

## Design and Development of a Software Defined Radio (SDR) Transmitter



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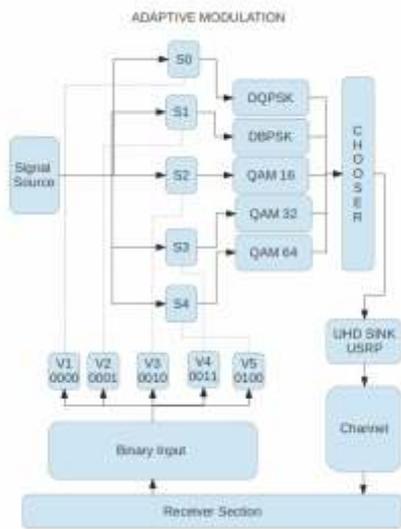
**Keywords:** SDR, GnuRadio, USRP, BPSK, QPSK, QAM

**Abstract:**

Software Defined Radio (SDR) is a radio communication system, which can tune to multiple frequency bands and interface with different communication technologies across a large frequency spectrum by means of a programmable hardware, which is controlled by software. It offers greater flexibility and potentially longer product life as the radio can easily be upgraded with software. Most of the realisations of SDR employ proprietary hardware and software where as SDR technologies developed using open source technologies such as GnuRadio will be of much use in research and development. In addition, there are very few reported SDR implementations that can adapt to multiple modulation schemes.

In this project, an SDR transmitter along with adaptive modulation mechanism is designed and implemented using GnuRadio and ported on USRP reconfigurable communication hardware platform. The SDR transmitter blocks are modelled and programmed using GnuRadio and integrated into a GnuRadio flowgraph. Various modulation methods such as BPSK, QPSK, QAM 16, QAM 32 and QAM 64 are implemented and a scheme for real-time switching between them is developed. The modulation scheme is selected based on the binary sequence input, which can be changed dynamically at any instant. The integrated SDR GnuRadio flowgraph along with the adaptive modulation scheme is ported on USRP board. Demodulation and SDR receiver section is also implemented for testing purposes.

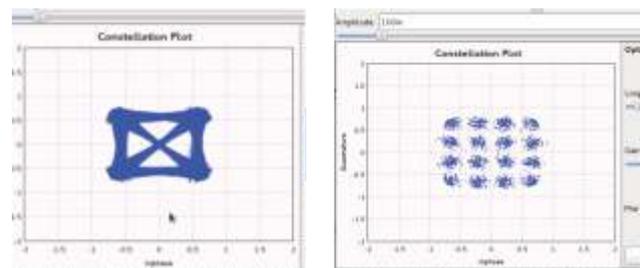
The SDR transmitter blocks and adaptive modulation switching is tested and the system is validated. The SDR transmitter ported on the USRP board and the live transmission of audio signal is demonstrated. The USRP is connected to the PC through an USB 2.0 port and 0-200 MHz transmitter daughter board is used to transmit signals. Transmit channel of the daughter board is connected to a VX7R radio handset for RF transmission. The developed SDR transmitter can be improved by incorporating forward error correction.



**Block diagram of adaptive modulator**



**Experimental setup of SDR transmitter**



**Constellation of QPSK and QAM 16**