

VDE/FTZ INTERFERENCE REGULATIONS - WEST GERMANY

RFI limits and measurement procedures are essentially the same for the VDE, FCC and many other countries.

HERBERT MERTEL, EMACO, INC., SAN DIEGO, CA

ITEM has presented a review of the West German RFI specifications since 1975. Each article was somewhat redundant with the previous one. Consequently, only annual updates were provided for awhile. However, frequent requests from old and new readers for a comprehensive summary of VDE/FTZ RFI requirements prompted this article.

Because of space limitations, ITEM cannot present all details. This article, though, will answer questions most frequently asked. Generally, ITEM readers are familiar with FCC Part 15, Subpart J requirements and the FCC Measurement Procedure, MP-4. What is not generally known is that the RFI limits and measurement procedures are essentially the same for the VDE, the FCC and most other countries, since the limits and procedures are derived from the work of the International Special Committee for Radio Interference (CISPR).

FTZ and VDE

Contrary to popular belief, the VDE is not a regulatory agency of the West German government. The regulatory agency is the Deutsche Bundespost, the German Postal Service. The International Telecommunication Union Treaty of 1947 is the foundation of the "Law for the Operation of High Frequency Apparatus," dated 9 August 1949. This is generally known as the "H Fr G" law and it assigns responsibility of interference control to the Minister fuer das Post und Fernmeldewesen. The Telecommunication Central Office, or FTZ, Referat S-24, Am Kavalleriesand, D-6100 Darmstadt, is the administrative office, and handles all regulatory matters related to RFI. In 1982, the licensing and permit procedures for RFI mat-

ters were assigned to a new office: Deutsche Bundespost, Zentralamt für Zulassungen des Fernmeldewesens (ZZF), Referat: T-4 (for transmitters and HF equipment) Talstrasse 34-42, D-6600 Saarbrücken. The VDE Testing and Certification Institute is the recognized testing agency of the FTZ.

The RFI-related VDE specifications are prepared by a committee of the German Electrotechnical Commission (DKE) under the umbrella of the Society of German Electrical Engineers (i.e., the VDE) and the German

Standards Institute (DIN). The VDE specifications are advisory only. They become legal documents when they are referenced in a German Law.

The interrelationships of VDE specifications, individual permits, general permits and the H Fr G Law are shown in Table 1. It should be observed that Vfg 1046/1984 updates 1115/1982 and reaffirms the limit B of VDE 0871 from 10 kHz to 1000 MHz. The H Fr G Law stipulates that a general permit shall be issued if the equipment meets the applicable limits

Law (Postverfügung)	Equipment Type	Test Procedure
Individual Permits Vfg 523/1969 Limit A	- Individual Permits of HF Equipment and Computers with FTZ-Series Test No. Limit A of VDE 0871	- VDE 0871 Limit A
Individual Permits Vfg 523/1969 Limit C	- Individual Permits of HF Equipment without FTZ Series Test No. Measured at place of operation	- VDE 0871 Limit C see VDE 0871, Sec. 8
General Permit Vfg 1044, 1984 & German RFI law, Part 1, No. 38 of 31 August 1984	- Household and Industrial Equipment with Broadband RFI Sources - Fluorescent Fixtures	- VDE 0875 Part 200 Limits of 82/499/EEC - VDE 0875 Part 200 Limits of 82/500/EEC
General Permit Vfg 1046/1984 Limit B	- Computers and HF Equipment	- VDE 0871 Limit B
General Permit Vfg 339/1979 Limit B	- Infrared Equipment	- VDE 0871 Limit B
General Permit Vfg 478/1981 Vfg 479/1981 Limit B	- TV and Radio Receivers	- VDE 0872
General Permit Vfg 604/1977 Vfg 605/1977 Limit B	- RFI Measuring Sets and Measuring Receivers	- VDE 0871
Vfg 631/1979 Limits A & B	- Private Wire Systems, Modems, etc., TV Attachments	- VDE 0871
General Permit Vfg 694/1979	- Motor Vehicles	- VDE 0879 Part 1
Vfg 1114/1981 Limit B	- Traffic Light Systems - Ultrasound Message Systems - Master Antenna Systems (Vfg 631 and 1114 are related)	- VDE 0871

Table 1. The FTZ RFI Laws and VDE Test Procedures.

of VDE 0871, VDE 0872 and VDE 0875. "General Permit" means that the equipment can be sold and used without further restrictions. The proof of compliance is either a self-certification statement by the manufacturer (importer) or the "Radio Protection Emblem," issued by the VDE Testing and Certification Institute, that must be affixed to the equipment for "Limit B" of VDE 0871 or "Limit N" of VDE 0875. For the relaxed "Limit A" requirements of VDE 0871, the equipment must be registered with the FTZ upon each sale. It is important to realize that the VDE specifications show the limits and the measurement procedures. However, regulatory RFI requirements are given in FTZ laws.

THE "A" LIMIT

The demonstration of compliance with the relaxed VDE 0871 "A" limit requires certain steps.

- Application is made to the VDE Testing and Certification Institute, Merianstrasse 28, D-6050 Offenbach, Tel. (611)83061, Telex: 4152796 (VDEP-D).
- The VDE tests the equipment for compliance.
- The VDE issues a Certificate of Conformity to the FTZ.
- The FTZ issues a Certificate (Urkunde) with a "FTZ Series Test Number."
- This FTZ number must be shown on the equipment.
- After the equipment is installed, a postcard must be sent to the FTZ, reporting the location of the equipment.

The "A" limits are applicable to 150 kHz to 1,000 MHz, as shown in Figure 1. The radiated limit below 30 MHz is $34\text{dB}\mu\text{V}/\text{m}$ at a distance of 100 meters.

THE "B" LIMIT

The demonstration of compliance with the "B" limit of VDE 0871, or with any other of the Special Postal Laws, has been

made easier with the Postal Law: Vfg. 1046/1984. This law allows self-certification and compliance labeling by the manufacturer or importer. As an option, the equipment can also be submitted to the VDE for RFI testing if the manufacturer desires the use of the VDE Radio Protection Mark for marketing purposes. The procedure for self-certification is as follows:

The manufacturer performs the test or has it performed by an independent test lab to verify that the equipment tested complies with the "B" limits for the following:

- Power-line conducted RFI
- Radiated RFI
- Conducted RFI power on all cables, which may be measured in lieu of radiated RFI if the equipment is not larger than one meter including stretched out signal cables.

The manufacturer must label his equipment as follows (in German and on the equipment or on a Certificate):

Hiermit wird bescheinigt, dass der Computer Model PC 10 in Übereinstimmung mit den Bestimmungen der Vfg 1046/1984 funk-entstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

PC Computer Company

The translation of this label is:

We hereby certify that the Computer Model PC 10 complies with the RFI Suppression Requirements of Vfg. 1046/1984. The German Postal Service was notified that the equipment is being marketed. The German Postal Service has the right to re-test the equipment and to verify that it complies.

The manufacturer sends a letter to:

Deutsche Bundespost
ZZF, Referat T-4
Postfach 3050
D-6600 Saarbruecken
West Germany

stating that the equipment will be marketed in West Germany.

The manufacturer may now market the equipment.

The ZZF will perform sampling tests to verify compliance with the "B" limits.

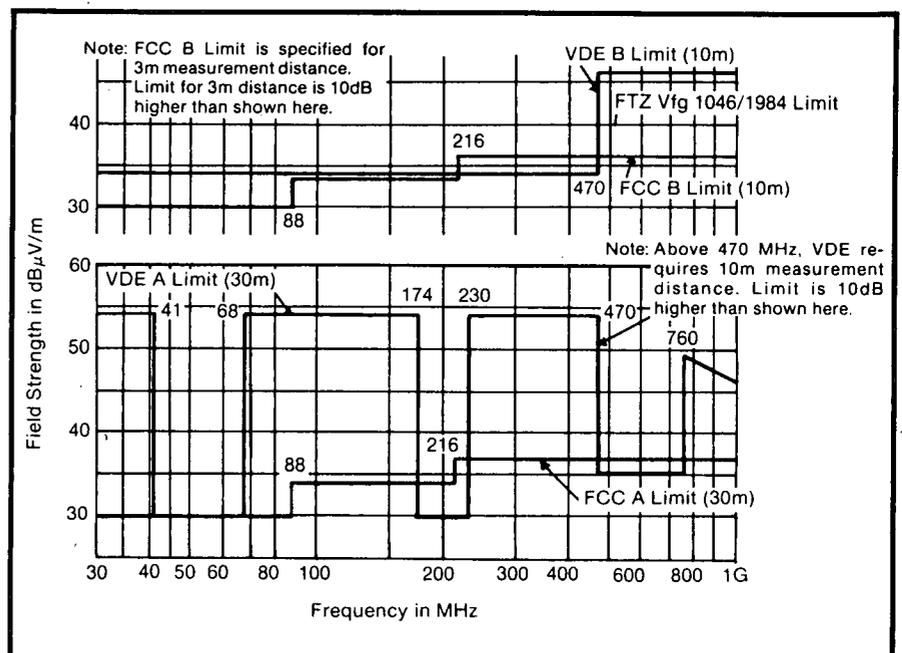


Figure 1. Comparison of FCC and VDE Radiated RFI.

If the sampling test reveals non-compliant equipment, the manufacturer will be notified, or the equipment may be confiscated, or the user will be told to cease operation.

The "B" limits are applicable from 10 kHz to 1,000 MHz, as shown in Figure 1. Even though VDE 0871 implies that compliance below 150 kHz is only recommended, the FTZ Vfg. 1046/1984 Law mandates compliance with the "B" limit (from 10 kHz to 1,000 MHz) for equipment for which the manufacturer desires a General Permit. The "B" limit is also required for equipment which is freely portable, such as printers, terminals, typewriters, word processors, personal computers, home computers, ultrasound diagnostic equipment and microprocessor-controlled equipment. The RFI power measurement is no longer mandated. However, the RFI power may be measured in lieu of radiated measurements on the power cable for equipment such as electronic typewriters. For this RFI power measurement, the power cable must be lengthened to 6 meters so that the absorbing clamp can be moved along it for determination of the standing wave maximum. The RFI power shall not exceed 33dBpW at 30 MHz and increases linearly to 43dBpW at 300 MHz. This limit is equivalent to the VDE 0875 "N" limit minus 12dB since it is for narrowband RFI. The different RFI power limits are shown in Figure 2. The radiated RFI below 30 MHz may be measured at 3 meters (instead

of the 30 meters required in VDE 0871). This 3 meter limit is shown in Figure 3.

In 1986, the FTZ will relax the radiated limits at narrow bands in the 15 kHz to 140.625 kHz to accommodate CRT monitors and switch-mode power supplies. In lieu of the limits shown in Figure 3, the limit will be relaxed to 114dB μ V/m at 3 meters or 65dB μ V/m at 30 meters; however, only at the following frequencies:

- 15 to 19 kHz
- 30 to 38 kHz
- 45 to 47 kHz
- 78.125 kHz \pm 600 Hz
- 93.750 kHz \pm 700 Hz
- 109.375 kHz \pm 800 Hz
- 125.000 kHz \pm 900 Hz
- 140.625 kHz \pm 1,000 Hz

These frequencies include the TV raster frequencies of 15.625 kHz and all harmonics up to the 9th.

If the equipment does not comply with the 3 meter limit, the equipment may be re-measured and compared to the 30 meter limit of 34dB μ V from 10 kHz to 30 MHz. If the equipment has unshielded data cables, the RFI voltage on all wires must be measured. The permissible voltage limit is "B-limit plus 14dB."

It must be noted that if commercial equipment cannot comply with the "B" limit, it needs to comply only with the "A" limit for commercial applications, but each equipment or system sold requires registration with the ZZF, and subsequent reporting of the location for each installed "A" limit equipment.

RFI LIMITS FOR SPECIFIC EQUIPMENT

The FTZ also has additional laws for equipment and systems that are connected to Post Office owned telephone lines or other public and private wire networks. Most RFI limits are the same as for the "B" limit of Vfg. 1046/1984 and VDE 0871.

In the FTZ Law 1114/1981, the limits are somewhat tighter. The radiated limit from 30 MHz to 1,000 MHz is 20dBpW into a resonant dipole. This is measured by the substitution method. The RFI power limit on all conductors shall not exceed 20dBpW from 30 to 300 MHz when measured with the absorbing clamp. In the future, these special purpose equipment RFI limits will be listed in VDE 0878, Part I. The document is still in the review cycle.

RFI LIMITS FOR ELECTRICAL EQUIPMENT

The VDE 0875 Part I/11.84 is applicable for household and industrial electrical equipment which does not utilize frequencies above 10 kHz. The document is harmonized with 82/499/EEC and CISPR 14. The power-line conducted limit is shown in Figure 4, as measured with a 50 μ H/50 ohm LISN. For hand-held tools and equipment above 700 watts, the limits are increased from 4 to 14dB, depending on the equipment types. Instead of radiated RFI, the RFI power is measured on the power cord with the absorbing clamp. The limit is 45dBpW at 30 MHz and increases to 55dBpW at 300 MHz, as shown in Figure 2.

PERFORMANCE OF RFI MEASUREMENTS

The RFI measurements are performed in the same way as for FCC Part 15 J, MP-4 and ANSI C63.4; however, some key deviations do exist.

The RFI voltages are measured with the ground safety wire connected and also isolated. This is specified in VDE 0871, Revision A. When RFI voltages are less than 5dB from the limit, the entire frequency range must

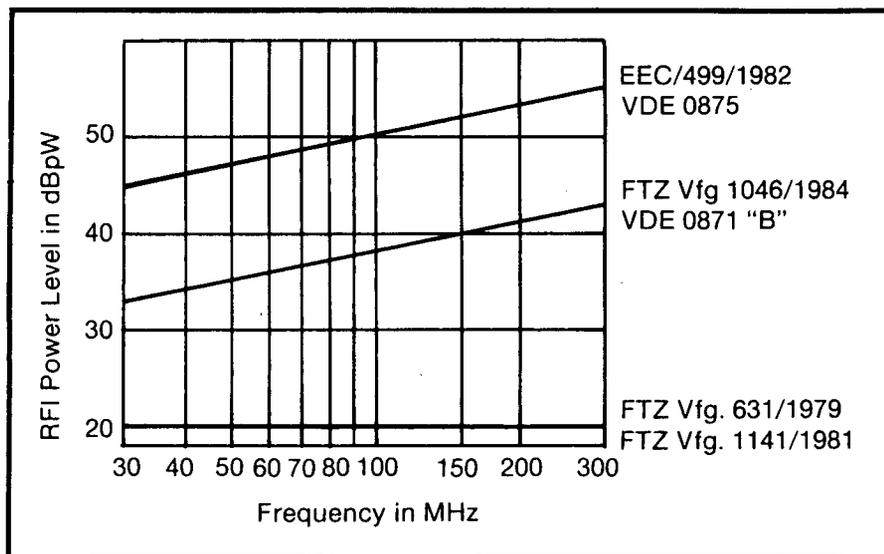


Figure 2. RFI Power Limits for Various Equipments Measured with Absorbing Clamp.

be re-measured with a 1.6mH choke connected in series with the ground safety wire.

The radiated RFI test setup is specified in VDE 0877, Part 2. Cables connected to an equipment under test must be arranged horizontally for 1.5 meters; at a minimum height of 0.8 meters for table-top equipment; and 0.1 meters for floor-mounted equipment. Beyond the 1.5 meter distance, the cables are routed vertically to the ground and may be routed under the ground plane. If the cable is shorter than 1.5 meters and cannot easily be extended by the user, the test is performed with the supplied cable.

The test site attenuation is calibrated in the same way as for the FCC requirements. However, the antenna factor and cable loss is subtracted from the measured attenuation to give a normalized site attenuation. During the test, fixed antenna heights may be used if the measurement distance is at least 10 times the maximum dimension of the equipment under test. For example, if the equipment under test is 30cm wide and the measurement distance is 3m, a fixed antenna height can be used. If the equipment is larger, the antenna height must be varied from one to four meters. Both horizontal and vertical antenna polarizations must be used. The maximum radiation potential of the equipment under test must be measured. If this requires rotation of the equipment under test, the equipment must be placed on a turntable.

THE VDE RFI SPECIFICATIONS

The following VDE RFI specifications are of primary interest. These specifications are also commercially available in English.

trical safety, the capacitors, chokes and filters must be in compliance with VDE 0565, Parts 1 to 3. The insulation requirements for capacitors are:

VDE 0871/6.78	RFI Limits: Equipment Operation Above 10 kHz
VDE 0872/7.72	RFI Limits: Radio and TV Receivers
VDE 0874/10.73	RFI Suppression Design Guide
VDE 0875-1/11.84	RFI Limits: Equipment Operation Below 10 kHz
VDE 0876-1/9.78	Part 1: RFI Measurement Set
VDE 0877-1/11.81	Part 1: Instruction: RFI Voltage Measurement
VDE 0877-2/02.85	Part 2: Instruction: RFI Field Strength Measurement
VDE 0877-3/4.80	Part 3: Instruction: RFI Power Measurement
VDE 0877-101/...78	Part 101: Instruction: RFI Decoupling Factor Measurement
VDE 0879-1/5.74	Part 1: Ignition System RFI Far Field Suppression
VDE 0879-2/1.58	Part 2: Ignition System RFI Near Field Suppression

RFI CONTROL AND ELECTRICAL SAFETY

The electrical safety design of a product must comply with the West German Safety Law. Since the RFI suppression devices influence elec-

X-Capacitors, Plate-to-Plate
1075V DC for 1 minute
1625V DC for 2 seconds

Y-Capacitors, Plate-to-Plate
1500V AC for 1 minute
1800V AC for 2 seconds

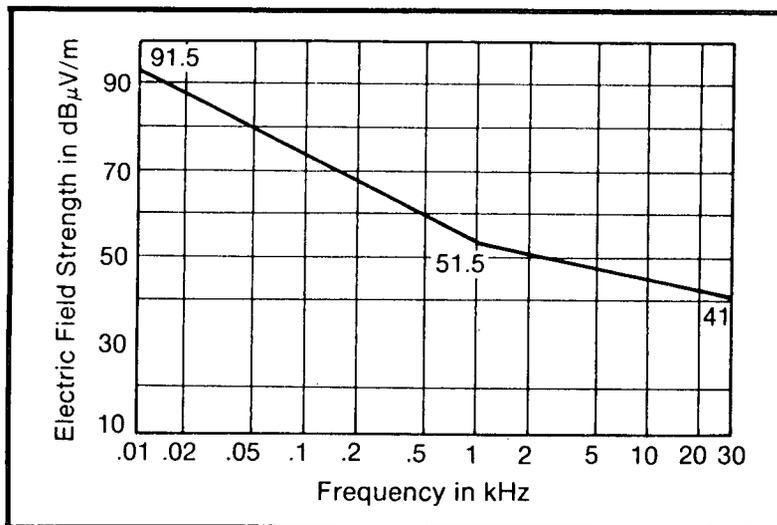


Figure 3. Radiated RFI Limit of Vfg 1046 and other Vfg's measured at 3 meters. Alternately, 34dB μ V/m Limit at 30 meters may be used.

In addition, the individual requirements of each equipment specification must be considered. For instance, VDE 0806/IEC 380 requires a high-pot test of 1250V AC from line to housing. For this case, the 1500V AC Y-capacitors will be adequate.

The West German Safety Law requires that all technical equipment is safe. Compliance with this requirement is demonstrated when electrical equipment is designed to meet the requirements of the VDE specifications. It is not mandatory to have the equipment safety-tested by the VDE Testing and Certification Institute. (NOTE: The RFI test or permit procedure is required by law.) However, when the equipment is tested by a recognized testing agency (VDE or TUV), the "GS" mark can be affixed to the end-use equipment.

THE VDE APPLICATION PROCEDURE

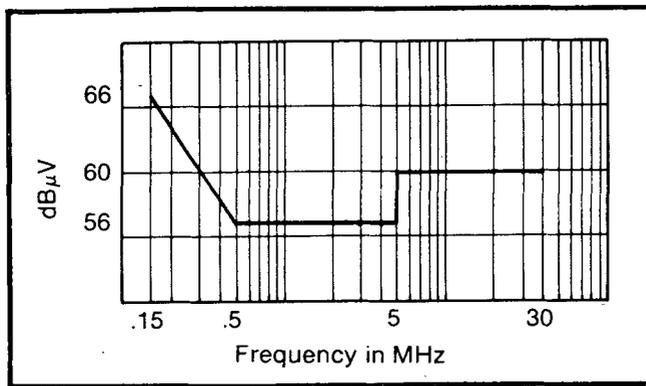


Figure 4. RFI Voltage Limit per VDE 0875, Part 1 and 82/499/EEC with 50 Ohm LISN.

The VDE safety specifications are being harmonized with the international IEC specifications. For instance, IEC 380, Safety for Office Equipment, is being used by the VDE as VDE 0806. Most other European countries are harmonizing their specifications per the Common Market Directive. In

1982, a CENELEC Certification Agreement (CCA) came into effect. This means that when a test is performed to IEC 380 by the VDE they will also, upon application, issue a CCA, which is valid at the other CENELEC member countries' testing agency.

Applications for RFI and Safety testing must be sent to the VDE Testing and Certification Institute, Merianstrasse 28, D-6050 Offenbach, West Germany, Tel.: (611)83061, Telex: 4152796 (VDEP-D). There are two separate applications required, one for RFI and one for safety. Typical waiting time is 3 months for RFI and 6 months for safety. The initial contact should be on company letterhead requesting the type of test and describing the equipment to be tested. A brochure of the equipment will be helpful. The subsequent steps are outlined in Figure 5. ■

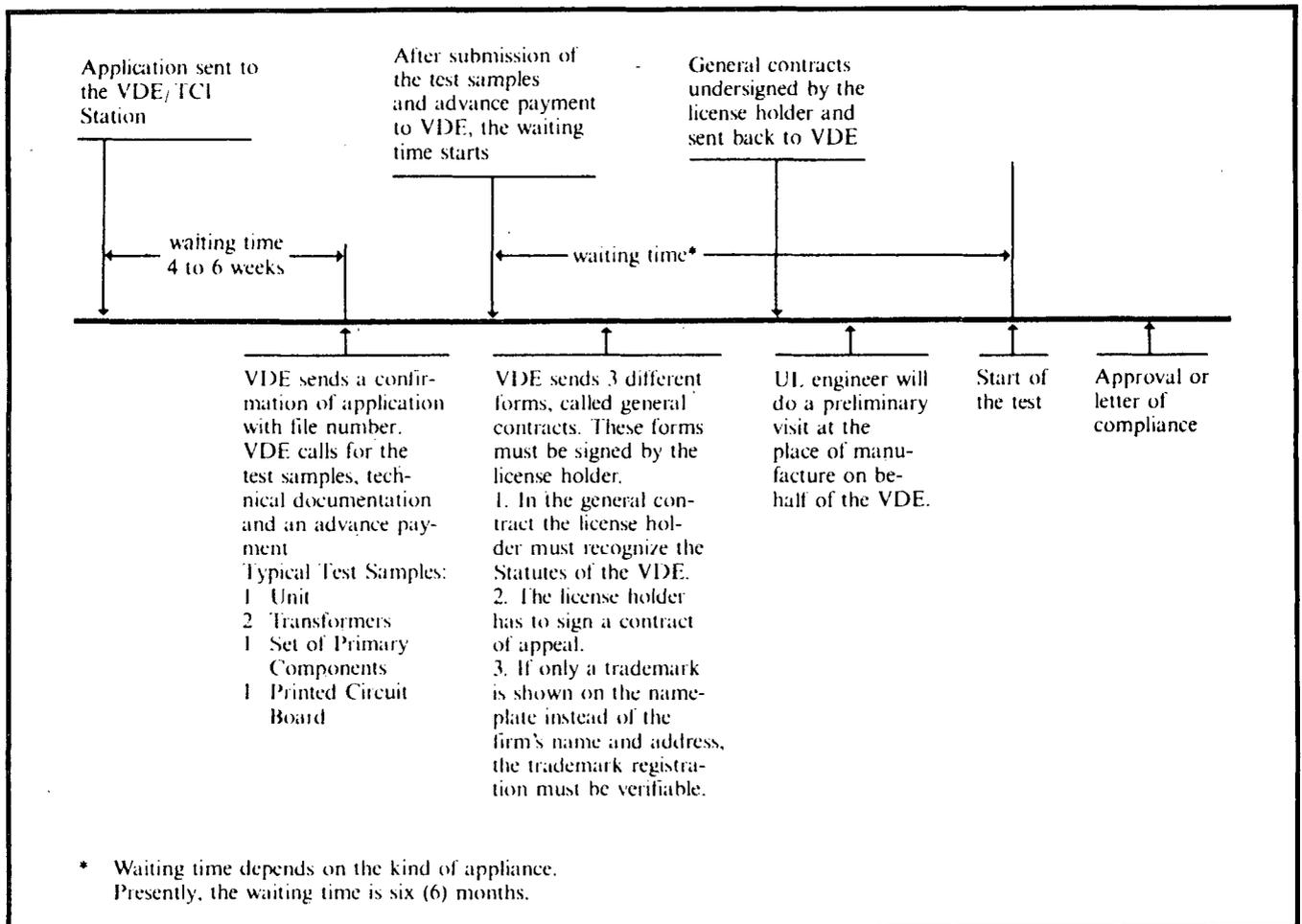


Figure 5. VDE Testing and Certification Institute Application and Test Schedule.