Program system for controlling EMC measurements and collecting measured data

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Abstract. *The aim of this submission is to introduce a wide program system assigned to control EMC measurement. This device was developed on the Department of Measurement and can be divided into three modules. First component realizes defined supply voltage fails. The core of listed module is the programmable generator. The next component presents remote client for collecting, math processing and measured data evaluation from various EMC measurements. It works thought a serial interface and offers an option to simultaneous watch the three different channels for data collecting and one for parameters sending. A client for collecting, displaying and evaluation of received data constitutes the last component. The intention of this client is a measurement of higher harmonic frequencies. Additional optional functions of this module are the application of norm defined filtering and comparing measured data with norm defined limit values.*

Keywords: EMC, harmonic analysis, measurement software, GPIB

1. Introduction

The huge expansion of electrical devices and the increase of electromagnetic interfering signals bring the necessity to make devices resistant to these disturbances. In regard of legislation every electrical device has to satisfy to electromagnetic compatibility standards about emission of interfering signals and immunity to such signals. To achieve a valid certificate it is necessary to realize several extensive tests, with the use of various testing and measuring devices. In most cases it is important to use such measuring equipments, which by themselves won't be the source of further interference and won't have negative affect on object of measurement. In the simple way electromagnetic compatibility is the ability of a device or system to work properly in its electromagnetic environment without creating unwilling emissions to other devices. It has to also resist to similar interference coming out of other environment.

The target was to build up a huge solid software system for performing control and analyze tasks in EMC measurements. The project goes out of real needs of the EMC laboratory. The project can be divided into three parts and matching software modules.

2. Subject and Methods

The specification of wished features was built up primary on the standards for Testing and Measurement Techniques (EN 61000-4-1) and Limits for Emission of Harmonic Current Emissions (EN 61000-3-2). There was also a request to use the whole potential, which is given to us by the measurement devices.

There was a fundament question for the **module for controlling immunity tests**, what would be the best way of creation noise signal by using the HP33120A generator. Basically there were two different accesses. The first one uses by creating noise signals built-in functions of

the generator. But the trouble is, that it is not possible to change the output state (in meaning: starting or switching noise signal) with milliseconds precision. In spite of that, these built-in functions could be used in long lasting signals. The second access uses internal memory of the generator to achieve the samples of own built signals. In this case it is possible to build signals with precise dropouts, but there is also a restriction. The maximum number of samples is 16000 and the signal repeats cyclic with defined frequency. This is enough for only a 3 second signal pattern with 50Hz frequency and density 100 samples per a period.

In case of the **remote interface for EMC tests**, the focus was to build a two way communication application. The first channel should communicate with a server application, which controls the generator with antenna and tell it the frequency steps. The second channel should be used to get the measured data into the computer. There was a necessity to achieve the compatibility with other existing components such as the server application.

The specific of the **harmonic analysis module** is, that it has strictly to work in real time and should be able to collect huge amount of data without lost five times per second. This module is also linked with a hardware device, which realizes the Fast Fourier Transformation (FFT) on the input signal. The need was to read this raw data from the HW device into computer and realize filtering and screening in the real time. The nearer features came out from the standards EN 61000-3.

3. Results

This paragraph describes the success of the project and every module. For better imagination several figures and graphs are present too.

Module for controlling immunity tests

The module uses the arbitrary waveform generator HP33120A to make noise signals and communicates with it through the GPIB bus. The basic signal presents a supply voltage, default set to 230V and 50Hz. However the output amplitude of the generator HP33120A is a hundred times smaller. The software module allows building up several types of noise signals listed bellow:

- Short voltage dropouts with defined phase and delay in milliseconds.
- Long lasting undervoltage/overvoltage.
- Linear changes of the supply voltage amplitude (lasting seconds till tens of seconds).
- Higher harmonic frequencies.
- Frequency shifts.

The noise signals are generated by combination of predefined waveform functions and sample waveforms defined on the generator. On the figure 1 is a sample signal, which can be generated with this module.

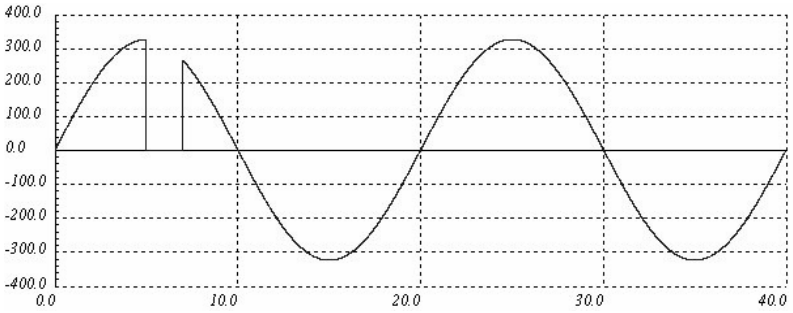

Fig. 1. Voltage signal with the defined short voltage dropouts.

Remote interface for EMC tests

This module is able to control the high frequency generator with the antenna in the shielded room. This is made by the communication with an existing server application through TCP/IP. The module simply connects to the server and sends appropriate commands to it. The results are several physical values, which describe the state of the tested device, which is exposed to the noise signal from the antenna. These physical values are transformed into an optical serial signal to minimize other interference. This data is then received with the module for collecting measured data trough RS232. Other features enable the math regress of the raw data, real time screening in a graph and archiving in a file. It is also possible to achieve three different input channels in the same time.

The next figure 2 shows the main application window with a graph section.

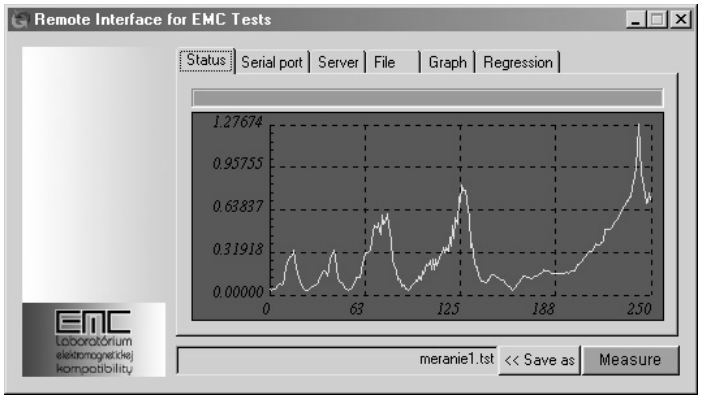

Fig. 2. Remote interface for EMC Tests application window. There is active a status page used to plot graph during measurement.

Harmonic analysis module

The last module presents a computer application, which communicates with a hardware device realizing Fast Fourier Transformation. This is performed through USB to reach a high data transfer speed. The raw data are then filtered with a first grade discreet filter as defined in the standard EN 61000-3. It is certainly possible to change the filtering properties. In the next step, these data are archived in the computer memory. In the last step, the data are screened in a bar graph.

This all happens in a real time five times per second for every fifty higher harmonic frequencies. The additional features enable to compare measured data with norm-defined limits and to show direct value of selected frequencies.

The figure 3 bellow shows the main application window with a bar graph of a sample measurement.

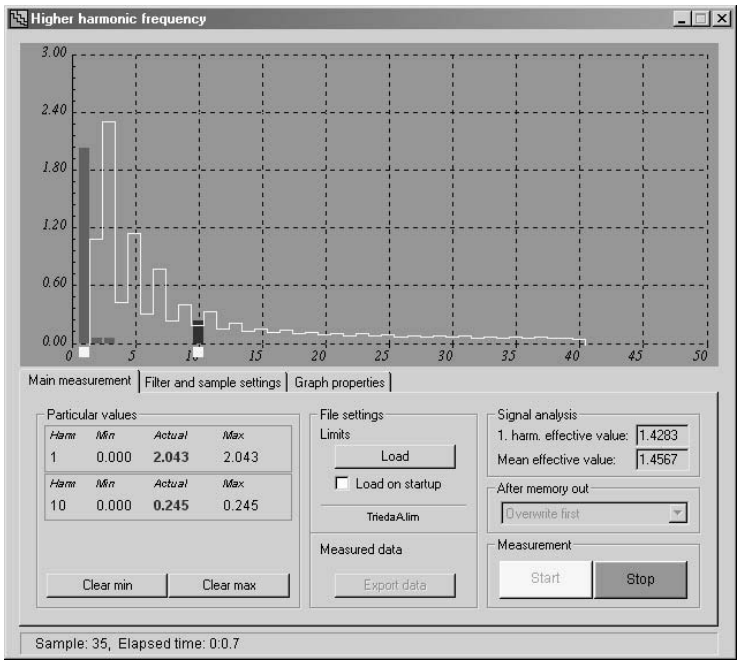

Fig. 3. Higher harmonic frequency module

4. Conclusions

The requirements of this program system have been reached and a full functional software package for controlling EMC measurements and collecting data has been made.

The module for controlling immunity tests has some known issues, which relate with the limitations of the arbitrary waveform generator HP33120A. Before putting in operation is also a power amplifier required. Collector module for gathering measured data is already installed in the EMC laboratory and is often used in practice in many measurements. And the last module for collecting harmonic analysis data is full prepared for installing in the practice.

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