A New Portable, PC Based, USB Powered Dynamic Signal Analyzer

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ABSTRACT

A new USB powered portable 4-channel real time Dynamic Signal Analyzer and its automotive applications are described. The design and architecture lend themselves to realtime NVH measurements and analysis in the field, in-vehicle or on production lines. Built-in signal conditioning provides for direct sensor power while the embedded DSP provides for signal processing on-board. Performance and implementation of FFT, digital filters and order analyses are presented.

INTRODUCTION

Lower cost, higher performance dedicated digital signal processing (DSP) with a more accessible programming environment has helped to change the nature of dynamic signal analyzers (DSAs) and bring portable solutions to the market. First generation DSAs used analog circuitry, were bulky, required significant power and had limited displays. Circa 1975, a dual channel Fast Fourier Transform (FFT) DSA[1] or single channel real time digital filter DSA[1] weighed nearly 75 pounds, had dimensions of 30 x 27 x 19 inches, and consumed as much as 600 Watts. The onset of DSP technology allowed DSAs in the 1970's to become more powerful, although portability could be best described as "transportable" as displays became larger, size and weight remained unchanged. In the 1980's portable systems[2] with LCD and CRT displays reached the market although battery life was limited and batteries were a major contributor to the system weight. With the advent of the PC and later the laptop PC, the display and some or all post-processing could be moved to the PC dividing the system into a front end and PC. This allowed the front end to be smaller, faster, and use less power while displays, documentation devices, post-processing and application support could steadily evolve with PC technology.

Circa 1988, PC based digital DSAs were introduced[3]. A front end box contained the DSP and analog to digital and digital to analog (AD/DA) circuitry. The front end box weighed 20 pounds, had dimensions 6 x 19 x 18 inches, and consumed 100 Watts.

Figure 1. Photon, USB cable and laptop PC

As internal connections and PC busses became standardized, hardware was soon designed for the PC's internal connections, making desktop systems more compact, but requiring expansion chassis for laptop installations. While size was reduced, external power was still required and portability suffered from a laptop-expansion chassis package. Heat, PC power supply electrical noise and PC component compatibility became new design issues

Now, using the new DSP technology the DSA size has been reduced in size while performance has been increased. The PC based portable DSA, presented in this paper weighs 0.5 pounds, has dimensions 3.75 x 4.75 x 1 inches, and consumes a maximum of 2.5 watts.

This paper presents the design of the Photon: a portable, PC based, Universal Serial Bus (USB) powered DSA that was developed by taking advantage of the new DSP and PC communication technologies.