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Jitter investigation in dual channel simultaneous sampling measurement methods

Abstract. *Dual channel simultaneous sampling measurement methods of power, phase angle or impedance are highly affected by the jitter of the A/D converter. Thus it is necessary to determine the jitter in the validation procedure of a particular measurement method. The article concerns the Authors' research continuation, this time based on extended measurement setup for detailed jitter analysis, with two independent signal sources and A/D converter circuits.*

Streszczenie. *W dwukanałowych pomiarach próbkujących duży wpływ na wynik pomiaru mocy, kąta fazowego, czy impedancji, może wywierać szum fazowy (jitter) przetwornika A/C. Oszacowanie wartości tego szumu jest zatem niezbędnym krokiem przy walidacji wybranej metody pomiarowej. W artykule przedstawiono wyniki kontynuowanych przez Autorów badań, w których tym razem, w celu przeprowadzenia szczegółowej analizy wykorzystano dwa niezależne źródła sygnałów i dwa układy przetworników A/C.*

Keywords: dual channel analog-digital conversion, jitter, phase noise.
Słowa kluczowe: dwukanałowe przetwarzanie analogowo-cyfrowe, jitter, szum fazowy.

Abstract of the article

Dual channel sampling measurement methods for evaluating such parameters as power, phase angle or impedance are highly affected by the jitter of the A/D converters. Thus it is necessary to determine the jitter in the validation procedure of a particular measurement method using chosen set of A/D converters or data acquisition card (DAQ).

Due to the fact that the measurement process for jitter estimation is disturbed by the complex phenomena it is necessary to perform and repeat entire procedure for different measurement topologies (Fig. 1). It should be noted that total jitter is the root-sum-square (rss) value of the generator output jitter and the digitizer jitter. That is why two different function generators and two independent A/D couples are used. This is very helpful in the analysis process for distinguish different jitter factors.

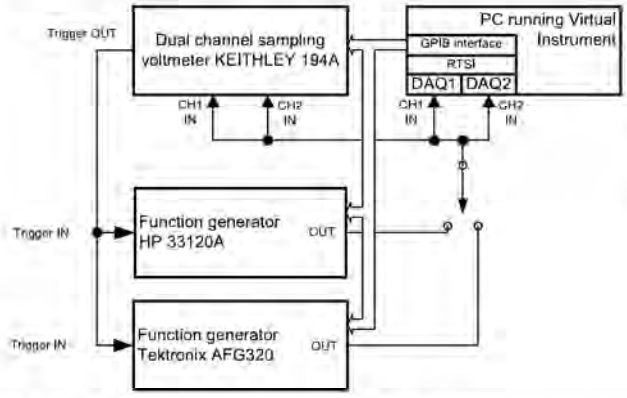

Fig. 1. Measurement setup for jitter estimation purpose.

The measurement can be performed independently for different function generators as well as for different A/D converters. The dual channel sampling voltmeter Keithley 194A and a pair of National Instruments 6251M data acquisition cards are used. The measurement system is all controlled by a PC with a dedicated "virtual instrument" application (beside a slight necessary change in signal routing concerning generator outputs, which is not done by the software because of the expected additional noise, and pursuit of the shortest and the simplest circuit).

When using measurement method with under-sampling technique Authors are taking into account long term jitter obtained by under-sampling method. In sampling method with the Shannon-Nyquist criterion fulfilled short term jitter obtained by cycle-to-cycle method can be more effective.

The other comparisons are taken with the results obtained in different measurement configurations including an autonomic simultaneous sampling dual channel voltmeter first, and the PC computer based measurement instrument with two equal DAQ boards configured for the simultaneous sampling tasks by using the Real-Time Synchronisation Interface (RTSI) bus. This allows for the closer determination of the observed phenomena as well as detailed investigation of the systematic and stochastic factors.

The paper summarizes analysis results and practical findings based on continued research carried out by the Authors in the last three years [1,2].

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