INTERNATIONAL EMI STANDARDS FOR EDP DEVICES: CISPR B AND ITS IMPACT

With CISPR B virtually assured IEC approval, the international harmonization of EMI standards seems virtually certain — but is it really? Closer inspection of this complex, technical, and politically-charged subject reveals that EMI harmonization still has quite a way to go.

WHY STANDARDS?

From a manufacturer's point of view, standards are one of life's many equalizers. They put worthy competitors on a similar footing, expose those who are weak, and permit competition to take place on a somewhat loftier societal plane.

The regulator's job, and the job of the many organizations that advocate standards development, is to draft standards that (1) clearly define the products covered, (2) are unambiguous, and (3) are compatible with other standards in the field. Even when this is done successfully and a mechanism is in place which ensures that manufacturers will be held accountable for their transgressions, a difficult and sometimes insurmountable problem still remains — harmonization of standards among different jurisdictions.

The difficulty in harmonizing national standards, and why true uniformity is so problematic, is both technical and interpretive. Often, valid technical reasons exist for one country adopting standards that are different from its neighbors. France, for example, has a radio/TV transmitter density approximately 1/3 that of the rest of Europe. This technical difference affects the field strength and frequency response of French domestic receivers which, in turn, affect their design and susceptibility to RFI. A receiver manufacturer selling throughout Europe, therefore, may have to develop different products, each suitably suppressed for the region in which it is marketed, or adopt a single standard appropriate for one jurisdiction, yet overly stringent for others. Either way, the manufacturer pays a penalty for the lack of receiver uniformity.

Honest differences in the interpretation of bilateral or multilateral harmonization efforts also can lead to different national standards. Whereas too much detail in a standards program creates costly compliance for relatively minor technical aspects, too little detail may provide insufficient guidance.

Manufacturers of electronic data processing (EDP) equipment are now witnessing a global effort to harmonize RFI standards which, if successful, will considerably enhance the marketability of EDP products throughout the world. If these efforts fail, however, manufacturers may continue to face costly compliance barriers, operational limitations on their equipment, and marketing restrictions which could severely affect trade of their devices.

RFI STANDARDS FOR EDP EQUIPMENT: A WORLD OVERVIEW

Outside the U.S. and West Germany, few countries have undertaken a comprehensive standards effort to control or minimize RFI from computer and EDP equipment. Although several nations publish a standard dealing with EDP interference, their collective attitude is largely one of benign neglect. When there is a complaint of interference, the government will investigate, propose corrective measures, and monitor the situation (which sometimes includes manufacturer probation). Otherwise, the EDP industry historically has been left alone. It is somewhat surprising that West Germany and the U.S. stand virtually alone among the industrialized nations in espousing an equipment interference policy that prevents rule violations *before* interference has occurred.

West Germany's RFI program for EDP devices has been in effect since 1969. RFI regulations which are drafted and enforced by the FTZ (a division of the Postal Authority), are predicated on the notion that manufacturers, not the government, should determine how to classify EDP equipment. Manufacturers elect the class under which they wish to market their devices, and test (primarily through the VDE) to the technical limits specified for that class; the easier the marketing, the tighter the technical limits.

U.S. regulations, which are drafted and enforced by the FCC, have been in effect for only 5 years. Unlike their West German counterparts, U.S. regulators do not believe manufacturers should be able to elect their equipment classifications. Instead, the FCC has divided the EDP industry into residential (Class B) and commercial (Class A) usage. Every computing device, therefore, is classified based on the user group—residential or business—to which it is marketed.

To further contrast West German and U.S. regulations, Class A devices require VDE testing and FTZ approval in West Germany but may be verified (i.e., self-certified) by manufacturers in the U.S. Class B computing devices, on the other hand, currently require certification in both countries, although a self-certification procedure in West Germany is going into effect. Another major difference is the U.S.'s willingness to recognize exempt categories of EDP devices which West Germany does not. Finally, U.S. technical limits are more liberal, on average, than those imposed by West Germany.

These and a myriad of other definitional, technical, and administrative differences between West German and U.S. RFI laws have, over the years, been compliance "migraines" for EDP manufacturers and vendors. Thus, it was with substantial foresight that the International Electrotechnical Commission (IEC) convened its International Special Committee on Radio Interference (CISPR) Subcommittee B several years ago, to harmonize these and other potentially conflicting national regulatory programs for EDP emissions.

THE CISPR B PROPOSAL

CISPR is a standing committee of the IEC, a voluntary international group which develops technical standards

for electrical and electronic products. A major function of the IEC is to harmonize conflicting or inconsistent standards already in force (or being studied) by its member countries. Although IEC standards are not binding on its members, they are nevertheless followed closely by voluntary agreement. In some regions, (the EEC, for example), IEC standards have the presumption of law. The U.S., Japan, and other industrialized nations, however, regard IEC standards as merely advisory; the task of adopting binding standards on domestic producers and importers is left to the government regulators in these countries.

CISPR Subcommittee B ("CISPR B") is the working group within the IEC which has been studying the matter of RFI from EDP devices. In July 1984, CISPR issued its second draft on the *Limits of Interference and Measurement Methods for Information Technology Equipment.* Designed to harmonize U.S., West German, and other national laws on RFI from EDP devices, the CISPR B draft reads like a model of compromise and fairness. Its major drawback is that, because it is a compromise, it is perhaps too flexible in some areas and is likely to create national or regional discord over RFI control. Additionally, because it is viewed as yet a *third comprehensive* standards program, multinational EDP manufacturers are likely to be further inconvenienced as some IEC members move quickly to adopt CISPR while the U.S. and West Germany move more slowly toward harmonization with their own laws. With CISPR B about to move onto the 1985 agenda of most major industrialized nations, how it compares to U.S. and West German EMI policies will become of increasing importance to multinational vendors.

Definitions. Whereas the FCC defines its program in terms of "computing devices" and FTZ/VDE talks in terms of "EDP equipment," CISPR has come up with a new, perhaps more modern, definition of "Information Technology Equipment" (ITE). While all these terms are essentially interchangeable, ITE is defined broadly enough to clarify some areas that have caused industry confusion.

West Germany, for example, has an EDP law and a Telecom Law, both of which regulate device RFI emissions. Some evolutionary products like computerized switches, however, have become slightly schizophrenic, since it is not clear which law should apply. Moreover, because of the way these two laws overlap, FTZ/VDE regulations treat multiplexors as EDP peripherals but treat modems as telecom devices. FCC Rules consider both devices to be computer peripherals which also is the way they would appear to be treated under the CISPR B proposal.

Another interesting definitional problem involves the treatment of EDP peripherals. Whereas the FCC treats "stand-alone" peripherals the same as CPUs for the purpose of full RFI compliance, VDE does not *require* a VDE radio protection mark or FTZ series test number (i.e., permitization) for peripherals unless they are part of an integrated system. This, however, is an inexplicable anomaly since a peripheral is just as likely (if not more so) to cause RFI than a CPU. Because an interfering peripheral manufacturer is subject to most of the same legal sanctions as the manufacturer of an interfering host, international vendors routinely seek full VDE conformity even for their stand-alone devices. Here, CISPR B seems to side with the FCC by requiring full technical compliance for stand-alone peripherals. This becomes clear upon examining CISPR's definition of ITE, which includes electronic/electronic units or systems "designed to perform functions such as...data transfer, record filing...storage, retrieval and transfer, and reporting of data and/or images." CISPR also defines test units as distinct from host units and provides for the use of simulators when testing "peripherals."

CISPR B is silent on the matter of device exemptions. In the U.S., test equipment, appliances, transportation electronics, certain medical devices, and industrial control systems are exempt from RFI compliance requirements. (Recently, the FCC began a rulemaking to remove the exemption for test equipment and it is speculated that the other categories also may fall in time.) West German regulations, on the other hand, do not recognize any exemptions from its RFI compliance laws for EDP. CISPR's silence on the matter has been interpreted as tacit approval of the West German approach, but IEC members will be left to make their own determinations.

Device Classifications. CISPR B suggests two categories of ITE equipment — Limit Class A and Class B. Class A device limits are more liberal than Class B, and are derived from commercial establishment concerns where 30-meter protection is deemed sufficient. Class B device limits, which are approximately 10 times more stringent than Class A, are based on residential establishment concerns and require 10-meter protections.

At first blush, CISPR's dual classification scheme seems to track closely the FCC's; however, there is one crucial difference. CISPR allows each country to *elect* whether to impose restrictions on the sale or use of Class A devices. The U.S. already has elected to restrict Class A devices to non-residential users. In contrast, West Germany has elected *not* to restrict sales of Class A devices. CISPR's failure to harmonize these marketing differences continues to create problems for Class A manufacturers.

For Class B devices, CISPR recommends that no restrictions be placed on sale or use. Here, the U.S., West Germany, and CISPR are in agreement.

Interference Limits. Table 1 sets forth the CISPR interference limits for radiated and conducted emissions from

Conducted			
	Frequency Range MHz	Limits (dB/uV)	
		Quasi-peak	Average
CLASS A	0.15 to 0.50	79	66
	0.50 to 30	73	60
CLASS B	0.15 to 0.50	66 to 56	56 to 46
	0.50 to 5	56	46
	5 to 30	60	50
Radiated			
	Frequency Range MHz	Quasi-peak Limits (dB (μV/m))	
CLASS A (at 30m)	30 to 230	30	
	230 to 1000	37	
CLASS B (at 10 m)	30 to230	30	
	230 to 1000	37	

Table 1. Proposed CISPR Limits.

Class A and B devices. In general, these limits are tighter than the FCC's and exceed VDE's as well (particularly for Class A terminal voltage). Where ambient noise is a problem, CISPR allows measurements to be taken at closer distances than 10 (Class B) and 30 (Class A) meters.

This latter provision is particularly helpful where user-site or manufacturer-site testing is required. Both FCC and VDE currently provide for special site testing but for different reasons. FCC rules allow user- and manufacturer-site testing for large or customized systems; VDE recognizes user-site testing only for limit Class C devices.

Two other items dealing with interference limits which CISPR B mentions but does not resolve, and which are bound to lead to confusion, are telecom line interference voltage and interference power limits. Several CISPR members have been ardent supporters of telecom line interference standards. Neither CISPR, the U.S. or West Germany take a position on this issue; CISPR member countries, therefore, may go in different directions when implementing their own national laws. On the question of interference power (as opposed to field strength) measurements, CISPR recognizes this as a suitable regulatory option for national test authorities. VDE, for example, requires interference power testing whereas the FCC does not.

Measurement Techniques. In reviewing the CISPR B draft, one immediately is taken by the fact that the measurement procedures are largely a "cut and paste" of existing FCC (Test Procedure MP-4) and West German (VDE 0876 & 0877) test procedures. Nevertheless, some test procedures are new.

For example, CISPR regards a suitable test site to be one where the ambient is 6 dB below the specified limits. A 6 dB margin is not required where the combined source (equipment under test) plus ambient is nevertheless below limits. This is consistent with current FCC and VDE policies. Where such limits are exceeded,however, CISPR requires the following two conditions be met: (1) the ambient must be at least 6 dB below source and ambient combined; and (2) the ambient must be at least 4.8 dB down. Neither the FCC nor VDE provide a similar variation for test site suitability although both permit testing under conditions where the ambient exceeds the 6 dB limits.

CISPR also requires conducted interference measurements to be made in *both* quasi-peak and average detector modes. FCC and VDE procedures, however, require only quasi-peak measurements.

Most other CISPR test procedures follow established FCC or VDE policies. On the appropriate configuration of the test unit, for example, CISPR adopts published FCC policies almost verbatim. This is significant insofar as it makes clear CISPR's intention to define stand alone peripherals as ITE and to require cables and other optional accessories to be included as part of the test unit. It is also important because improper test configurations are the prime reasons devices fail when called in by the FCC. CISPR B, therefore, standardizes a host of sound measurement techniques which have taken the FCC years to flesh out. For example:

- stand-alone CPUs must have all "one-of-each-type" interface ports cabled;
- systems must include one of each type of peripheral that can be connected;
- ITE test units must contain one of each type of module (PC cards, modems, internal I/O devices, etc.) that can be included;
- cables must be moved during testing and lengthened or shortened to maximize emissions;
- if shielded or special cables are used for testing or any other conditions are placed on the use of the equipment, users must be so informed;
- all cable positioning, lengthening, shielding, etc. must be documented in the test report.

Two other measurement techniques are worth mentioning because there is still some international controversy. These involve the use of simulators and dipole antenna requirements. The FCC's policy opposing the use of host simulators has been unequivocal since a July 1983 **Report and Order** on the subject. There, the FCC ruled that simulators may be used only where a host does not exist—that is, where a peripheral has been developed in advance of a technically suitable host. Based on its own empirical data, the FCC has discovered that many devices which pass with simulators were failing with "off-the-shelf" hosts. Notwithstanding, CISPR B adopts the VDE position which allows testing with simulators.

CISPR's antenna requirements also side with VDE and tighten those tolerated by the FCC. Dipole antennas with low standing wave ratios (SWR) have been demonstrated to provide the most accurate field strength readings. FCC test engineers rely on this type of antenna, but FCC Rules do not explicitly require their use. As a consequence, U.S. manufacturers using antennas with high SWR's may be unknowingly obtaining inaccurate readings.

WHERE HARMONIZATION WILL WORK — WHERE IT WON'T

Because IEC standards are, by design, voluntary international accords, true harmonization is difficult. Where trade treaties or agreements exist, as in the EEC, standards harmonization may be enforceable under international law. Where they do not exist, uniform technical standards can only be achieved through cooperation among nations who share mutual economic goals. In either case there may be valid technical and political reasons why standards, no matter how "agreed upon", vary from country to country.

The immediate problem confronting EDP manufacturers, therefore, is how to avoid the rapidly approaching "tri-lemma," where non-harmonized FCC, VDE and CISPR technical standards govern how EDP devices are sold in different parts of the world. If the U.S. and West Germany can set aside political differences and agree to conform their RFI standards to CISPR, the problem will quickly resolve itself — if not, manufacturers will continue to be the unwitting victims of relatively minor technical disagreements which may have the potential to escalate into genuine international trade disputes.

European Economic Community (EEC). The EEC, established in 1970 by the Treaty of Rome, provides for the cooperative economic development of the European nation states. Article 100 of the Treaty requires the harmonization of national standards so that equipment

manufactured in one will *de facto* conform with the national standards and requirements of other EEC members. This article has been invoked over the years to prevent the erection of trade obstacles. Perhaps the most relevant example was the "Low Voltage Directive" in 1973 which harmonized the various electrical safety codes throughout Europe.

Under existing EEC practice, IEC and other technical standards are harmonized by the member states through voluntary regional committees. CENELEC is one of the better known European standards committees and deals with matters involving electrical safety. When CENELEC or another regional committee undertakes harmonization work, the members abide by a so-called "standstill" rule, meaning that all national committees cease standards-making until the regional committee's harmonization work is completed. Once the committee's work is completed and a favorable vote is reached among the members, the EEC publishes a harmonization directive in its Official Journal which the members have 6 months to adopt in the context of their own national laws; any national standards which fail to conform to the EEC directive are unenforceable under the treaty. Through this process, a European manufacturer is assured that any device produced in accordance with EEC-harmonized technical standards will be presumed to conform to the national laws of each EEC member.

EEC policy also provides that where a harmonization standard does not yet exist, as in the case of RFI from EDP devices, compliance with an equivalent IEC standard is sufficient to establish a presumption of conformity. Thus, a member state which adheres to an IEC standard—e.g., CISPR B— can provide a manufacturer with a conformity mark or certificate of conformity which must be recognized by all member states.

Under this scenario, West Germany, for example, could not refuse entry to a device manufactured in, or approved by, a member country provided it had been properly tested and found to comply with the CISPR B limits. Although West Germany must permit entry to such a device, it could refuse to issue its own conformity mark or certificate if the device did not meet West Germany's own technical standards and administrative requirements.

EEC practices also deal with the potential for standards abuse by national certifying bodies (e.g., VDE). In the case of electrical safety, an EEC directive requires certifying bodies to provide a report on product conformity even where a product does not conform to that administration's standards, as long as it conforms with the IEC-adopted (or recognized) standards. Thus, a manufacturer could fail VDE testing and not get a VDE conformity certificate, yet still obtain a VDE report which could be used to market the device within West Germany.

EDP manufacturers are likely to witness a situation involving RFI compliance similar to that experienced in the area of electrical safety, where each EEC country develops its own code and conformity mark, but products move freely among nations. Dealers and vendors are required to recognize that all such marks and national jurisdictions cannot adopt standards for quality or performance which might abridge the free movement of technically conforming goods. Any member state which restricts the marketing of a product "presumed to conform" would have the burden of proof to show why such restriction is lawful. Aggrieved manufacturers would be able to obtain preliminary relief from the Court of Justice of European Committees (Article 177 of Treaty) or the EEC itself (Article 169 of Treaty).

Non* EEC *Countries. Outside the EEC, manufacturers "presumed to conform" to CISPR will not have it so easy, since there is no international Court of Justice on which to rely. Here, manufacturers will have to be ever cognizant of the technical regulations, administrative procedures, and national policies governing RFI compliance for EDP and similar devices. International sanctions for standards abuse will rarely be possible. Indeed, unless the non-harmonized standards of one country create treaty or trade accord violations with another, even obstructionist policies will not likely be actionable.

Nations who are members of the IEC will require time to harmonize their national laws. In the U.S. for example, there is no assurance that IEC/CISPR B standards will ever replace the Part 15 Rules and test procedures which have been in place for nearly 5 years. The FCC's position is that it will be up to the industry to seek rule changes that will harmonize Part 15 with CISPR. Some FCC officials even believe that the more lenient FCC standards will continue to be supported by U.S. manufacturers who care only about the domestic market for their devices. These manufacturers, it is reasoned, will not want to assume the

	FCC	FTZ/VDE	CISPR B
DEFINITIONAL			
Scope	Computing Devices	Electronic Data Processing (EDP)	Information Technology Equipment (ITE)
Stand-Alone Peripherals?	Yes	No*	Yes
Modems?	Yes	No*	Yes
Exempt Devices	test equipment, appliances, transportation electronics, industrial control systems, certain medical devices	None	None Specified (may be imposed by individual countries)
DEVICE CLASSIFICATIONS			
Classes	A & B	A, B & C	A & B
MARKETING RESTRICTIONS			
Class A Devices	May be sold *only* to non-residential users	None	Optional
Class B Devices	None	None	None
Class C Devices	N/A	Device is restricted to approved site	N/A
TECHNICAL			
Conducted Measurements	Quasi-peak	Quasi-peak	Quasi-peak and Average Mode
Radiated Measurements:			
Class A	at 30m	30m	30m
Class B	at 3m	10m	10m
Interference Power Test	Not required	Required	Optional
Testing with Simulators?	No	Yes	Yes
CPU Testing	Fully Loaded ("one-of-each-kind" ports and option cards)	Not Clear	Same as FCC
Compliance Testing Performed By Private Laboratories	Yes	Class A & C: No Class B: Yes*	Not Specified
Antenna SWR Requirements	None	Under 2:1	Under 2:1
OTHER			
Sampling Formula	"Statistical Sampling"	Not Clear	80/80 Rule

Table 2. A Comparison of U.S., West German and Proposed CISPR B Regulations.

*See text for explanation

"extra cost" of compliance merely to achieve standardization for international markets which they have no intention of serving.

Even if one were to assume, under a best possible scenario, that all IEC members adopt, without disagreement, the technical limits and test procedures set forth in CISPR B, there still exists a host of issues on which countries are likely to deviate. There will be a cost to manufacturers and their customers where these differences impinge on a manufacturer's opportunity to enter new markets.

Problem Areas for the Future. The following are some of the areas where national jurisdictions are likely to deviate, even in a "harmonized" environment.

Technical Limits and Test Procedures. Technical RFI limits are relatively easy on which to agree because they tend to be static. Devices are required to meet frequency ranges. The methods of measuring devices to determine whether those objectives are met are more difficult issues on which to agree. In reviewing the history of the FCC's Part 15 program, it is interesting to note that measurement procedures have been the subject of more formal rulings than any other aspect of the program.

West Germany already has hinted that it will not modify its technical limits to conform to CISPR. Because of existing treaty provisions, however, this will not necessarily affect devices manufactured or certified to conform by other EEC members. West Germany obviously believes that the limits which it has previously adopted together with VDE conformity have created a valuable image of technical assurance which it wishes to maintain. As noted, the U.S. also may not conform to CISPR B technical limits unless the domestic industry urges for harmonization.

Regarding test procedures, CISPR B contains some obvious flexibilities which are likely to surface in the form of different national test requirements. Examples already mentioned are CISPR's recognition of an interference power test as a permissible procedure (West Germany requires this test but the U.S. does not) and the use of simulators for testing peripherals (which the FCC has opposed vigorously over the years). Because of the obvious difficulty in providing too much detail in a draft of this type, national differences also can be expected to surface over such mundane concerns as cable configurations, testing of peripherals, and telecom line interference testing.

Definitions. Definitional variations among CISPR members are likely to be a major stumbling block to standards harmonization. Troublesome terms which already have emerged under FCC and VDE programs are "peripheral", "modem", and "multiplexor". CISPR does not address the point; instead, it contributes new definitions like "ITE", "test unit", "host unit" and "module". As a consequence, it is not clear how certain hybrid or advanced devices are intended to fall within the RFI standards program developed by CISPR.

Another potentially thorny issue involves exempt devices. CISPR is understandably silent on the matter, leaving it instead to each jurisdiction to decide for itself. Here again, different regulatory approaches taken by CISPR members for legitimate technical reasons could undermine standards harmonization for certain types of EDP devices.

National Testing. One of the most politically-charged issues surrounding standards harmonization is test administration perogatives. Here, again, CISPR is understandably silent. In the U.S., the FCC accepts test data from qualified test facilities anywhere in the world. VDE, on the other hand, historically has not accepted test data unless performed by or under the direct supervision of, VDE test engineers. This policy is changing, however, at least with regard to Class B devices.

France and some other EEC members are known to be leaning towards the U.S. approach because of its tendency to speed up the compliance process. Significantly, device certification in the U.S. takes 30 to 60 days, whereas in West Germany it takes a minimum of 6 months. Governmental "red tape" in the form of national testing delays, therefore, can be a major stumbling block to successful product entry where timing is important.

Administrative and Marketing. Perhaps the greatest variations under a harmonized RFI compliance program will occur in the areas of program administration and marketing restrictions. Here, CISPR is quite flexible, providing little details on what the certification application process should involve (e.g., required submissions, fees, samples, etc.); whether government permits are required for marketing ITE; or what labeling or other information should be required for end users.

In the area of marketing and use restrictions, CISPR speaks only in general terms — Class A equipment *may* be subject to sale and/or use restrictions while Class B *should not.* Unanswered, however, are a host of sale/use issues such as trade show demonstrations, beta testing, temporary permitizations, etc. Different nations can be expected to take differing approaches here, just as the FCC and FTZ/VDE have in the past.

Rx for Manufacturers. As the foregoing analysis demonstrates, international standards harmonization may be something of a misnomer. Manufacturers intent on exploiting EDP market opportunities here and abroad are advised, therefore, to establish their *own* internal harmonization efforts through experienced consultants and standards engineers. Groups familiar with the pitfalls of foreign compliance can be of substantial assistance to manufacturers in avoiding unnecessary product redesign and testing, and the costly effects of an uncoordinated compliance program. EDP manufacturers, vendors, and consultants who keep abreast of national standards activities in international markets will maintain a significant edge on those who fail to understand the commercial fact of life, that technical compliance is a necessary first step towards international marketability of technical products.

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