



Analysis of modulation scheme using GNU Radio

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Outline

- ❖ Introduce
- ❖ Project Goal
- ❖ QPSK
- ❖ CPFSK
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- ❖ Project conclusion
- ❖ Project challenges
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Introduce (1)

- ❖ GNU radio: One of the most popular applications of Software Defined Radios
- ❖ Use C++ to write blocks
- ❖ Use python to connect blocks and run your program
- ❖ All the codes in GNU is free and easily for everyone to get it

Introduce (2)

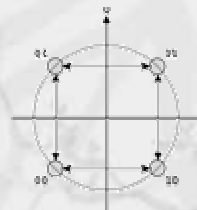
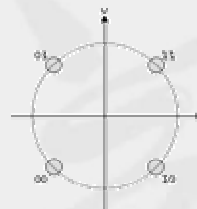
- ❖ Use Gnu-radio to draw plots:
two ways to draw (Is there any other way?)
- ❖ Using USRP
- ❖ Using wxgui packet and its inside functions
stdgui2: Basic GUI stuff
fftsink2: plot FFT
scopesink2: output

Project goal

- ❖ To get the FFT figure of QPSK and CPFSK
- ❖ Compare them
- ❖ What's advantages and disadvantages

QPSK and OQPSK

- ❖ *The FFT figure between QPSK and OPQSK is nearly the same*
- ❖ *Offset quadrature phase-shift keying*
- ❖ OQPSK make the phase changes like 0° $+90^\circ$ and -90°



CPFSK

- ❖ Continuous-phase frequency-shift keying
- ❖ When $h=0.5$ we call it MSK

$$s(t) = \sqrt{\frac{2E}{T}} \cos(2\pi f_c t + \phi(t, a))$$
$$\phi(t, a) = 2\pi h \int_{-\infty}^t \sum_{i=-\infty}^{\infty} \alpha_i g(\tau - iT) d\tau$$
$$g(t) = \begin{cases} \frac{1}{2T} & 0 \leq t \leq T \\ 0 & \text{elsewhere} \end{cases}$$

Modulation using GNU radio

Sender



Receiver

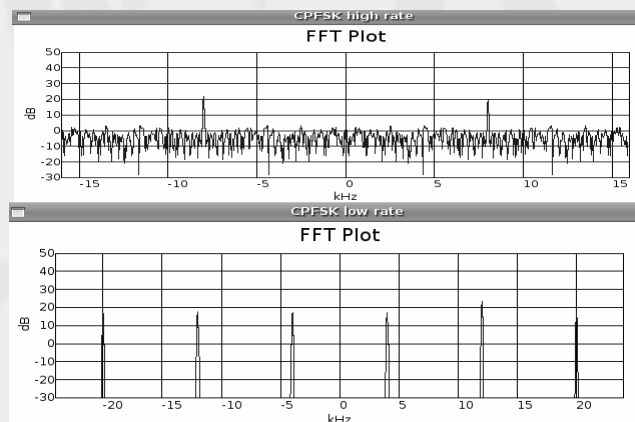


Result

- ❖ Demonstrate
- ❖ It's a theoretical plot, with out add any noise
- ❖ The FFT is added with some SINC functions

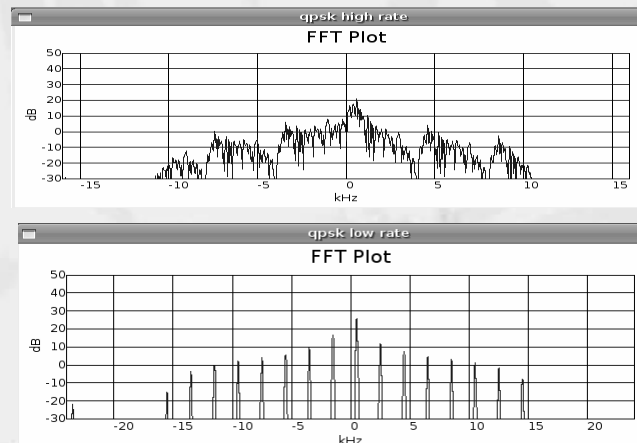
result

The figure of CPFSK



result

The figure of QPSK



Conclusion

1. I use the same sample rate and same random input.
2. The spectrum of CPFSK is spread, which can decrease the noise
3. The bandwidth efficiency of QPSK is better
4. But PSK is cheap and its system is easy

Project challenges

- ❖ How to draw the figures
- ❖ Why I change my goal from pulse shape to FFT
- ❖ To generate the input signals (float and binary)

Reference

- ❖ 1 <http://gnuradio.org/trac/wiki/UbuntuInstall>
- ❖ 2 <http://www.gnu.org/software/gnuradio/doc/exploring-gnuradio.html>
- ❖ 3 Exploring GNU Radio, Eric Blossom 2004
- ❖ 4 How to Write a Signal Processing Block, Eric Blossom 2005
- ❖ 5 <http://www.cs.uni-paderborn.de/en/research-group/research-group-computer-networks/projects/gsr.html>
- ❖ 6 <http://en.wikipedia.org/wiki/QPSK>
- ❖ 7 GNU Radio-Open Source Software and Hardware for Software Radio, Eric Blossom 2002
- ❖ 8 Digital Modulation Techniques , Fuqin Xiong. 2000
- ❖ 9 A GNU Radio Based Software-Defined Radar, Lee K. Patton 2007



To be continued...

Thank you

Questions?

It's the ending~