AUTOMATED EMI/EMC TESTING

The key to success in the EMI/EMC business is to properly use the unique expertise of the EMI/EMC engineer, technician and analyst. Unfortunately, the supply of qualified personnel has always been extremely limited. When faced with periods of rapid growth in which the demand for qualified personnel exceeds supply, how can a laboratory improve its efficiency to meet the demand? This was the issue facing an EMI/EMC test organization in the 1970's when EMI/EMC growth was projected to be rapid and outstrip both the supply of qualified personnel and the ability of the organization to adequately train new people.

When confronted with these growth projections in the testing marketplace, management made the decision to automate the measurement process. What to automate in the realm of EMI/EMC testing became a major consideration. The objectives of the effort were to develop a system which would result in increased productivity, reduced test costs, and which could be operational. In 1976, the company's management approved funding for a Semiautomated Test System (SATS). A team of EMI/EMC engineers and software experts was assembled to create and implement an operational system. Once hardware parameters were defined, the specifications were translated into software which would produce accurate measurements and would be usable by all levels of personnel.

The system was originally developed to meet testing requirements for NACSIM 5100, and has since been updated for NACSIM 5100A and other applicable EMI/EMC documents. SATS is based on a receiving system which is controlled by a DEC 11/23 PLUS Computer System (see Figure 1). Hard copy is produced by a pen plotter which receives its data from a real time graphics terminal. The plotting system (shown in Figure 2) can also be used off-line for manual data entry plots.

The SATS software was designed to be used by an experienced test technician; the operator does not need knowledge of computer hardware or software. The program presents a series of questions and options which leads the operator through the decisions required for a valid test scan. Once the initial questions are answered, the receiver parameters are defined according to criteria set by the appropriate test specification (start frequency, stop frequency, bandwidth, and so forth). Before the actual scan is started, the system is calibrated by computer-controlled frequency synthesizers. During the scan, the measurements are plotted in real time on a graphics terminal. At the conclusion of the scan, a plot is produced which contains the detected emanations with all correction factors and, at the option of the operator, the appropriate specification limit and the receiver sensitivity.

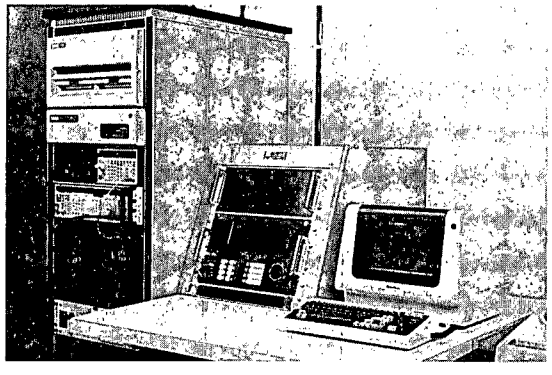

Figure 1. Automatic Detection System with PDP 11/23 + Computer System and Calibration Sources.

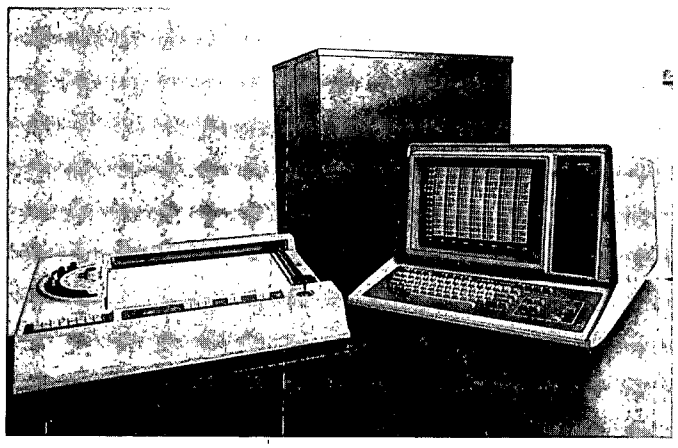

Figure 2. Data Plotting System.

The benefits accrued since the development of the original SATS have more than offset the substantial initial investment. In recognition of this fact, three SATS are now in operation. While the cost of equipment for the automated system is on the order of twice that of a comparable manual test system, with software adding a like amount, the productivity of the EMI/EMC testing laboratory has increased five-fold. Additionally, only one person is required to operate the system versus two or more for a total manual system, including the plotting requirements. Managerial time is also reduced due to a reduction in paper handling and coordination required in the preparation of test reports. The automated plotting function is an important factor in the increased efficiency of the system, providing the benefits of reduced drafting and typing time, increased accuracy of data reduction, and consistent, high quality graphs.

While the system provides no automated analysis capability, the identification of areas requiring further analysis is rapid and precise, allowing test technicians and analysts to rapidly move into the analysis stage for signals above the limits. The capability exists in the system to expand into the analysis area. Being able to devote larger blocks of time to the more interesting and challenging analytical work has proven to be a tremendous morale booster for those involved in testing.

After successfully implementing a major automated testing system, the engineers turned their attention to the remaining manual data gathering systems and their requirements. The objective was to maximize the efficiency of manual data gathering in order to make the best use of the talents of technicians, analysts and engineers.

A system was developed based on using a low cost personal computer primarily as a data storage and manipulation device. It became apparent very early in the

development that high cost, high-speed personal computers were not necessary. In fact, the major factors for selection of the appropriate personal computer were portability and cost. The company standardized on the Kaypro II computer to meet the manual test data gathering requirements. Figure 3 shows a Kaypro II with a manual detection system. A software package was written with the guidance of the EMI/EMC test personnel which includes the following features and capabilities:

- contains data files of basic detection system parameters which normally required extensive notebook reference;
- accepts, corrects, and stores test data, and combines it with detection system parameters; and
- transfers this data to a floppy disk for use by the independent plotting system which is a part of SATS, or to a separate plotting system.

The benefits derived from the manual data gathering and data reduction systems developed at the test organizations are similar to the benefits of the SATS, that is, reduced requirements for paper handling; reduced raw data manipulation by engineers, technicians and drafters; reduced plotting and report reproduction time; and standardization of documents for both the manual and the automatic system. Due to the reduction of routine chores, the impact on improved morale and increased productivity of the technicians, analysts and engineers has been dramatic.

A look to the 1990's shows that the dramatic growth in measurement technologies will continue, and that automating to the maximum extent feasible is the key to being a viable, competitive testing laboratory. While investments required are not trivial, the benefits derived are substantial. It is important to remember that the most significant benefit of automation is the more efficient use of our rare and valuable experienced measurement personnel.

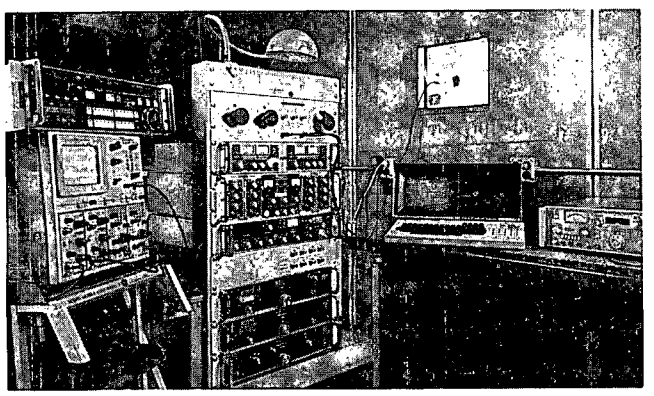

Figure 3. Typical Manual Data Gathering System with Personal Computer for Data Entry/Reduction.

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