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An automated control system by probe signal generator in radar

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Abstract

The article discusses the creation an automated system by probe signal generator in radar. This system was created by means of National Instruments measurement equipment and LabVIEW software environment. The paper shows a block diagram of test system and describes its components. For this test system a test method, software and typical signals were developed. This system is used for the production monitoring of the probe signal generators.

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1. Introduction

Modern radar – is a complex system comprising mechanical, hydraulic, electrical and other elements. But the main importance is the radio equipment. Radio equipment is used for control of the radar, for generating and receiving radar signals, for transmit, receive, processing and storage of information [1-6]. In the production of radio is very important to monitor its performance. Currently, control is carried out by conventional methods which are based on measuring the values of input and output signals and reception waveforms at the control points. Unfortunately, these methods do not allow finding a failure and operational error, especially when verifying digital signal processing systems [7-9].

One example is the evaluation of the main characteristics of the chirped pulse for probing signals that are generated by radar heterodyne. Radar heterodyne consist of frequency synthesizer for producing carrier, modulator, amplifiers, and balanced circuit. The efficiency of radar depends on quality of heterodyne signal. Therefore, parameter monitoring of chirp pulses is important part of the control system by radar. Due to the large number of measurements, parameter monitoring must be automatized.

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One of the most effective ways to solve this problem is the using modular instruments from National Instruments. The redefined instrumentation approach provided by National Instruments uses open software and modular hardware with key elements (multicore CPUs, user-programmable FPGAs, PCI Express, data converters, and LabVIEW system design software) to address such demanding challenge. Using NI LabVIEW software with PXI modular instrumentation to create a test system that can be used in both characterization and production testing and delivers 11X reduction in capital equipment costs, 15X reduction in footprint, 66X reduction in weight, and 16X reduction in power consumption over the previous automated test equipment used in production. With this approach, we can build test systems based on flexible hardware and scalable software resulting in savings in capital equipment, system development, and maintenance costs while realizing faster test execution. [10].

The aim of the presented paper is the development of an automated system for control of parameters of probing chirp signal.

2. Methods of solving the problem

A number of methods to creation of automated systems is referred in works [11-16]. Similar systems are described in works [17-19]. As we can see from that works, the optimum way is use modular measurement equipment with integrated software development environment. Modular measurement equipment from National Instruments is used for generating test signals, digitizing measured signals and measuring parameters. Software development environment LabVIEW is used for processing received information and display of results.

3. Description of the system

Block diagram of the measurement system is shown in Fig. 1.

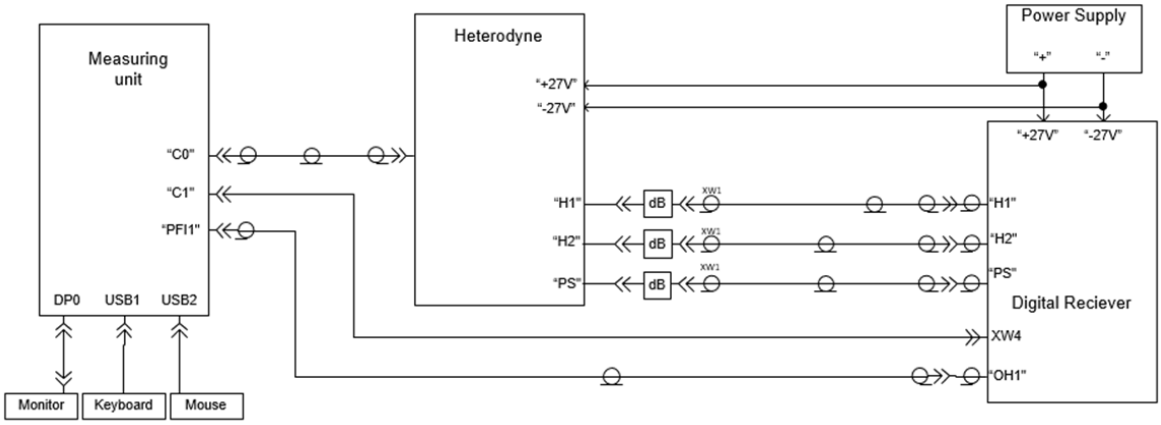

Fig. 1 Block diagram of the measurement system

The system comprises: a heterodyne, a receiver and a measuring unit. To supply the heterodyne and the receiver uses an external power supply ±27 V.

Heterodyne generates the following signals:

- pilot signal (PS), which is chirped pulse with a duration of 67 μs and frequency deviation of 1.2 MHz in most measurement modes;
- start trigger (H1);
- coherent wave signal with frequency 24 MHz (H2).