

An Overview of the EMC Directive

MICHAEL HOPKINS
Thermo Voltek Corporation, Lowell, MA

The methods for compliance are well-defined. Many standards have been published and others are in revision stages.

INTRODUCTION

The EMC Directive applies to virtually *all* electronic products shipped into the European Union (EU) beginning January 1, 1996. To quote the directive itself:

This Directive applies to apparatus liable to cause electromagnetic disturbance or the performance of which is liable to be affected by such disturbance.

The EMC Directive was originally mandated by the EU to be effective the end of December 1992. However, it was

recognized that compliance would be impossible by this date: standards weren't in place, and test facilities would not be able to handle the volume of expected business. Considerable pressure by industry resulted in the implementation being delayed until January 1, 1996. Even though that date is now behind us, questions about the directive, test standards, and the routes to conformity are still being asked by manufacturers.

COMPLIANCE WITH THE EMC DIRECTIVE

There are three basic routes to compliance:

- EC Declaration of Conformity (also called a Manufacturers Declaration)
- Technical Construction File (TCF)
- Type Acceptance

In every case, there is one constant: the *manufacturer* must file a declaration of conformity in the European Union. This can be with the manufacturer's office in a member state or with the product importer in the EU. Even when the declaration is based on tests done by others, conformance with the directive remains the responsibility of the manufacturer.

80% OF ALL TESTING IS PERFORMED DURING PRODUCT DEVELOPMENT. G-STRIP™ IS THE TOOL TO USE.

G-Strip™: RF Immunity and Emissions Engineering Testing Tool

The G-Strip is a cost effective tool for companies to perform in-house testing during product development.

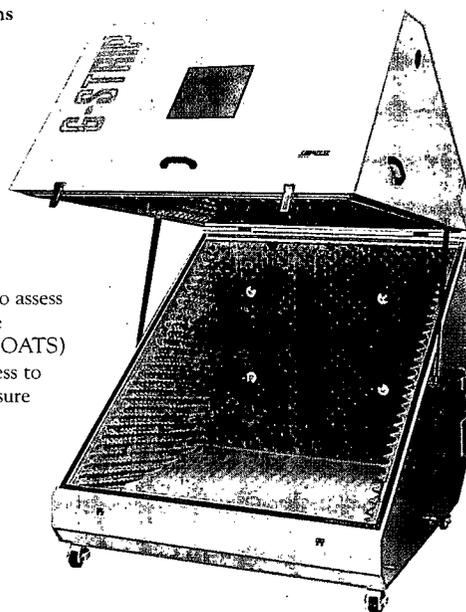
Benefits

- Low cost device at about 1/10 the cost of an anechoic room
- Enables rapid cut-and-try procedures to identify and correct non-compliant performance
- Radio quiet environment in which to assess EUT emission levels without outside interference (an advantage over the OATS)
- Ergonomically designed for easy access to EUT as well as shielding from exposure to RF fields.
- Turnkey system with minimum training required
- Windows® compatible software

RF Tests

Radiated Immunity
Radiated Emissions
Conducted Immunity

The G-Strip makes it possible for companies to avoid costly redesigns by detecting potential EMC problems during the product development stage. And, if a fault is identified, a fix can be implemented faster with the G-Strip.



G-Strip™ 1.2m

For detailed product information, please contact Thermo Voltek sales department in the USA and Comtest in Europe:



Comtest Ltd.
Redfields Park
Fleet • Hampshire • GU13 ORD • UK
Tel: +44 0 1252 855500
Fax: +44 0 1252 851185

Thermo Voltek
One Lowell Research Center
Lowell, MA 01852-4345 USA
Tel: +1 508 275 0800
Fax: +1 508 275 0850

Comtest is a subsidiary of Thermo Voltek, a Thermo Electron Company. G-Strip is a trademark of Thermo Voltek Corporation. Offices and Service Centers worldwide. ©Thermo Voltek Corporation. Specifications are subject to change without notice.

Thermo Voltek

COMTEST • KALMUS • KEYTEK • PACIFIC POWER SOURCE
UNIVERSAL VOLTRONICS • VERIFIER

EC DECLARATION OF CONFORMITY

In cases where the standards are identified and the required tests can be performed as specified, the manufacturer performs the tests using in-house test equipment or the facilities of a commercial test house.

After the tests are completed and documented, the manufacturer or an authorized representative in the EU files a declaration of compliance and affixes the CE Mark to the product.

This is the easiest and simplest route to conformity. Assuming the resources for performing the necessary tests are at the disposal of the manufacturer, the entire process — design, pre-test, compliance test, re-tests if necessary — are all under the control of the manufacturer.

TECHNICAL CONSTRUCTION FILE

If for some reason, the tests *cannot* be performed to the relevant standards, a Technical Construction File (TCF) is

the route to compliance. The TCF is required if the product doesn't fit into any of the defined categories, or if alternative test standards or methods must be used because of product size or other constraints.

The manufacturer prepares a TCF which describes the product to be tested, sets out the procedures used to insure conformity of the product *and* includes a technical report or certificate from a Competent Body. Competent Bodies are test facilities designated by member states as able to make decisions regarding compliance with the EMC Directive. In many countries, including the U.S., Competent Bodies have affiliates where products can be tested locally.

Once the TCF is completed, the manufacturer or authorized representative within the EU files a declaration of conformity based on the TCF and report or certificate from the Competent Body and the CE Mark is affixed to the product.

There are clearly advantages to the TCF; however, decisions about the testing and the determination of conformity now lie with the Competent Body.

TYPE ACCEPTANCE

Type acceptance is required for any apparatus "... designed for the transmission of radio communications, as defined in the International Telecommunications Union Convention." For these products, "... an EC type-examination certificate concerning this apparatus issued by one of the notified bodies..." is required. (Notified Bodies are generally government agencies in the member state. There are typically one or two Notified Bodies per country.)

Once the type-examination certificate is obtained, the manufacturer files a declaration of conformity and affixes the CE Mark, just as in the two previous cases.

For radio transmitters, including cellular telephones, mobile radios, and

AT KALMUS, "RELIABILITY" ISN'T A TERM WE USE CASUALLY

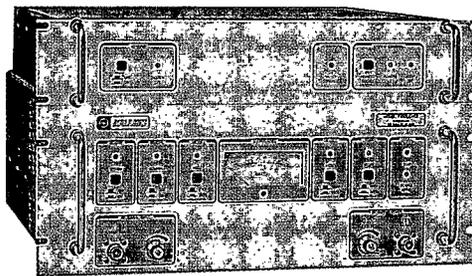
Not when your success -
and ours - is on the line.

We have been building ruggedly-reliable power sources for our EMC, commercial and military customers for over 25 years. Our customers depend on Kalmus amplifiers to do the job, day after day, month after month, and year after year. In all environments and under all conditions.

Reliability. At Kalmus, it is not a buzzword, it is a mission. You can depend on it.

Call today for more information.

Ruggedly-reliable Kalmus EMC power sources from 2 Watts to 4000 Watts and more.



Model 7100LC

For detailed product information, please contact Kalmus:



Kalmus
11807 N. Creek Parkway South
Suite #109
Bothell, WA 98011 USA
Tel: +1 206 485 9000
+1 800 344 3341
Fax: +1 206 486 9657

Kalmus is a division of Thermo Voltek, a Thermo Electron Company. Offices and Service Centers worldwide. Kalmus is a registered trademark of Thermo Voltek Corporation. ©Thermo Voltek Corporation. Specifications are subject to change without notice.

Thermo Voltek
COMTEST • KALMUS • KEYTEK • PACIFIC POWER SOURCE
UNIVERSAL VOLTRONICS • VERIFIER

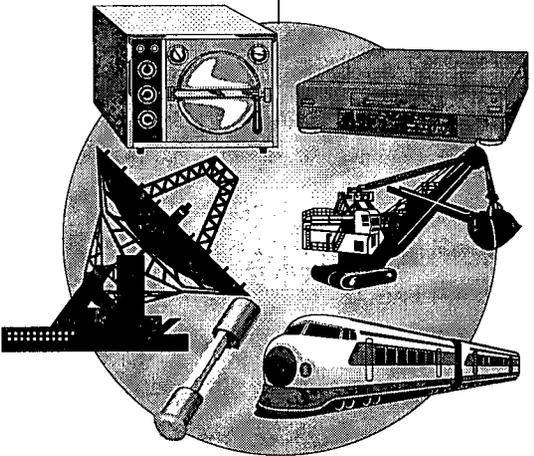
Residential, Commercial and LV Professional Family (equipment connected to the LV mains)	Industrial Family	Traffic, Transportation	Special
<ul style="list-style-type: none"> • <i>Audio, video, audiovisual equipment for domestic entertainment</i> • <i>Broadcast satellite receivers and related equipment</i> • <i>Audio, video, audiovisual lighting control equipment for professional use</i> • <i>Domestic appliances & similar household appliances (including toys)</i> • <i>Lighting (general use)</i> • Alarm systems (without mains connection) • <i>Mains signaling in low-voltage systems</i> • Building automation (also concerns HBES) • <i>Small Power electronics (stabilized power supplies)</i> • <i>Uninterruptible power supplies</i> • Lifts (elevators) • LV switchgear and control gear • LV circuit breakers and similar equipment • LV switches, disconnectors, switch-disconnectors and fuse-combination units • Residual current devices • <i>Electronic switches</i> • Trucks 	<ul style="list-style-type: none"> • Industrial measurement equipment and control equipment • Machine tools (electronic control of manufacturing machinery robots) • Power electronics (converters, rectifiers) • Power electronics (adjustable motor drive) • Industrial electroheat equipment • Electrical welding • Industrial transport equipment (cranes) • Power capacitors • Related filters for power capacitors • LV switchgear and control gear • LV switchgear and control gear assemblies • Proximity switches • AC semi-conductor motor controllers and starters • LV contactors and motor starters • LV control-circuit devices & switching elements – electromechanical control circuit devices • LV multiple function equipment – automatic transfer switching equipment • LV multiple function equipment – control and protective switching devices for equipment • LV ancillary equipment – terminal blocks for copper conductors • Rotating machinery • Fuses LV • <i>Programmable controllers</i> 	<ul style="list-style-type: none"> • Railway applications – EMC, General • Railway applications – EMC, Emission of the whole railway system to the outside world • Railway applications – EMC, Rolling stock, Train and complete vehicle • Railway applications – EMC, Rolling stock, apparatus • Railway applications – EMC, emission and immunity of the signaling and telecommunications apparatus' • Railway applications – EMC, fixed power supply installations • <i>Motorway communications and traffic control equipment</i> • Electrical installations of ships • Maritime navigation and telecommunication equipment 	<ul style="list-style-type: none"> • Medical equipment • <i>Electrical and electronic test and measuring instruments (including scientific instruments)</i> • CATV cable distribution equipment • Hearing aids • Implantable cardiac pacemakers • Digital TV systems – Receiver characteristics • DAB • Radiated emission testing of physically large telecom systems • Private mobile radio trunked and ancillary equipment (analog speech and combined analog speech equipment) • DECT equipment • "Generic" EMC standard for radio communications equipment • ERMES (pager) equipment • GSM 900 MHz/DCS 1800 MHz equipment digital fixed links and ancillary equipment with data rates at around 2 Mbit/s and above • Private paging equipment • Short range devices • VHF FM broadcast • Wide-area paging • Cordless telephone CT2 • Digital Short Range Radio (DSRR) • Wideband data transmission systems (WDS) operating in the 2.45 GHz ISM band • Wireless microphones • Amateur radio equipment • Digital private mobile radio • Trans-European trunked radio (TETRA) • Marine mobile radio equipment
	Utilities	<ul style="list-style-type: none"> • HV Switchgear and control gear/secondary systems • Measuring relays and protection equipment • <i>Measuring, metering and load control apparatus</i> • Telecontrol, teleprotection and associated telecommunication for utilities • <i>HV fuses</i> 	
	Information technology equipment (including telecommunication terminal equipment)	<ul style="list-style-type: none"> • <i>General emission LF</i> • Radio interference characteristics • General immunity • ESD • Radiated radio frequency fields • Fast transient bursts • Surges • Continuous conducted interference • VDU's • ISDN - emission • ISDN - immunity 	

Table 1. Product and Product Family Standards. Standards published in the OJ as of this writing are italicized.

virtually all other wireless data and communications equipment, a type-examination certificate is necessary.

PRODUCT AND PRODUCT FAMILY STANDARDS

The function of a product or a product family standard is to specify the tests to be performed in order to be in compliance with the EMC Directive. They state what product or product types are covered, define the tests that must be done (an ESD test for example), to which ports (ac mains, I/O lines, etc...), the level to which the test is done (1 kV, 2 kV, etc...), and the failure criteria (no loss of function, no unsafe operation, etc.).

For many items "product" and "product family" standards exist or are in process. These include household appliances, information technology equipment (ITE), and audio-visual equipment.

Recognizing that all product standards wouldn't be completed in time for the January 1, 1996 implementation date and that it would be impos-

sible to identify a product standard for every possible product, four *generic* standards were developed:

- Immunity requirements in a residential, commercial, and light industrial environment
- Emissions requirements in a residential, commercial, and light industrial environment
- Immunity requirements in an industrial environment
- Emissions requirements in an industrial environment

If a product or product family standard does not exist for a particular product, the generic standards are to be used.

Table 1 lists all the product family standards that are anticipated. Many are now complete and published in the *Official Journal (OJ) of the EC*, but many are still in the development stage. Those published in the *OJ* as of this writing are indicated. It should be noted that most of the product and product

family standards listed in Table 1 must be tested in accordance with EN 61000-3-2 and EN 61000-3-3 for harmonic currents and voltage flicker. These standards have been published in the *OJ*. Products classified as household appliances, portable tools, or lighting fixtures must now comply; all other electronic products not included in the scope of earlier versions of these standards will have until June 1, 1998 to comply.

BASIC EMC STANDARD

Basic EMC standards describe how a test is performed, the characteristics of the simulator to be used, the test set-up and test levels. Manufacturers should be cautioned not to confuse the *environmental* test levels in the basic standards with the *mandatory* test levels called out in product and product family standards.

Product and product family standards define the tests to be done, but they do not generally describe how to do the tests. That task is left to Basic EMC

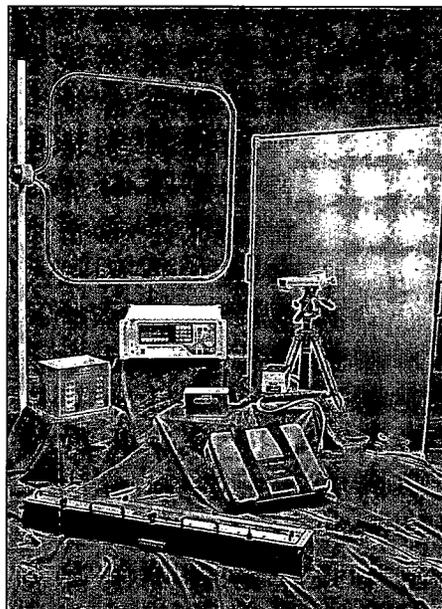
NEED AN EMC IMMUNITY COMPLIANCE TESTER THAT DOES IT ALL AT THE LOWEST COST?

Introducing the CEMASTER™, the ideal fully-compliant test system for those in need of the CE Mark.

- Low Cost - starting under \$12K (US)
- Enables growing companies to afford in-house compliance testing
- Large manufacturers can purchase multiple units for various departments
- Perfect for Test Houses seeking to supplement high capability systems (such as KeyTek is ECAT™ systems)
- Ease of use and portability are ideal features for Rental Companies and Test Houses requiring customer on-site testing
- Standard - 2 year warranty
- Calibration at factory or KeyTek authorized service distributor

Compliance Standards

IEC 1000-4-2	ESD
IEC 1000-4-4	EFT
IEC 1000-4-5	Surge
IEC 1000-4-8	Power Frequency Magnetic Field
IEC 1000-4-9	Pulse Magnetic Field
IEC 1000-4-11	Dips & Interrupts



CEMASTER™

KeyTek test systems are supported through our exclusive worldwide service and calibration facilities.

For detailed product information, please contact KeyTek:



KeyTek
One Lowell Research Center
Lowell, MA 01852-4345 USA

Tel: +1 508 275 0800
Fax: +1 508 275 0850

KeyTek is a division of Thermo Voltek, a Thermo Electron Company. Offices and Service Centers worldwide. KeyTek is a registered trademark and ECAT and CEMASTER are trademarks of Thermo Voltek Corporation. ©Thermo Voltek Corporation. Specifications are subject to change without notice.

Thermo Voltek

COMTEST • KALMUS • KEYTEK • PACIFIC POWER SOURCE
UNIVERSAL VOLTRONICS • VERIFIER

Standards. These basic standards are too numerous to list; however, there are some that are common throughout most product and product family standards:

- ESD (Electrostatic Discharge)
- Radiated RF Immunity
- EFT (Electrical Fast Transient)
- Surge
- Conducted RF Immunity
- Power Frequency Magnetic Fields
- Dip and Interrupt Tests
- Harmonic and Flicker Tests

Basic EMC Standards for immunity are developed by the International Electrotechnical Commission (IEC) and emissions standards are developed by CISPR, an acronym for Comité International Spécial des Perturbations Radioélectriques, which translates to the International Special Committee on Radio Interference.

SUMMARY

Compliance with the EMC Directive is now mandatory for products shipped into the European Union. The methods for compliance are well-defined. A number of standards have been published and others are in revision stages.

Although many manufacturers conduct product tests to be able to affix the CE Mark to their products, many others are still trying to learn what's required. Many of those who have been through the process are now looking at ways to bring some or all of the testing in-house because they realize that testing is an on-going process. All new designs must comply and existing designs will need to be re-tested if any modifications are made to them which might affect their EMC performance. Most importantly, manufacturers can reduce costs and have better control over the process by testing in-house.

Compliant simulators for the pulsed immunity tests and small tests cells for

RF immunity testing have come down in price and are now affordable by most manufacturers. Test systems are available as turn-key packages with easy-to-learn control software operating under MicroSoft Windows™. In short, testing in-house is both possible and affordable for most manufacturers.

MICHAEL HOPKINS has 20 years experience in EMC, specializing in pulsed EMI immunity. He is currently an active member of IEC TC77A Working Group 6, and several ANSI and ESD Association committees and working groups. Michael is a full member of the IEEE and a member of the IEEE EMC Society. His experience with manufacturers of electronic systems, products, and devices includes training in the proper use of EMC test instrumentation, establishing in-house test standards and programs, and assisting in the evaluation of test results. Additionally, he is the author of several papers and articles, and he has participated in numerous national and international seminars as author, speaker, and panelist. Michael is currently Director of Technical Sales at Thermo Voltek, and has held the positions of V.P. of Marketing and V.P. of Sales at KeyTek Instrument Corp., a division of Thermo Voltek. (508)275-0800.

NEED A POWERFUL, LOW COST, AC COMPLIANCE TESTER FOR HARMONIC AND FLICKER MEASUREMENTS IN ONE BOX?

Introducing the TMX Series, a family of fully compliant AC test systems that provide a programmable AC Power Source and AC Compliance tester in a single rack mount unit.

Applications include:

- Test houses looking for low cost, high productivity tools to provide reliable AC compliance testing.
- Large manufacturers requiring AC test tools for BOTH in-house certification and for product development work.
- Rental companies requiring precision and portability for customer on-site testing.



TMX-Series

Other Pacific Power Source products:

- AMX Series high performance linear AC Power Sources from 500VA to 12kVA
- ASX Series space and cost efficient switching AC Power Sources from 1.5kVA to 12 kVA
- G Series switch selectable 1/3 phase, exceptionally high reliability AC Power sources from 6 to 90 kVA.
- MS Series high efficiency, high performance, field parallable AC power sources from 62.5 to 625kVA.

Standard TMX-Series tests include:

- IEC 1000-3-2 Harmonics
- IEC 1000-3-3 Flicker
- IEC 1000-4-11 Voltage Dips and Variations
- IEC 1000-4-13 Harmonics and Interharmonics

For detailed product information, please contact Pacific Power Source:



Pacific Power Source
15122 Bolsa Chica Street
Huntington Beach, CA 92649 USA

Tel: +1 714 898 2691
+1 800 854 2433
Fax: +1 714 898 8076

Pacific Power Source is a division of Thermo Voltek, a Thermo Electron Company. Offices and Service Centers worldwide. ©Thermo Voltek Corporation. Specifications are subject to change without notice.

Thermo Voltek

COMTEST • KALMUS • KEYTEK • PACIFIC POWER SOURCE
UNIVERSAL VOLTRONICS VERIFIER