Source Code Release of Own Functional Blocks for GNU Radio Companion that Enables Phase Synchronization of USRP N200 / X300 devices

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1. Introduction

In wireless signal observation and measurement applications, frequency/phase synchronization between channels or between transmitters and receivers are expected. The GNU Radio Companion (GRC) is a well-known environment for developing software radios. However, the GRC environment does not have sufficient parameter setting functions for phase synchronization of USRP devices. This poster describes own GRC functional blocks that realize phase synchronization on USRP N200 or X300 with SBX or SBX-120 daughterboards.

2. Own functional blocks for GRC using with SBX

The SBX series do not have a capability to share a local oscillator (LO). Frequency/phase synchronization can be achieved by adding codes categorized as UHD timed commands to the Python code generated by the GRC[1]. Whenever a signal flowchart is changed on the GRC, the synchronization codes need to be added, which is a very complicated task.

In order to streamline software development in the GRC environment, we have extended the USRP Sink and USRP Source blocks and developed several own blocks that can generate Python code containing the frequency/phase synchronization codes proposed in [1].

3. Example of use of the proposed own blocks

Figure 1 shows an example of the use of our proposed own blocks. Two USRPs connected to different PCs can transmit and receive with same sample timing on Coordinated Universal Time (UTC).

Figure 2 shows amplitude of demodulated signal for double side band suppressd carrier (DSBSC) with carrier frequncy F_c = 925MHz, baseband sampling frequency F_{sb} = 2MHz. Figure 3 shows demodulated sinusoidal waveforms of two channel coherent receiver in Fig.1.

4. Conclusion and Acknowledgment

We have proposed several own GRC blocks that enable LO synchronization of USRPs. Detailed performance evaluation of phase synchronization accuracy is a future work. The source codes are available at https://dsp-lab.net/ under GPL v3.

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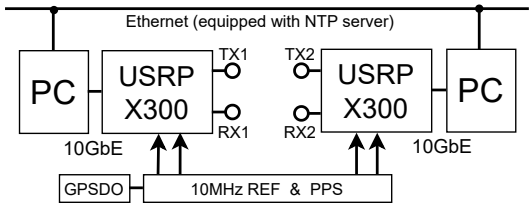

Fig. 1 Diagram of two USRPs operating synchronously with sampling time using the proposed blocks.

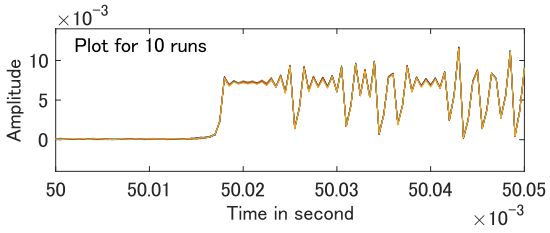

Fig. 2 Amplitude of 10 times overwriting demodulated signals for DSBSC from TX1 to RX2, F_c = 925MHz and F_{sb} = 2MHz in Fig.1.

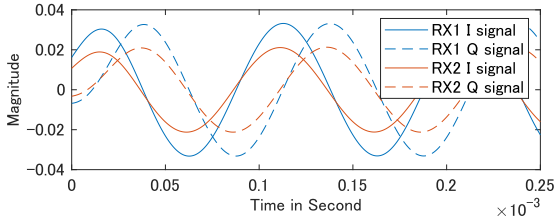

Fig. 3 Demodulated sinusoidal waveforms of two channel coherent receiver in Fig.1 withF_c = 925MHz and F_{sb} = 2MHz.

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References

[1] T. Nakahama, Y.Yamada and S. Kameda,"Example GNU Radio Implementations of Phase Alignment between USRP devices," IEICE Technical report, vol. 120, no. 238, SR2020-34, pp. 74-81, Nov. 2020.