FM Signal Reception using Pi

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Contents

***Abstract*—This module explains how to interface RTL-SDR dongle with Raspbery Pi and Demodulate FM Signal.**

1 Software Installation

1.1 Preliminary Tools

If you do not have GIT, cmake & unzip installed them using following commands.

```
sudo apt-get update
sudo apt-get install git-core
sudo apt-get install cmake
sudo apt-get install unzip
```

1.2 Update & Install Dependencies

Update the internal repository of Pi

```
sudo apt-get update
```

Download or clone dependencies.html file from the github to know list of dependencies required to interface RTL-SDR dongle.

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```
git clone https://github.com/
    PrasannaIITH/UHD-dependencies.
    git
cd UHD-dependencies
unzip dependencies.zip
```

Open the .html page in the directory using browser

```
ls
chromium-browser ./Dependencies.
    html
```

Open a new terminal and install the dependencies which are present in the page as per instructions.

1.3 Download & Build RTL-SDR software

Download or clone from github:

```
git clone git://git.osmocom.org/
    rtl-sdr.git
          (or)
git clone https://github.com/
    PrasannaIITH/rtl-sdr.git
```

Build with cmake :

```
cd rtl-sdr
mkdir build
cd build
cmake ../
make
sudo make install
sudo ldconfig
```

In order to be able to use the dongle as a non-root user, you may install the appropriate udev rules file by calling cmake with the following command in build directory.

```
cmake ../ -DINSTALL_UDEV_RULES=ON
```

Building with auto tools:

```
cd
cd rtl-sdr/
```

```
autoreconf -i
./configure
make
sudo make install
sudo ldconfig
```

In order to be able to use the dongle as a non-root user, you may install the appropriate udev rules file by calling

```
cd
cd rtl-sdr/
sudo make install-udev-rules
```

we can see *rtl_ tcp, rtl_ test & rtl_ sdr* in *rtl-sdr/src* directory. By this we can say the software is successfully.

2 Hardware Installation

We use DVB-T RTL-SDR R820TU dongle with antenna as RF front-end.

Fig. 1: DVB -T RTL-SDR Dongle

2.1 Interior Components

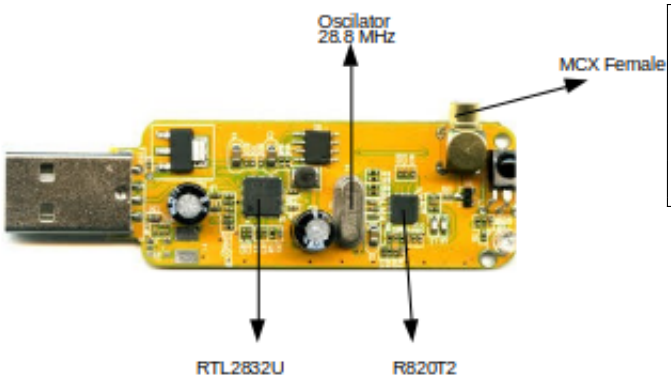

Fig. 2: Components of RTL-SDR Dongle

2.2 Working Process

RTL-SDR Dongle consists of two important blocks **Radio tuner** & **Demodulator with ADC**.

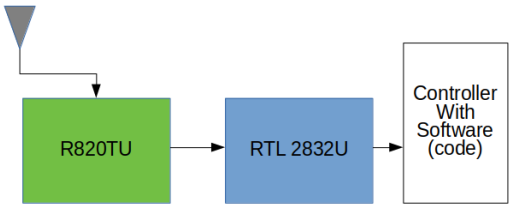

Fig. 3: Block Diagram

1) **Antenna:** Antenna converts the electromagnetic signal to electrical analog signal.
2) **Radio Tuner:** R820T2 chip is an radio tuner here, it converts high frequency signal to a lower intermediate frequency.
3) **Demodulator:** RTL2832U helps to demodulate the signal and convert the analog signal to digital.
4) The digital signal with help of USB fed to the computer.

2.3 Test Connection

Connect the dongle to Pi, connect the antenna to the dongle with help of MCX Male & Female. Now run the following command in the terminal to see device details.

```
rtl_tcp
```

3 Operation

Run the following commands to receive & play audio single from the FM transmitter

```
cd rtl-sdr
cd src
sudo ./rtl_fm -f 89.9e6 -M wbfm -s
    200000 -r 48000 - | aplay -r 48
   k -f S16_LE
```

References

[1] Open Source Mobile Communications, https://osmocom.org/.
[2] RTL-SDR Dongle and GQRX on Mac https://www.youtube.com/watch?v=bSAa2aOXpCc.
[3] Official Osmocom mirror, Mirror of the git.osmocom.org repositories https://github.com/osmocom.