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Synchronizing multiple DACs and ADCs for future use in a 4x4 MIMO demonstrator

In this paper is presented a synchronized method used for the synchronizing of DACs and ADSs. This method was used at synchronizing a two DACs and two ADCs.

1.Introduction

In this paper the upgrade of a 2x2 MIMO Transmission System into a 4x4 MIMO Transmission System will be presented. This work was concentrated on base band transmission without RF transmission testing which will make the topic of other works. The installation has 4 transmitting and receiving channels and a trigger connection between sender and receiver. The clock signal is provided from an external clock generator through one power splitter.

The schematic of the previous installation in use is presented in figure 1.

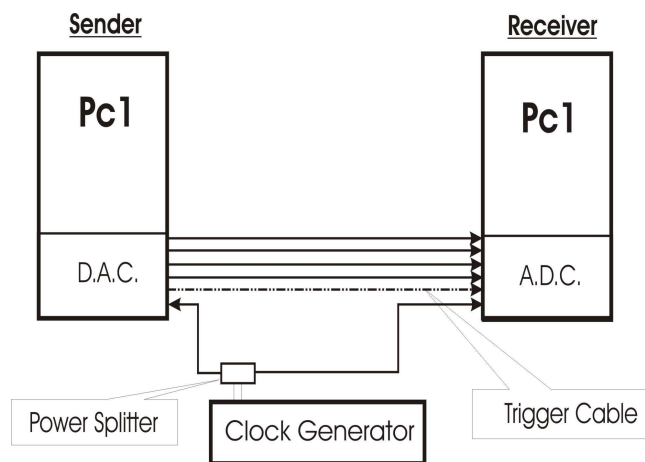


Figure 1: Previous installation scheme

2. The current developed installation

The development of installation was having four stages:

a) Internal Synchronization of DAC boards

Conclusion: This option of the DAC boards has been abandoned because of the fact that the 10MS/s speed could not be achieved. The maximum sample rate that the system could reach with two synchronized DAC boards in FIFO mode on one computer was 6 MS/s.

b) External Synchronization of DAC boards

Conclusion: The delay between trigger master board and trigger slave board at 10 MS/s was 168ns and this delay was constant during the testing period.

c) DAC and ADC Synchronization

Conclusion: The amplitude signal of the received clock signal was low. The loss at the power splitter had high. All other parameters remained the same.

d) Trigger Separation

When both boards are started channels 0 and 2 start first and after one period start channels 1 and 3. The first samples transmitted are shown in figure 2

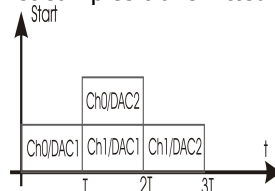


Figure 2: Previous installation scheme

To eliminate this delay the sample transmitting forma has been changed according to the algorithm shown in figure 3

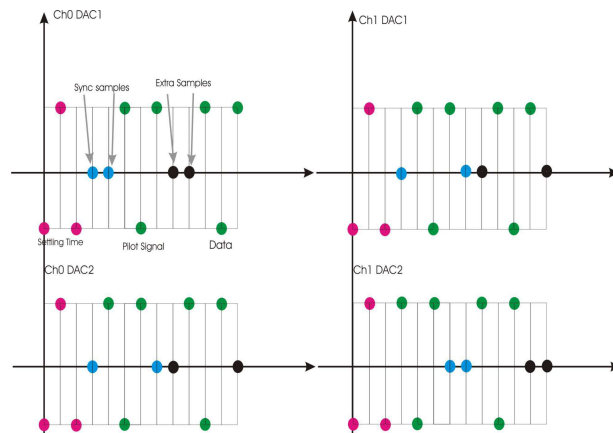


Figure 3: Sample algorithm for synchronization

The channel trigger possibility is the channel window trigger. This option is the most complex option and it offers a larger variety of possibilities.

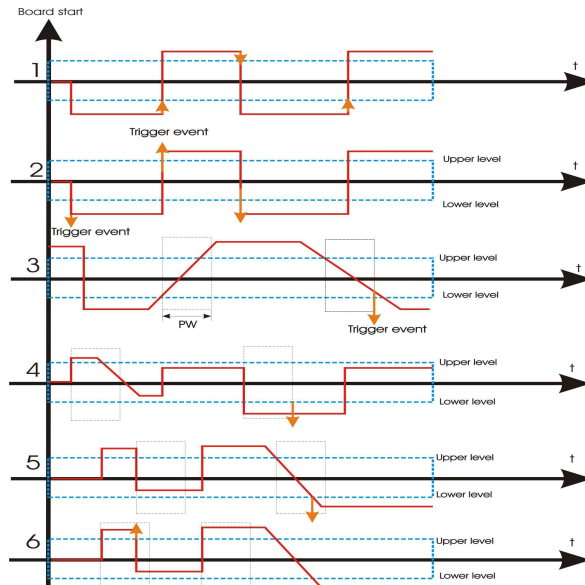


Figure 4: Possible Channel Window Trigger Options

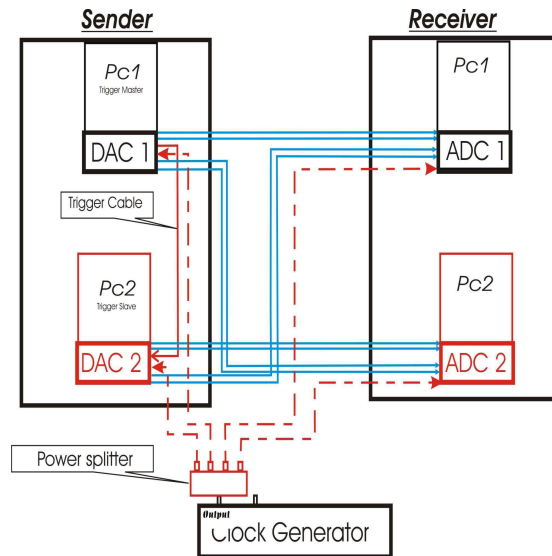


Figure 5: Current installation scheme

The current developed installation is shown in figure 5.

3. Conclusions

In order to have trigger separation between the transmitter and receiver computers channel trigger method has been used because of the various advantages that it gives.

One advantage of this method is that no extra cable or any kind of connection is necessary in order to make the ADC boards trigger. With this possibility the board samples the signal received at the analog inputs of the boards. The user has various possibilities to set the channel trigger, according to the received signal. The user must select the values of the high and low levels for the triggering of the board correctly.

The method chosen for triggering the ADC board was channel window trigger for leaving signals. The board triggers every time the received analog signal leaves the window. The analog signal can leave the window of the upper level or (not and!) on the lower level.

References

- [1] Jim Brewer Joe Sekel, *PCI express technology*, Dell Incorporated, 2004
- [2] *****, *Samplerate generation on MI.xxxx boards*, Spectrum Systementwicklung Microelectronic GmbH, 2004

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