Implementation of Software Community Radio Using Low Cost Resources

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Abstract

Community radio is the third model of radio broadcasting besides the commercial and public systems. It aims to provide individuals with local news and information that are important to a small community. This poster presented a new method of implementing community radio using low cost hardware and free software. The transmitter system consists of PC, USRP, and antenna while the receiver side consists of Raspberry Pi, RTL–SDR, and antenna. The main goal is to define and demonstrate a low cost, flexible transmitter consisting of the USRP N210 and commodity PC and a receiver consisting of a Raspberry Pi computer and USB plug-in device.

Introduction

During catastrophic situation such as tornados, hurricanes, and even immigration crisis as in Greece right now, it is highly required to have simple, cost-effective, and easy to build and carry communication system which will give the first responders a great opportunity to reach people who need immediate help. This concept of communication is known as Community Radio (CR) according to the global communication standard.

This poster presents a novel method of implementing community radio system using low cost hardware such as USRP,RTL-SDR, Raspberry Pi, and free software such as GNU Radio and Linux operating system.

Implementation of CR- Transmitter

The transmitter is the core piece of equipment in a CR setup. CR stations typically use low power FM transmitters with geographical coverage from 0 – 35 km. it should be mentioned here that the power of the transmitter is not solely responsible for range, other factors like efficiency, antenna terrain and atmospheric conditions also play a crucial role. However, a rough estimate of the coverage achieved with different power levels is provided by United Nations Educational, Scientific and Cultural Organization (UNESCO) [1]-[2] and is reproduced in Table 1. For a town level community, the recommended power level is 20-watt. Additional technologies like linear or a power amplifier may be employed to boost the power level of the transmitter. It should be noted that certain countries have limitations on the transmitted power level (like India) while some have no limitations as far as CR is concerned (like Australia). The CR-transmitter is shown in Fig.(1).

Table 1: Estimated reach of different transmitter power.

Power	Class A	Class B	Class C
10 W	0-4Km	4-6Km	7-15Km
20 W	0-6Km	6-8Km	8-15Km
50 W	0-8Km	8-14Km	14-25Km
100 W	0-10Km	10-20Km	20-35Km

Implementation of CR-Receiver

An aspect of community radio that is often overlooked are receivers. This is due to the fact that traditional CR implementations have fixed signaling format (FM) combined with the ubiquity of low-cost FM receivers. If fully reconfigurable SDR transmitters and receivers are investigated, then low-cost, low power computing platforms like Raspberry Pi and USB based RTL-SDR modules may be required. The CR-Receiver was built using RTL-SDR dongle for the front end part and Raspberry Pi for the signal processing part as shown in Fig.(2).

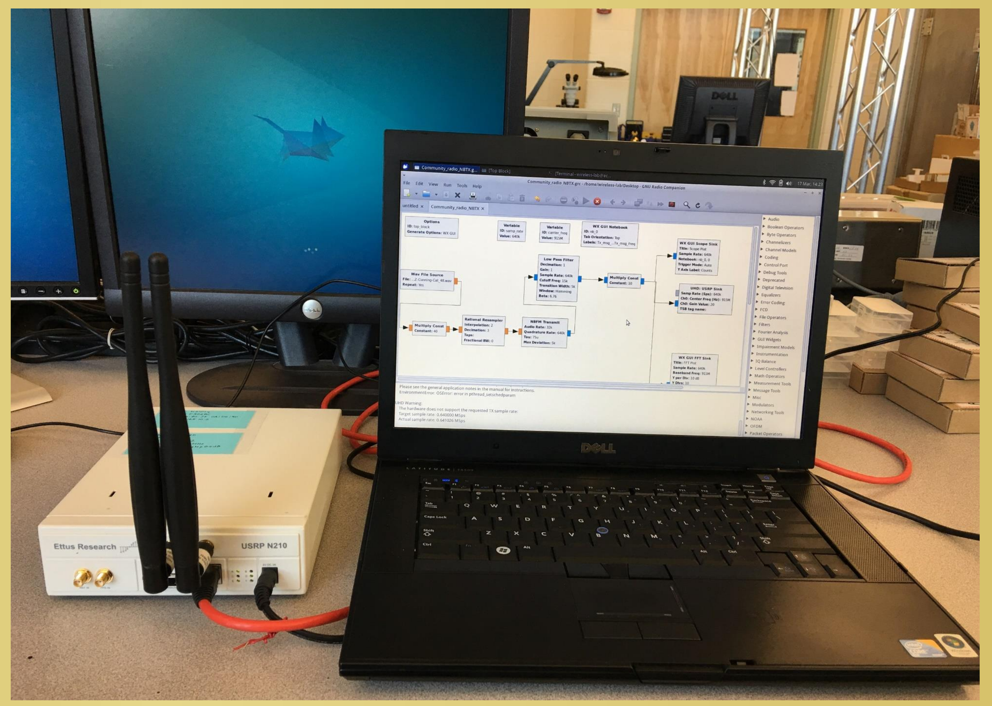

Fig.(1): Community radio transmitter.

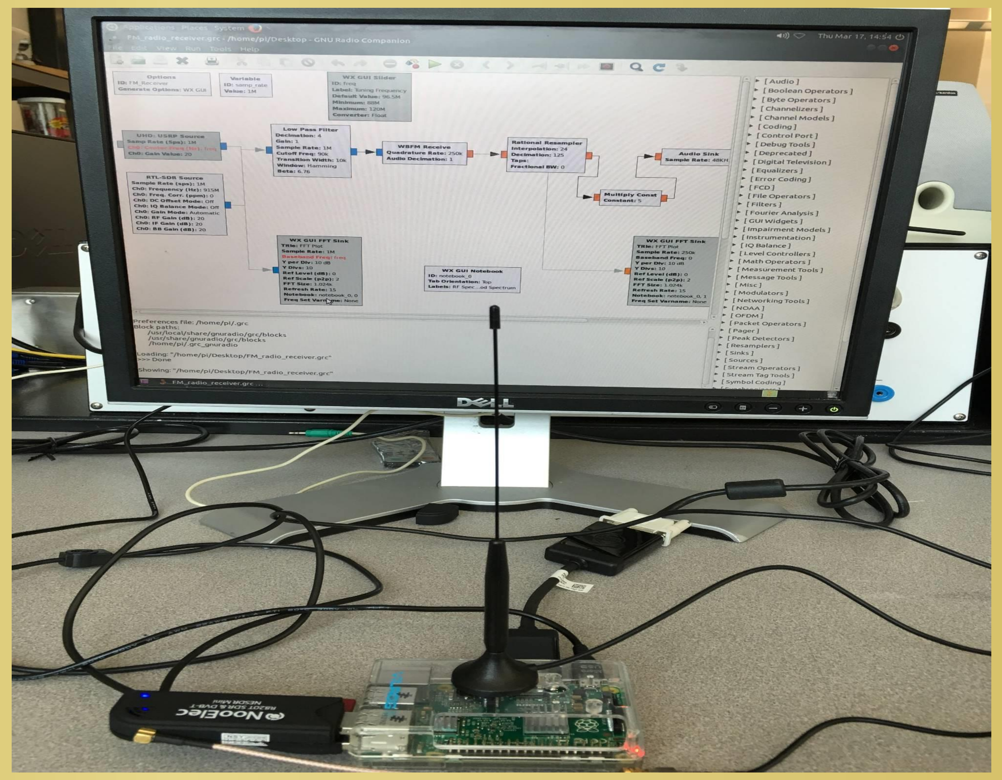

Fig.(2): Community radio receiver.

Implementation Results

To verify the performance of the implemented CR-Transmitter and receiver, different kinds of signals such as audio and text signals were sent and received correctly without any errors. Figs.(3)-(4) show the transmitted signal in time and frequency domain while Fig.(5) is a snapshot of the received signal in frequency domain

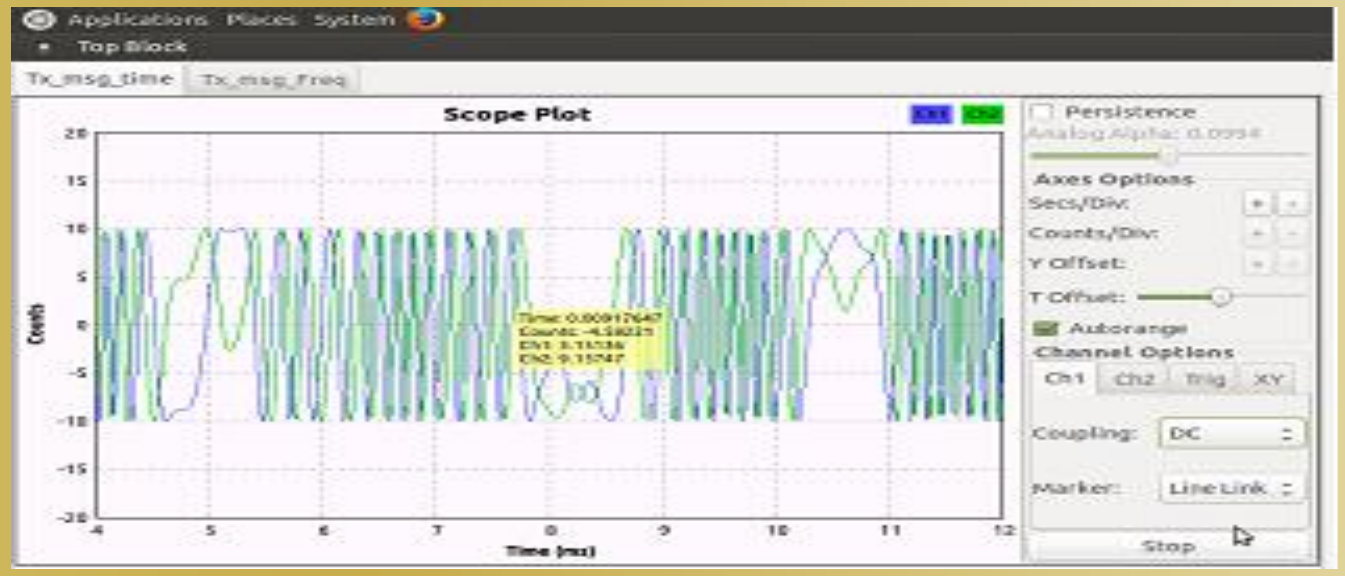

Fig.(3): Transmitted signal in time domain.

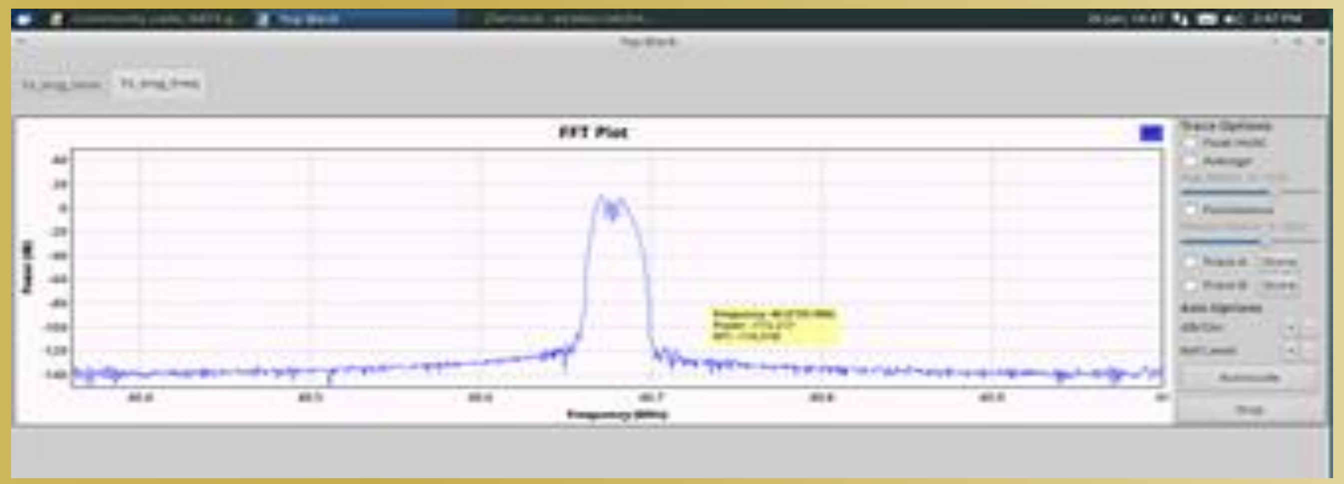

Fig.(4): Transmitted signal in frequency domain.

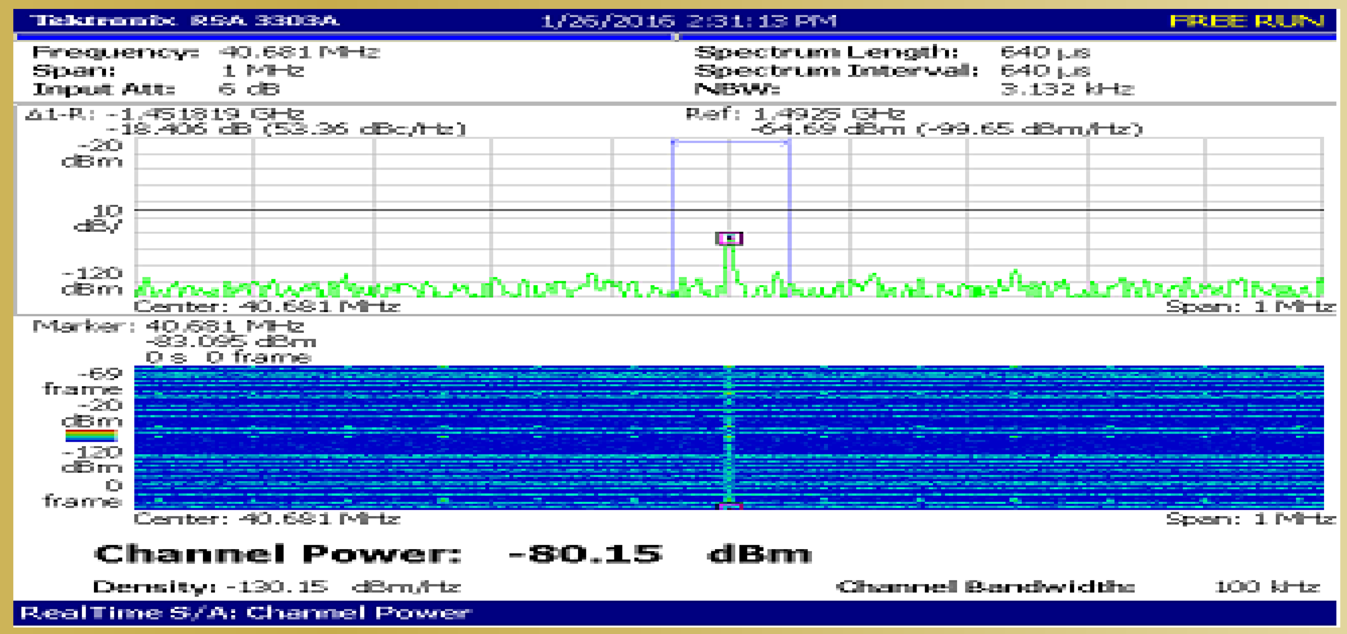

Fig.5: RSA 3303A real time spectrum analyzer snapshot.

References

[1] L. Tobing, “How to do community radio: A primer for community radio operators”, New Delhi, UNESCO.
[2] UNESCO, "Legislation on community broadcasting: Comparative study of the legislation of 13 countries", UNESCO, 2003.

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