real time analysis is shown in Figure1. In this block diagram a digital source is set as an input integral which is first unpacked and then to improve the performance of communication system reddened bits are added. Case statement in LabVIEW allows us to create an adaptive system for distinct modulation technique. Modulation scheme at receiver side matched filter applies specified matched-filter coefficients to the input complex IIQ baseband waveform. It gives matched filtered output with duration equal to an integer number of symbols. Modulation scheme at receiver side matched filter applies specified matched-filter coefficients to the input complex IIQ baseband waveform. [2] It gives matched filtered output with duration equal to an integer number of symbols. Next block which decimate oversampled waveform and it is use to decimate the matched filtered waveform at the output of the Matched Filter to recover the symbols corresponding to the ideal symbol timing location. Then PSK symbols are converted to bits. The front panel control of Communication system implemented in LabVIEW for transmitter and receiver respectively are shown in Figure 2a, 2b.

II. Modulation Techniques

A modulation system is required to transmit information over a communication channel. The modulation methods chosen for this paper are: Binary Phase Shift Keying (BPSK), 8PSK, 16 PSK. Binary phase shift keying has the best performance of all the ASK, FSK and PSK technique in presence of the noise. M-ary Signaling is best for use in band limited channels. M-ary modulation techniques accomplish better bandwidth efficiency. An 8-PSK system requires a bandwidth that is $\log_2 8 = 3$ times smaller than a BPSK system and 16 PSK system requires even lesser than that of 8PSK [1]. BPSK (also sometimes called PRK, phase reversal keying, or 2PSK) is the simplest form of phase shift keying (PSK). It uses two phases which are separated by 180° and so can also be termed 2-PSK.

Fig. 1: Basic block diagram of transmitter and receiver of communication system

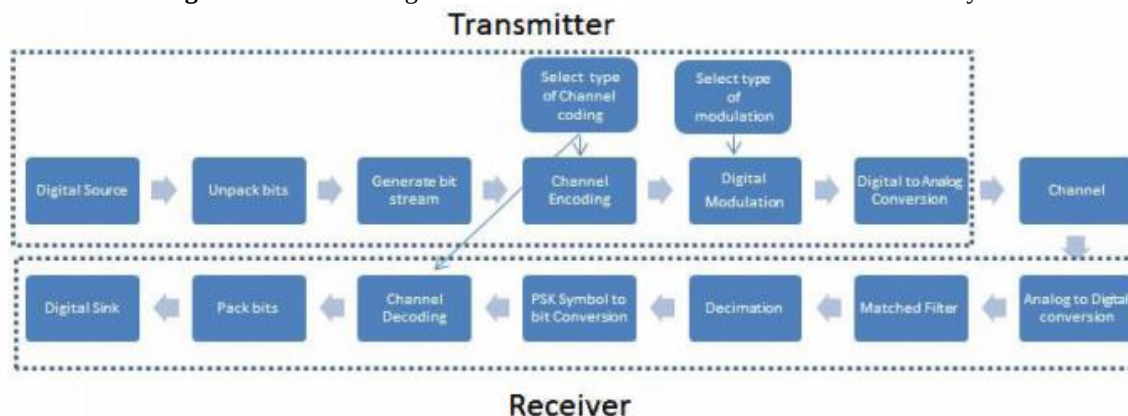


Fig. 2a1: Packet transmitter

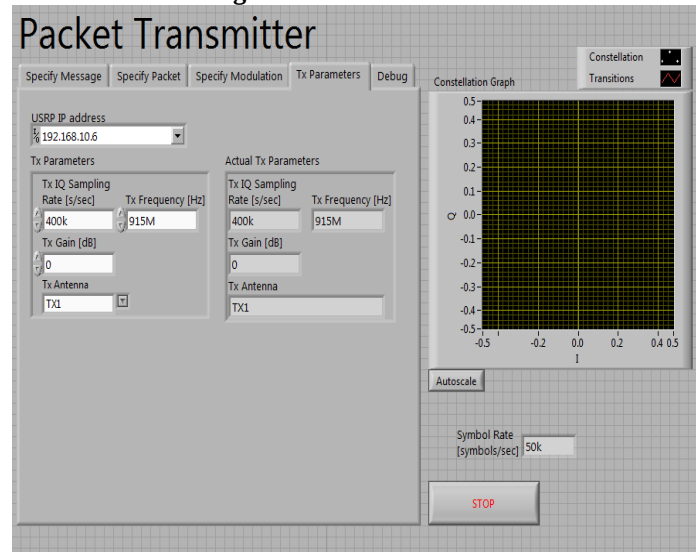
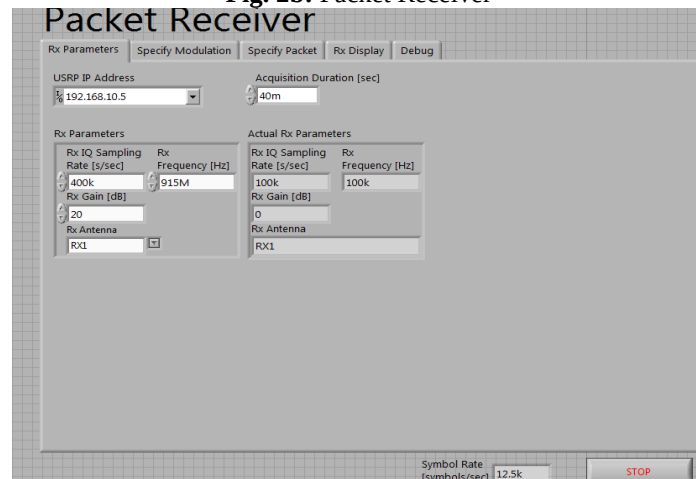


Fig. 2b: Packet Receiver



III. Testbed Design

We used NI USRP 2921 and Laptop with LabVIEW to design a testbed [3] as shown in Figure 3. A single laptop controls the USRP devices to tune transmit and receive parameters. In this testbed [4], we consider channels only in 2.4 to 2.5 GHz and 4.9 to 5.9 GHz ISM bands as USRP 2921 is hardware device designed to operate in this frequency range, apart from this we do not need any licensing for these frequency bands. The link is established over various modulation techniques to compare their performance and to understand interferences while transmitting in free space [5, 6].

Fig. 3: A testbed setup for real time communication link using LabVIEW



IV. Results

The following section shows various modulation schemes and their comparative transmission and reception in ISM band as shown in fig 4(a-c) [7]. Following figures show transmitted and received signals established through a communication link using USRP devices.

Fig. 4a: Transmitted and received signal of 8 PSK

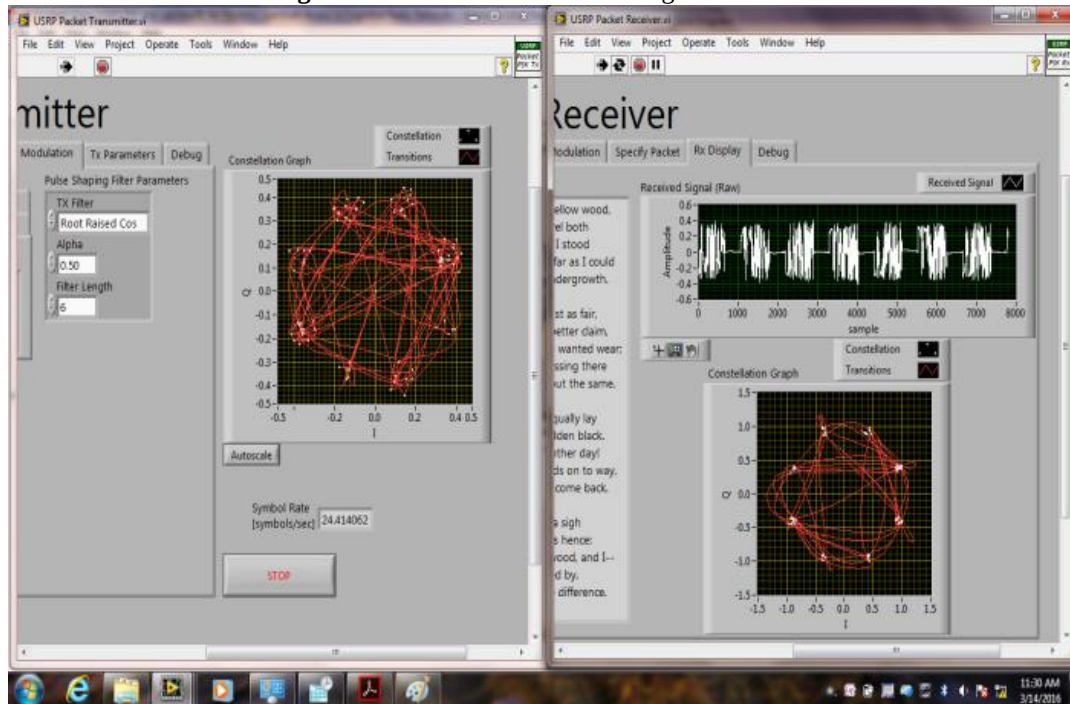


Fig. 4b: Transmitted and received signal of 16 PSK

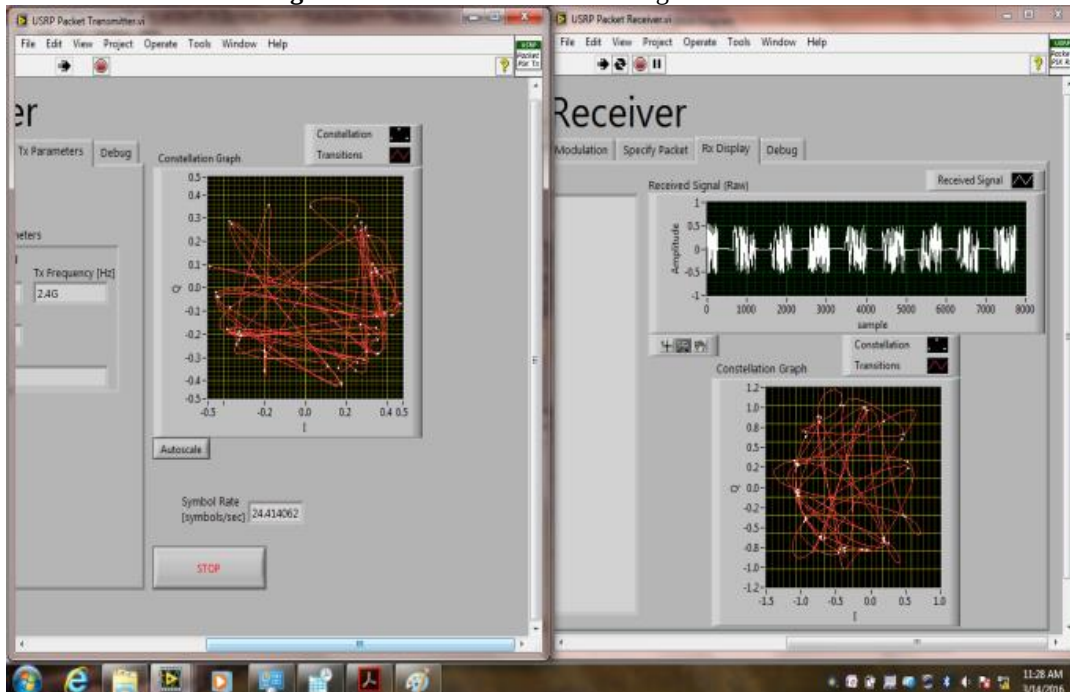
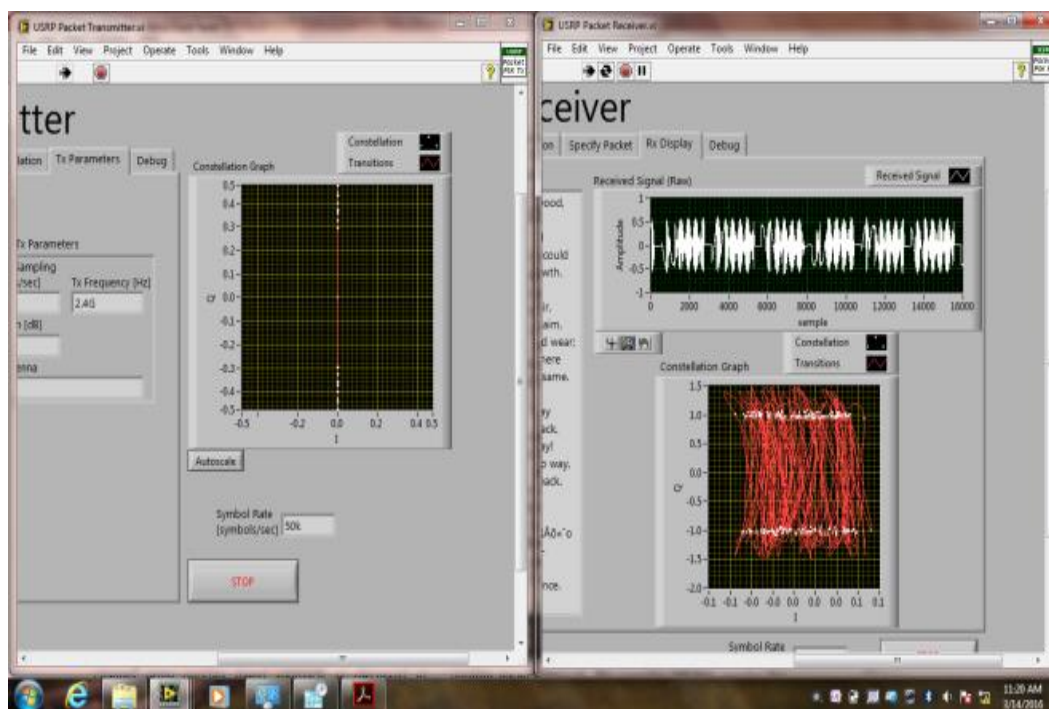


Fig. 4c: Transmitted and received signal of BPSK



V. Conclusion

In this paper a performance of different modulation techniques is analysed on the basis of communication link. As per above analysis of different modulation techniques, we can say data transmission of various modulation schemes can be easily achieved using USRP 2921. Above all results describe BPSK modulation channel was toughest to reconstruct in ISM band. Any signal transmitted through ISM band seeks maximum interference due to unlicensed users. USRP is an economical way to transmit data for research projects which can be further extended to secondary channel transmission, cognitive radios and other modulation setup schemes.

VI. References

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