VDE TESTING IN THE UNITED STATES

A thorough understanding of the VDE EMI testing process in the U. S. will expedite approval for international marketing.

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The Verband Deutscher Elektrotechniker (VDE) test team first performed an on-site qualification test in the United States for electromagnetic emissions from a computer product in the spring of 1978. Since that beginning, regular tests have been performed by the VDE for many U. S. manufacturers at various locations, including certain independent test laboratories within the United States.

Type acceptance testing for VDE for electromagnetic interference (EMI) includes the technical testing procedures and associated paperwork. The testing procedures are comprised of monitoring the product under test for conducted emissions on external wires, and for spatially radiated emissions from hardware systems (cabinetry plus cables). The paperwork for the VDE process can be substantial and includes an initial application to the VDE, the completion of the test report, including system description and documentation of the suppression devices employed, and the final submittal to the German Post Office for the system license.

INITIAL PAPERWORK

The VDE application process (Figure 1) begins with a manufacturer determining that the particular product would sell in the European market. If the manufacturer operates an appropriately equipped open field site, where measurements have been taken by the VDE (see below), and he wishes to pay the full travel and per diem expenses of having the VDE come to the United States specifically to test the unit, he may make application directly to the VDE-Prufstelle for a visit to the site. However, a manufacturer may desire to have one of the independent electromagnetic compatibility (EMC) test labs, who have the VDE visit on a regular basis, coordinate the type acceptance. The manufacturer may request that the independent EMC lab make application at least thirty (30) days in advance of the scheduled date of the VDE's regular visit. (Some manufacturers request their West German subsidiaries to make the application directly to the VDE, and have the actual testing done in the U. S. by the appropriate EMC lab.)

Since dates for the VDE visits are generally scheduled by some independent EMC labs as long as a year in advance, the opportunity for a manufacturer to be scheduled at the independent EMC lab on a timely basis improves substantially, enabling manufacturers to easily find a convenient "window" corresponding to their product announcement and "roll-out" schedule.

Some independent EMC labs handle a number of VDE applications on a regular basis and provide the manufacturer with invaluable assistance in preparing the application. (The EMC lab is empowered by the VDE and the manufacturer to make the actual application.) For example, a simple application form by one EMC lab has enabled many manufacturers to take advantage of the VDE's "shorthand" application which precludes the need for submitting as many as four copies of circuit diagrams and other complicated procedures.

Upon receipt of the correctly completed application, the VDE returns

Manufacturer determines if product would sell in Europe

Independent EMC Lab (visited by VDE) contacted

Preliminary Application Forms completed by Manufacturer

Application Form submitted by EMC Lab

Pretesting at the EMC Lab

Application Confirmation returned to the EMC Lab

Testing Performed at the US facility by the VDE engineer
Paperwork is completed

Test report is written and Gutachten given on equipment

Manufacturer requests License Number from the German Postal Authorities

Customer receives License

Figure 1. VDE Application Process. (Testing with an Independent U. S. EMC Laboratory.)

See advertisement on page 310.

the Antragsbestatigung (confirmation of application) to the independent EMC lab.

Prior to the actual VDE testing visit, many manufacturers take advantage of the opportunity to pre-test the unit at the independent lab's open field site. Trouble-shooting while the VDE engineer is present is generally not a cost-effective procedure. Pre-testing can be a cost-saving precaution, as it enables the independent EMC lab (particularly those which do not market filters, etc.) to recommend less expensive suppression techniques.

TECHNICAL TESTING

The VDE testing in the U. S. is performed at open field test site laboratories which are staffed with personnel and equipment capable of testing to the appropriate West German EMI/RFI specifications. Initially, the VDE test teams brought their own test equipment when testing in the U. S. Now, because of the physical problems with shipping equipment around the world, the high quality of the equipment at the U. S. labs, and because of the demand in the laboratory in Offenbach, the VDE test teams use the test equipment in the laboratory where the tests are performed. The test equipment used by the VDE team must comply with VDE 0876 (Part 1)—"Equipment for the Measurement of Radio Frequency Interference, Radio Frequency Interference Measurement Equipment with Quasi-Peak Indicator and Accessories."

The first time a laboratory is utilized by the VDE, technical measurements on the quality of the site are executed, per VDE 0877 (Part 2)—"The Measurement of Radio Frequency Interference, Part 2: Measurement of RFI Field Strength." For future reference, the ambient levels of "extraneous interference" are also recorded and noted.

In general, a typical product can be tested to the VDE 0871 specification in one day. Of course, the larger the system, the longer it will take to test it. Very large computer systems take as long as 3 to 4 days.

A typical VDE test at one lab proceeds as follows: The customer usually arrives at the laboratory at 7:30 A.M. and has an hour or so to get his equipment operational before the VDE arrives at about 8:30 A.M. The

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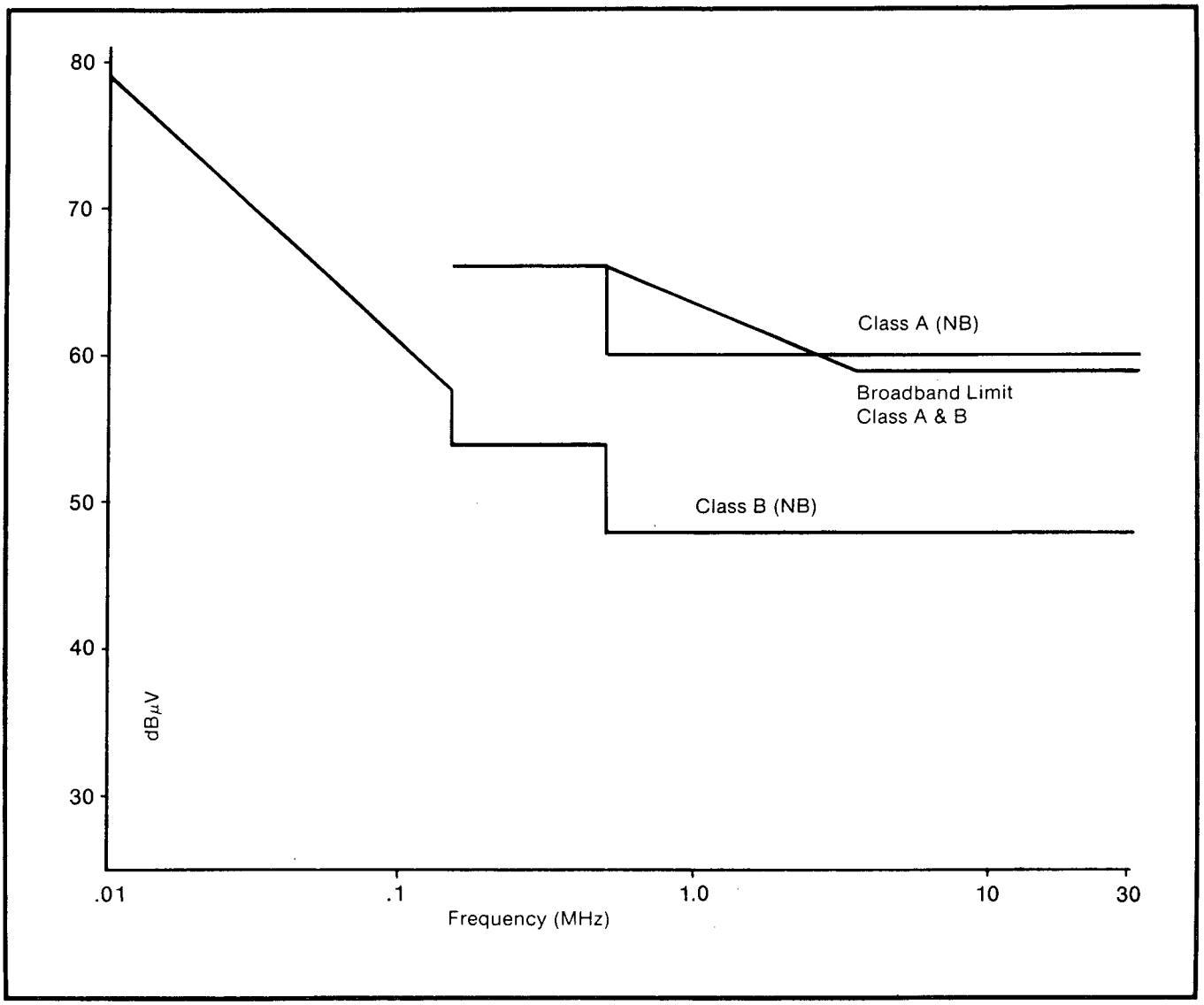

Figure 2. VDE Conducted Emissions, 50 Ohm LISN.

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VDE test team begins the testing by making a visual inspection of the test setup for compliance with VDE 0877, Part 2. This includes a check to note that all data cables are laid out for 1.5 meters horizontally at a minimum height of 0.8 meters for table-top equipment and 0.1 meter for floor-mounted equipment. The VDE team also verifies that every cable interface on the equipment has a cable attached to it. Unlike the current FCC practice, the cables may be open-ended. They may also be terminated in an appropriate impedance, or have a piece of peripheral equipment on the opposite end. The decision is up to the manufacturer, but all cable-ports must have cables attached.

The actual testing usually begins with a radiated emission scan from 30 MHz to 470 MHz using a quasi-peak adapter on a spectrum analyzer or a receiver with quasi-peak capability. Using a 10-meter horizontal antenna distance and a fixed 3-meter vertical antenna height, the highest emanations are recorded. The antenna is then rotated from a vertical position to a horizontal position (or, vice versa), and the highest emissions are checked again. Searching through the data, any points close to the 30-meter limit for Class A products or the 10-meter limit for Class B products are watched as the equipment is rotated via a turntable. Finally, if there are any points from Class A equipment over the 30-meter limit, they are double-checked by moving the antenna to a 30-meter horizontal distance.

The second step in the radiated emission analysis is to scan the 470-1000 MHz range. A 10-meter horizontal distance is used for both Class A & B equipment. The antenna height is varied from 1 to 4 meters in height. The measured emissions are compared to the appropriate A or B limit.

Generally, the third step is to check the magnetic field radiated emissions from 10 kHz to 30 MHz, which is usually done at a 3-meter horizontal antenna distance with a loop antenna whose bottom is 1 meter above the ground. If there are any emissions over the specified limit, the antenna is moved to a 30-meter horizontal antenna distance and the highest readings compared to the limit at 30 meters. (Class A equipment may even be checked at 100 meters.)

The fourth step is to check the conducted emissions on the 50 Hz

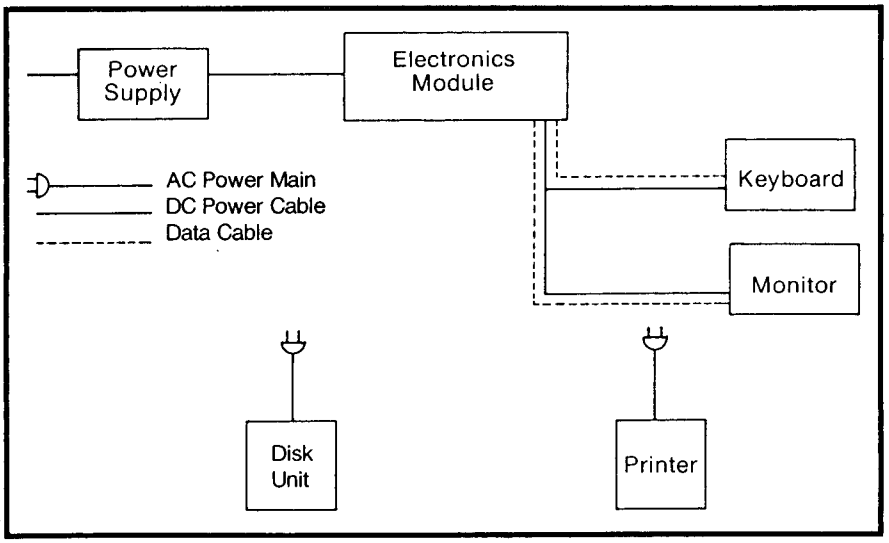

Figure 3. Blockschalbild (Block Diagram) Approach.

power-line using a quasi-peak receiver and a 50-ohm/50-μH line impedance stabilization network (LISN). (Figure 2) The emissions are compared to the appropriate narrowband or broadband conducted limit either for Class A or Class B. If an emission is found within 5dB of the limit, the unit is ungrounded by placing a 1.5 milli-Henry choke in the ground wire of the unit, and re-tested.

After testing, a series of photographs, indicating appropriate suppression devices employed, etc., are taken by the VDE test engineer. These become a part of the report.

SPECIAL TESTS

If an unshielded power cord between units in a system or an unshielded data cable is used, and is longer than two meters, then a conducted emission test is performed on the cable, using a capacitive probe of 1500 ohms, e.g., a Schwarzbeck Tastkopf 9416. The results noted from the receiver, plus a 20dB correction factor, are compared to the appropriate narrowband or broadband limit.

For a broadband source, the absorbing clamp measurement may also be made. The absorbing clamp is moved along the power-line until the highest emission is detected. The measured RF power is compared to the allowed VDE limit at each significant frequency.

FINAL PAPERWORK

Upon the completion of the testing, the final paperwork is completed by the VDE and the manufacturer, with the assistance of the independent EMC lab. The VDE uses the Blockschalbild (block diagram) approach (Figure 3), enabling the central processing unit (CPU) and each of the peripherals to be handled in an individual, yet syncopated, fashion. If discrete filters are employed, the VDE will ask for the schematics of these units. It is also important to have the manufacturer's stated component values of these units and their part numbers.

The VDE engineer returns to Offenbach with the completed package and produces the test report. This takes the form of a Gutachten (expert opinion) and the Unterlagen (attachments) which are the photographs of the unit and any appropriate schematics of discrete filters. This is mailed to the independent EMC lab who, in turn, forwards the package to the manufacturer with instructions on how the firm may apply to the Deutsche Bundespost, Zentralamt fur Zulassungen des Fernmeldewesens (ZZF) for the appropriate license or permit number. At this point, the customer signs the Schiedsvertrag (arbitration contract) and submits the paperwork package to the ZZF with a cover letter. Marketing can begin immediately, although the formal license from the Post Office may take as long as 8 weeks. ■