# Automating an EMC Test – The Way Forward

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## INTRODUCTION

Following the publication of the 1996 European directives which legally require that all new product designs be tested to International Electrotechnical Commission (IEC) electromagnetic immunity standards, compulsory volume production compliance testing is seen by observers as the next development. Many leading manufacturers are actively considering the possibility as a significant enhancement to quality control procedures. This article discusses the concepts behind automated, integrated EMC test and measurement systems and software designed to address this growing market.

## INTEGRATING REAL-TIME MEASUREMENT

Automating the EMC test procedure offers all the benefits of test program storage, test sequencing, optimization, automatic execution and reporting that the electronics automatic test equipment (ATE) sector has enjoyed for years. Some manufacturers and test houses are already discovering these benefits in a small way, with low-volume compliance testing using a semi-automated system. Such systems typically consist of a series of interference generators applying standard test pulses, and are usually controlled by simple software which allows pulses to be saved and sequenced for automatic execution. However, if full volume production testing is to become a production floor reality, then what is needed is a combined

**Automated EMC test systems can expedite compliance testing.**

EMC test and measurement system which can monitor the equipment under test (EUT), stop the test if there is a problem and provide feedback about the behavior of the equipment. Without this, the semi-automated system relies on an engineer to monitor the equipment visually during the test and to manually check it afterwards – putting impossible time constraints on production test procedures, introducing an unacceptably high margin for human error, and possibly leaving temporary failures completely undetected.

## OPEN ARCHITECTURE

Using an industry-standard, open-architecture approach, it is possible to combine measurement instrumentation – digital voltmeter or scope, for example – with electromagnetic interference generators in an ATE-type system (Figure 1). By basing such a system on an industry-standard communications bus – VXI, IEEE or RS232 – instruments and generators can be

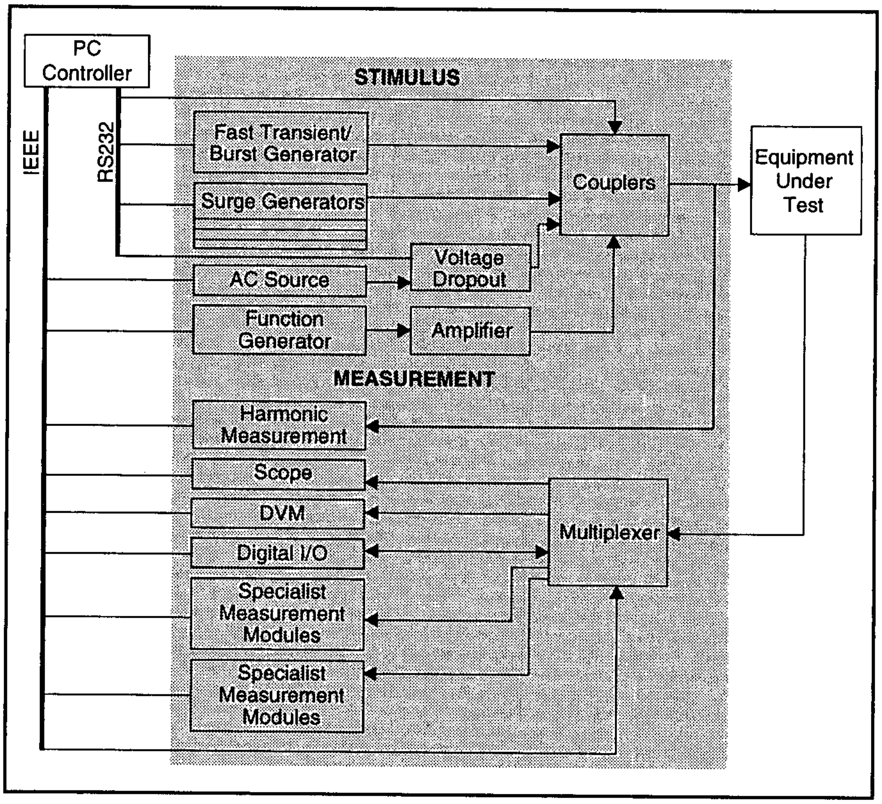


***Figure 1.*** *Test System Designed for a Computer Peripheral Manufacturer.*

added to the basic system to suit the application, and the system can be upgraded and/or expanded in the future to meet changing requirements. It can even be integrated into an existing-production ATE.

This open-architecture approach is vital if flexibility of configuration and application is to be achieved cost-effectively. For a specialist manufacturer, such as in the telecommunications industry, specialist test instrumentation can easily be integrated into such a test-system architecture.

## CONTROL SOFTWARE

In order to capitalize on the flexibility of an open-architecture hardware test system, the control software needs to provide a high-level test management capability as well as real-time control of the individual EMC generators and measurement instruments. If it is to be widely used for production tests, then it must also offer a simple user interface. Selection of the software for such a task is a cornerstone decision for manufacturers developing life-cycle EMC test and measurement strategies. Through the software, manufacturers can capitalize on design characterization work at the production test stage, developing a life-cycle test strategy from concept to production and field support.

The test management advantages of using such a system for production testing are considerable. With the right software tools, design engineers are able to build complete EMI test sequences, including measurement and analysis of the EUT and automatic shut-down in the event of failure. Once such a test program has been developed and optimized for a particular product during the design phase, it can be saved and run as many times as required throughout the development cycle and can be used as a basis for the production test sequence, with automatic logging of data and reporting results. The net effect is much more detailed EMC profiling information available to design engineers, giving them the tools to ensure that, despite changing standards, designs remain compliant.

A high-level software package with hooks to applications such as LABVIEW, Lotus 1-2-3, etc., and the ability of engineers to build their own custom tests as well as call on a pre-programmed library, can become the backbone of a comprehensive test strategy spanning design, compliance, product testing and field repair.

**With the right software tools, design engineers are able to build complete EMI test sequences.**

The example shown in Figure 1 meets the particular EMC test needs of a computer peripheral manufacturer. It is a typical example of the way in which an integrated test and measurement system can be configured, using modular industry standard hardware under advanced software control for automated testing to a variety of international standards.

## HARDWARE

Table 1 lists the IEC standards that one customer needed to meet. In this case, the requirement was for a 3-phase system, but all the instrumentation could work equally well in a single-phase setup by changing the coupling networks. A universal coupler applies burst and surge pulses to the EUT via a single connection.

The voltage measurement capability of the system is provided by a 2-channel oscilloscope and a digital voltmeter which are used to monitor output voltage levels and for real-time waveform capture during EMC tests. Failure of the EUT can be detected using these voltage measurement instruments and/or with additional specialist instrumentation such as temperature transducers, acoustic measurement modules or light sensors to detect arcing. The digital input/output (I/O) in the system diagram monitors the status of any EUT digital/signal lines, such as a power status line or computer signalling cable.

## SOFTWARE

The PC-based control software provides all the control functions for the EMC pulse generators and measurement instrumentation in the system. The IEC standard pulses are pre-programmed, so they can be called up and run on their own, or "dragged and dropped" into a test sequence to be executed automatically. There is also a library of standard measurement tests which can be selected and combined into the sequence. The software provides direct real-time control of all the generators and instruments in the system via "virtual front-

| STANDARD | TEST TYPE |
|---|---|
| IEC 1000-4-2 | Electrostatic Discharge |
| IEC 1000-4-4 | Fast Transient/Burst |
| IEC 1000-4-5 | Surge |
| IEC 1000-4-6 | Conducted Disturbances |
| IEC 1000-4-11 | Voltage Drop-out, Dips, etc. |
| IEC 1000-3-2 (IEC 555-2) | Harmonic Measurements |
| IEC 1000-3-3 (IEC 555-3) | Voltage Flicker |

***Table 1.*** *IEC Standards Which Are Addressed by the Integrated EMC Test System Shown in Figure 1.*

panel" control screens.

Production test routines are typically a mixture of standard IEC compliance-type tests and a manufacturer's own tests to in-house quality standards or to specific customer requirements. The software also provides an automatic data logging function, which can be linked to a remote terminal and/or data storage facility. Data plotting and analysis modules, which can be run on the test-station PC or as stand-alone packages on a remote terminal, provide management information about trends over time, or from batch to batch.

The direct real-time instrument control facility referred to above can also be used for design characterization during product development. This gives the engineer the opportunity to learn a great deal about the EMC profile of the product. The effect on the performance of the new design is monitored and documented automatically. The degradation of performance can be plotted against the number of surges applied, for instance, in a study of the impact of surges on the product life cycle.

## CONCLUSION

High functionality is being realized by a number of forward-thinking manufacturers in production, pre-compliance electromagnetic immunity testing and measurement. EMC issues for manufacturers are changing all the time with new global legislation and changing attitudes – and those who opt for a minimalist, fixed solution are likely to find it a very short-term answer. Conversely, those who take up the challenge to develop life-cycle EMC test strategies will undoubtedly gain a significant competitive edge.

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## *THE EC DIRECTIVE 89/336/EEC*

**The EC Directive 89/336/EEC came into force in Europe in 1992, with a subsequent amendment directive 92/31/EEC which delays compulsory compliance until January 1, 1996. During the transition period, manufacturers selling products in Europe can comply with the old directives or the new standards, as they choose.**

**The new regulations demand that products made or sold in the EC "be so constructed that they do not cause excessive electromagnetic interference and are not unduly affected by electromagnetic interference." Responsibility to meet the regulations lies with the manufacturer. This can be done in two ways - either by testing each product to the appropriate standard, or by producing a Technical Construction File (TCF) to demonstrate that it meets the standard. The route chosen will depend on many factors, including the type of product and the development status of the applicable standard.**

**The standards themselves fall into four groups: Product Standards, Product Family Standards, Generic Standards and Basic Standards. A product should always be tested to its Product Standard if one exists. If not, it must meet the appropriate Product Family Standard. If one does not exist, the Generic Standard is applied. Standards exist for a number of residential, commercial, automotive and light industrial products and the IEC is currently working on many more.**

**Basic Standards describe the phenomenon, specify the test equipment and give details about the test setup and methodology. The Basic Standards concerned with EMC immunity are the IEC 1000-4-x series. For a number of tests, they are identical to the well-known series of IEC 801 Product Family Standards. Committees generating product standards, such as the EC's CENELEC, refer to the technical base of the IEC-4-x series of international standards.**