

**Tco**Development

**Tco'05**

**DESKTOPS**

[www.tcodevelopment.com](http://www.tcodevelopment.com)

# TCO'05 DESKTOP COMPUTERS

<b>Introduction</b>	<b>2</b>
<b>A Criteria</b>	<b>3</b>
<b>A.1 General information</b>	<b>3</b>
A.1.1 TCO Document	3
<b>A.2 Visual ergonomics</b>	<b>4</b>
A.2.1 Visual quality	4
<b>A.3 Work load ergonomics</b>	<b>5</b>
A.3.1 Ergonomics	5
<b>A.4 Emissions</b>	<b>6</b>
A.4.1 Alternating electrical fields	7
A.4.2 Alternating magnetic fields	8
A.4.3 Acoustic noise	9
<b>A.5 Electrical safety</b>	<b>11</b>
A.5.1 Electrical safety	11
<b>A.6 Ecology</b>	<b>12</b>
A.6.0 Product description	13
A.6.1 Environmental management system certification	15
A.6.2 Environmental hazards	16
A.6.3 Preparation for Recycling	24
<b>A.7 Energy</b>	<b>30</b>
A.7.1 Energy consumption	30
<b>R References</b>	<b>31</b>
<b>B Test Methods</b>	<b>33</b>
<b>B.1 General test conditions</b>	<b>33</b>
B.1.1 Definition of a test object	33
B.1.2 Required test object information	33
B.1.3 Conditions for the equipment under test	34
B.1.4 Instruments used for testing	35
B.1.5 Settings of the desktop computer	35
B.1.6 Test report	35
<b>B.2 Visual ergonomics</b>	<b>36</b>
B.2.1 Basic test requirements	36
B.2.2 Equipment	36
B.2.3 Test Method	36
B.2.4 Test evaluation	37
B.2.5 Overall uncertainty	37
<b>B.4 Emissions</b>	<b>37</b>
B.4.0 General test conditions for emissions	37
B.4.1 Alternating electrical fields	44
B.4.2 Alternating magnetic fields	47
<b>B.6 Ecology</b>	<b>50</b>
<b>B.7 Energy</b>	<b>52</b>
B.7.0 General test conditions for Power measurements	52
B.7.1 Energy Requirements	53

# Introduction

TCO (The Swedish Confederation of Professional Employees) has, since the end of the 1980s, been involved in influencing the development of IT equipment, particularly Visual Display Units (VDUs), in a more user-friendly direction. Since 1998 this work has been carried out by TCO Development, a wholly-owned TCO subsidiary company.

With the collective knowledge and experience of the 1.3 million office workers associated with the confederation, TCO Development has developed requirements and test methods for IT equipment used in offices. These quality and environmental requirements have pointed the way for the rapid pace of development in this characteristically international branch.

The TCO certification system is a challenge for those manufacturers who have decided to adapt information technology to meet the needs of professionals, the work environment and nature, while at the same time accepting high quality requirements as a possibility rather than a burden.

The first TCO labelling scheme, TCO'92, was launched in 1992, and has since been succeeded by TCO'95, TCO'99 and TCO'03. Each new generation of labelling has seen the requirements extended and tightened, in pace with progress in technical innovation and development. Nevertheless, there has been a constant focus on the professional users and their demands on the tools they use in their work.

The TCO'05 Desktop computers document is an upgrade of its predecessor, TCO'99 System units. TCO Development has chosen the terminology Desktop computers as this is the most common wording used by manufacturers and end users. The requirements in TCO'05 Desktop computers also embrace desk-side computers and computers of tower type.

We have chosen to retain the same areas as in TCO'99 but have revised the requirements and when necessary included new requirements. There are Desktop computers with a variety of functionality included in the basic package

Stockholm July 1st 2005

TCO Development

SE-114 94 Stockholm, Sweden

Fax: +46 (0)8 782 92 07

E-mail: [development@tco.se](mailto:development@tco.se)

Jan Rudling

Managing Director

Helena Nordin

Development Manager

# A Criteria

## A.1 General information

This document contains requirements, test methods and references for Desktop computers. Desktop computers, as well as desk-side computers and computers of tower type, are defined for the purposes of this document as follows:

A Desktop computer is a computer, with the minimum basic configuration that includes a mother board, a processor, a hard disc drive, memory boards, graphics card, CD/DVD-drive, a modem, a network card and a fan for cooling, all enclosed in one casing. A Desktop computer can communicate with the end user via a display that can be connected via analogue or digital I/O ports.

### A.1.1 TCO Document

#### Background

It is desirable that the purchaser of a product which has been certified in accordance with *TCO'05 Desktop computer* receives information concerning the quality and capabilities of the product. This information is based on the viewpoint from the user's perspective that TCO Development represents.

#### Applicability

All Desktop computers.

#### Mandate:

**A TCO Document written in English shall accompany the product, describing why these particular requirements have been chosen for the products within the scheme of TCO'05 Desktop computers and what is expected to be achieved by them.**

**Examples of how the document can accompany the product are presented below:**

**- A separate printed document.**

**-As an electronic file or in the user's manual.**

**-At the manufacturers web site, together with information about the product. A reference to the web site shall accompany the product.**

**The text can be obtained from TCO Development or can be downloaded at [www.tcodevelopment.com](http://www.tcodevelopment.com).**

**The following information shall be submitted:**

**A written guarantee that the above mandate is fulfilled. The document shall be signed by the responsible person at the applicant company.**

We hereby guarantee that the above mandate is fulfilled.

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

## A.2 Visual ergonomics

Today computers are common work tools for users in different types of professions. Good visual ergonomics is an important aspect of quality that can also have a direct effect on the health and comfort of the user. Since desktop computers generate images on a display it is important to test that the desktop computer together with a TCO'03 labelled display fulfils the requirements in TCO'03 Displays, Flat panel displays, most recent version.

### A.2.1 Visual quality

#### Background

This requirement is to ensure that the Desktop computer provides a picture on a display with an image quality that fulfils the users requirements on a VDU.

#### Applicability

All desktop computers.

#### Reference

1.

#### Mandate:

1. The computer shall be equipped with a digital output.
2. The computer shall be able to present an image on a TCO'03 labelled CRT display that fulfils the criteria specified in section A.2.3.1, A.2.3.3 and A.2.4.1, TCO'03 Displays, CRT Displays. The analogue output shall be used during testing.

#### The following information shall be submitted:

A copy of a test report from a test laboratory accepted by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

# A.3 Work load ergonomics

Work load ergonomics concerns the adaptation of work, tools, work place and the rest of the physical environment in order to meet and optimize the user needs for a good working environment.

## A.3.1 Ergonomics

### A.3.1.1 Easily accessible connections

#### Background

It should be easy to connect common external devices, such as a USB memory stick. A digital connection on the Desktop computer guarantees a high quality signal to the display which enhance the visual ergonomics of the display

#### Applicability

All Desktop computers.

#### References

2.

**Mandate:**

At least one USB connection should be located on the front side.

**The following information shall be submitted:**

A written guarantee that the Desktop computer meets the above mandate. The guarantee shall be signed by the responsible person at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

## A.4 Emissions

The amount of electrical equipment in our work places is increasing tremendously, with a concomitant increase in the presence of electrical and magnetic fields. Users of IT equipment now have several nearby field sources placed in their work environment that are constantly in use. The degree of exposure of users working with this equipment is increasing as well as the permanent proximity of the body to certain field sources from IT equipment.

When the first TCO label was introduced in 1992 one of the main interests was the requirement for limiting electrical and magnetic fields. Scientists and experts still disagree over the question of whether or not they can cause any harm to humans.

The amount of fields surrounding us is increasing so the criteria in the labelling document are still more than relevant.

Users should be aware that connecting a Desktop computer with Class I plug to a mains outlet without a protective earth contact would raise the electric fields to a level that is many times higher than if it was connect to a mains outlet with protective earth. This also applies to the magnetic fields.

## **A.4.1 Alternating electrical fields**

### **Background**

Alternating electrical fields are created between objects that have different levels of electrical potential which change over time. When the potential changes in a periodic manner, an electrical alternating field is set up, with a specific field strength and frequency. A Desktop computer contains many sources of alternating electrical fields. The field characteristics depend on the actual electrical potential difference and the distance from the Desktop computer.

The mandatory requirements are based on the ambition to reduce the alternating electrical fields to such a low level as not to burden the work environment with unnecessary factors. The mandatory requirements shall not be regarded as hygienic limit values.

### **Applicability**

All Desktop computers.

### **Test procedure**

See B.4.1.

### **Mandate:**

**Band I: 5 Hz to 2 kHz,  $\leq 10$  V/m, measured at 30 cm and at 50 cm in front of the Desktop computer.**

**Band II: 2 kHz to 400 kHz,  $\leq 1.0$  V/m measured at 50 cm around the Desktop computer and at 30 cm in front of the Desktop computer.**

### **The following information shall be submitted:**

**A copy of a test report from a test laboratory accepted by TCO Development.**



## A.4.2 Alternating magnetic fields

### Background

Alternating magnetic fields are created when an alternating electrical current flows through a conductor. Like other electrical equipment, Desktop computers are surrounded by alternating magnetic fields. These alternating magnetic fields are generated by different parts of the Desktop computer, e.g. the power supply unit, voltage inverters and other electrical circuits. The field strength depends on the actual electric current and on the distance from the Desktop computer.

The mandatory requirements are based on the ambition to reduce the alternating magnetic fields to such a low level as not to burden the work environment with unnecessary factors. The mandatory requirements shall not be regarded as hygienic limit values.

### Applicability

All Desktop computers.

### Test procedure

See B.4.2.

#### **Mandate:**

**Band I: 5 Hz to 2 kHz,  $\leq 200$  nT, measured at 30 cm in front of the Desktop computer and at 50 cm around the Desktop computer.**

**Band II: 2 kHz to 400 kHz,  $\leq 25$  nT measured at 50 cm around the Desktop computer.**

#### **The following information shall be submitted:**

**A copy of a test report from a test laboratory accepted by TCO Development.**

## A.4.3 Acoustic noise

### Background

Acoustic noise from fans, hard disk drives, etc. can be annoying. To prevent such annoyance, the aim shall be that Desktop computers shall cause a minimum of noise during usage. Many end users are sensitive to noise with different characteristics. To enable the end user to choose a product with a comfortable noise level and acceptable generated frequency characteristics, this information should be declared, together with all other data related to a particular product.

### Definitions

To be able to provide information about acoustic noise levels that permits comparison between different Desktop computers, the declared A-weighted sound power level ( $L_{WAd}$ ) in operating and idling mode in bels (B), in accordance with ISO 9296 shall be reported. The following definitions apply:

*Sound power level ( $L_W$ ):*

Total emitted sound power from a sound source, given in bels (B) and with the reference 1 pW .

*A-weighting:*

The measured linear sound level (sound pressure or sound power) weighted against the sensitivity of the human ear for different frequencies (A-curve).

*Declared A-weighted sound power level ( $L_{WAd}$ ):* in bels (B). Defined in accordance with ISO 9296 3.2.5.

*Operating mode.* A condition in which the system and hard disk drive shall be operated in accordance with ISO 7779 C.15.3.2 and C.9.3.2.

*Idling mode.* A condition in which the system shall be operated in accordance with ISO 7779 C.15.3.1.

### Applicability

All Desktop computers.

### Test procedure

See B.4.3.

### References

3, 4, 5, 6, 7, 8, 9.

**Mandate:**

1. The *declared A-weighted sound power level (LWAd)* shall not exceed:

*Operating mode: 4.4B*

*Idling mode: 3.9B*

If the product does not emit prominent discrete tones according to procedures specified in ECMA 74 Annex D a higher declared A-weighted sound power level (LWAd) is accepted but shall not exceed:

*Operating mode: 4.7B*

*Idling mode: 4.2B*

2. The A-weighted sound power level for a product shall be declared in the product data sheet and/or in any other product descriptions.

**The following information shall be submitted:**

A copy of a test report from an accredited test laboratory together with a written guarantee that the above mandates are fulfilled.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

## A.5 Electrical safety

### A.5.1 Electrical safety

#### **Background**

Electrical safety concerns the electrical design of apparatus with respect to its electrical insulation and other arrangements that are intended to prevent accidents resulting from contact with live components, and the risk of fire or explosion as a result of electrical flash-over due to inadequate or faulty electrical insulation.

#### **Applicability**

All Desktop computers with built-in power supplies as well as any external power supply intended to be used together with the Desktop computer.

#### **References**

10.

#### **Mandate:**

The Desktop computer and the declared internal or external power supply/supplies shall be certified in accordance with EN/IEC 60 950

**The following information shall be submitted:**

A CB certificate or a national certificate from a CB member (NCB) shall be submitted.

## A.6 Ecology

The TCO Development labelling requirements have a unique integrated balance of indoor and outdoor environmental issues. A good workplace environment shall not be gained at the expense of environmental problems in the surroundings we all share. We call our demand on outdoor environmental criteria “the ecological requirements”.

The requirements that are present in this document are those that are, in terms of the environment, relevant to the product group and can be verified in a suitable way.

When deciding on the environmental aspects to be included, TCO Development in the first place bases its selection on international references, and secondly on those which are European or national.

The Ecological requirements cover environmental management systems in production, potential harmful substances in the product and aspects that support material recycling.

In this document the requirements for Notebook computers are omitted, namely A.6.3.2.

### **Plans for updating**

TCO Development actively follows research development of standards and legislation, with the result that areas which are not at present included in the requirements are under continual review by TCO Development.

Areas that may well be included in future updates are requirements concerning maximum levels of chemical emissions from various plastics and chemical substances that are included in the Desktop computer. TCO Development is also investigating the possibility of shifting towards a principle whereby requirements are defined for environmental characteristics instead of the current system of prohibiting various chemical substances or groups of substances. Different kinds of requirements to facilitate recycling are of importance but they are also quite complex to handle. TCO Development will continue to build knowledge of how to set and achieve stricter requirements in this field.

## A.6.0 Product description

### Background

The aim of this product description is to provide information about the product that is to be reviewed for compliance with the ecological requirements of Section A.6 and also for information collection.

### Definitions

*Marking plate*/Marking label is the label that states the computer's electrical rating in terms of voltage, frequency, current and the manufacturers name, trademark or identification mark together with the manufacturers model or type reference. The label shall be in accordance with IEC 60 950:1 clause 1.7.1.

### Applicability

All Desktop computers and the equipment specified in requirement A.1.2 supplied with them.

### References

10.

#### **Mandate:**

A product declaration shall be provided for the Desktop computer.

#### **The following information shall be submitted:**

1. The declaration below, completed where applicable.
2. A copy of the *marking plate* for the Desktop computer.

The information submitted shall be signed by the responsible person at the applicant company.

**Declaration of a Desktop computer.**

<b>Desktop computer</b>	<b>Information</b>
<b>Manufacturer</b>	
<b>Brand name</b>	
<b>Type/Model name</b>	

All possible options of the parts of the Desktop computer stated below should be declared in the table below. (Please increase the number of rows when necessary).

<b>Power supply (external/internal) Brand &amp; model name</b>	<b>Rating and characteristics</b>

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

..... Signature	..... Name and title in block capitals
..... Date	..... Company

## A.6.1 Environmental management system certification

### Background

A certified environmental management system is proof that the company shows concern for the environment and has chosen to work in a systematic way with constant improvement of the environmental performance of the company and its products in focus. A certified environmental management system includes external independent reviews.

### Definitions

*Manufacturing plant* is the site where the final assembly of the product is taking place.

### Applicability

The company or companies that manufacture the Desktop computer.

### References

12, 23.

#### Mandate:

Each *manufacturing plant* shall be certified in accordance with ISO 14001, or EMAS registered. If the product is manufactured by a third party, this company shall be certified or registered. The certificate shall be issued by a certification body that is accredited by an accreditation body covered by the International Accreditation Forum\* Multilateral Arrangement on Environmental Management Systems.

#### The following information shall be submitted:

1. The table below completed with the names and addresses of the manufacturing plants.
2. Copy of the ISO 14001 certificate or EMAS registration.
3. A written guarantee that the certificate/registration is valid, signed by the responsible person at the applicant company.

\*www.iaf.nu

Manufacturing plant	Address	Certificate expiry date

We hereby guarantee that the above mandate is fulfilled.

\_\_\_\_\_

Product brand name and model/type

.....

Signature

.....

Name and title in block capitals

.....

Date

.....

Company



## A.6.2 Environmental hazards

### A.6.2.1 Cadmium (Cd), mercury (Hg), and hexavalent chromium (Cr<sup>VI</sup>)

#### **Background**

The effects of mercury and cadmium on human health and the natural environment have been very thoroughly documented since the mid-1950s.

Hexavalent chromium causes severe allergic reactions and is also considered genotoxic, potentially damaging the DNA. In addition, hexavalent chromium compounds are assumed to be toxic for the environment.

In an EU Directive, mercury, cadmium, and hexavalent chromium shall be phased out in electrical and electronic equipment, no later than by July 1<sup>st</sup>, 2006.

The UN/ECE Convention on Long-range Transboundary Air Pollution (CLRTAP) was extended in June 1998 by a Heavy Metals Protocol that included cadmium pollutants and products containing levels of mercury.

#### **Applicability**

All Desktop computers.

#### **References**

11, 14, 16, 19, 42.

#### **Mandate:**

The Desktop computer shall not contain cadmium, mercury and hexavalent chromium. The requirement applies to components, parts, and raw materials in all assemblies and sub-assemblies of the product, e.g. batteries, paint, surface treatment, plastics and electronic components.

Exemptions and definitions of limit values are to be found in the TCO'05 Guidelines and are in accordance with EU Directive 2002/95/EC (RoHS).

#### **The following information shall be submitted:**

A written guarantee that the mandate above is fulfilled. The guarantee shall be signed by the responsible person at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

## A.6.2.2 Lead (Pb)

### Background

Lead is a well known hazardous element. Lead has a very well documented negative health effect and is subject to restrictions in many countries and for different kinds of use.

In an EU Directive, lead shall, with some exemptions, be phased out in electrical and electronic equipment, no later than by July 1<sup>st</sup>, 2006.

UNEP has defined lead as one of the substances that requires regulation on a global level with a binding convention.

### Definitions

*Printed wiring board* (PWB) is a printed board that provides point-to-point connections but not printed components in a predetermined arrangement on a common base.

### Applicability

All Desktop computers.

### References

11, 14, 16, 42.

#### **Mandate:**

The Desktop computer shall not contain lead. The requirement applies to components, parts and raw materials in all assemblies and sub-assemblies of the product e.g. batteries, paint, plastics, etc.

#### **Exemptions until July 1<sup>st</sup> 2006:**

*Printed wiring boards*, electronic components, and solder are exempted. Other exemptions and definitions of limit values are to be found in the TCO'05 Guidelines and are in accordance with EU Directive 2002/95/EC (RoHS).

#### **Exemptions from July 1<sup>st</sup> 2006:**

Exemptions and definitions of limit values that are valid from July 1<sup>st</sup> 2006, are to be found in TCO'05 Guidelines and are in accordance with EU Directive 2002/95/EC (RoHS).

#### **The following information shall be submitted:**

A written guarantee that the above mandate is fulfilled. The document shall be signed by the responsible person at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

### A.6.2.3 Information regarding plastics and flame retarding agents

#### Background

This requirement is intended to give information about the plastics and flame retarding agents in the product, to be reviewed for compliance with the ecological requirements A.6.2.4, A.6.2.5, A.6.2.6, A.6.3.1, and A.6.3.2.

#### Definitions

*Plastic parts* are parts made mainly of plastics, e.g. the housing. Parts containing other materials in any significant amounts, e.g. cables with their metal conductors, are not included in the requirements.

*Printed wiring board* is a printed board that provides point-to-point connections but not printed components in a predetermined arrangement on a common base.

#### Applicability

All Desktop computers.

#### References

13, 15-22, 24-28, 30-40.

#### Mandate:

The material specifications shall be provided for *plastic parts* and *printed wiring board* laminates weighing more than 25 grams and which have flame retardant concentrations above 1 percent by weight.

#### The following information shall be submitted:

The table below shall be completed and signed by the responsible person at the applicant company. Manufacturers of plastic materials who consider such information confidential may submit the information to a test laboratory approved by TCO Development.

Plastic part and PWB name	Weight in grams	Type of plastic	Plastic manufacturer name	Plastic model name	Flame retardant type	Flame retardant CAS number <sup>*)</sup>	Plastic label code

\*) Chemical Abstract Service number [www.cas.org](http://www.cas.org)

We hereby guarantee that the above mandate is fulfilled.

\_\_\_\_\_

Product brand name and model/type

.....

Signature

.....

Name and title in block capitals

.....

Date

.....

Company

#### **A.6.2.4 Restricted flame retarding agents**

##### **Background**

The general requirements and discussion in respect of brominated and chlorinated flame retardants and the phasing out of this group concern about 75 substances. Two families within the brominated flame retardants group will be prohibited, by EU law, for use in electronics from 1<sup>st</sup> July 2006. These are PBB and PBDE.

Brominated and chlorinated flame retardants used are often persistent, can bioaccumulate in living organisms and have been detected in flora and fauna.

A series of international elimination activities in respect of brominated and chlorinated flame retardants is currently in progress within the EU, OECD, North Sea Conference, OSPAR (the Commission for the Protection of the Marine Environment of the North-East Atlantic) and HELCOM (the Baltic Marine Environment Protection Commission).

Other flame retardants may also pose significant risks to human health and the environment.

##### **Definitions**

*Plastic parts* are parts made mainly of plastics, e.g. the housing. parts containing other materials in any significant amounts, e.g. cables with their metal conductors, are not included in the requirements.

*Printed wiring board (PWB)* is a printed board that provides point-to-point connections but not printed components in a predetermined arrangement on a common base.

##### **Applicability**

All Desktop computers.

##### **References**

13, 15, 18, 20, 24, 25, 30, 40, 42.

**Mandate:**

1. *Plastic parts* weighing more than 25 grams shall not contain flame retardants that include organically bound bromine or chlorine. The requirement applies to *plastic parts* in all assemblies and subassemblies. Exempted are *printed wiring board laminates*, electronic components and all kinds of cable insulation.

2. The Desktop computer shall not contain PBB and PBDE (listed in the TCO'05 Guidelines). The requirements apply to components, parts and raw materials in all assemblies and sub-assemblies of the product, e.g. batteries, paint, surface treatment, plastics and electronic components.

3. The flame retardants used in plastic parts weighing more than 25 grams shall not have been listed in Annex I EU Directive 67/548/EEC and the following amendments to the Directive as being assigned one or more of the following risk phrases at the time of application:

- R45 (may cause cancer)
- R46 (may cause heritable genetic damage)
- R60 (may impair fertility)
- R61 (may cause harm to the unborn child).

**The following information shall be submitted:**

A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the responsible person at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

..... Signature	..... Name and title in block capitals
..... Date	..... Company

## **A.6.2.5 Environmental characteristics of flame retarding agents**

### **Background**

The spread of synthetic chemical substances in various products is a global and very widespread environmental problem. Knowledge in respect of the different health and environmental characteristics of these substances is very limited. In order to be able to apply the correct type of measures, good basic information is required. TCO Development wants, by means of this requirement, to stimulate and speed up the gaining of such knowledge and its dissemination in respect of the various health and environmental risks associated with these chemicals. This is also in line with the proposed EU directive REACH (Registration, Evaluation and Authorisation of CHEMicals), which gives greater responsibility to industry to manage the risks from chemicals and to provide safety information regarding the substances. TCO Development is also investigating the possibility of shifting towards a principle whereby requirements are defined for environmental characteristics instead of the current system of prohibiting various chemical substances or groups of substances.

### **Definitions**

*Bioaccumulation.* The capacity of a chemical to accumulate (be stored in the tissue) in an organism as a result of uptake from all environmental sources.

*Toxicity in a water environment.* This means how toxic the chemicals are for aquatic species.

*Persistence.* The tendency of a chemical substance to persist (survive) in the environment without biodegrading into non-harmful substances.

*Plastic parts* are parts made mainly of plastics, e.g. the housing. parts containing other materials in any significant amounts, e.g. cables with their metal conductors, are not included in the requirements.

*Printed wiring board (PWB)* is a printed board that provides point-to-point connections but not printed components in a predetermined arrangement on a common base.

### **Applicability**

All Desktop computers.

### **Test procedure**

See B.6.2.5.

### **References**

17, 19, 28, 31-39.



### A.6.2.6 Plastics with chlorine and bromine as part of the polymer

#### Background

PVC is by far the most common halogen containing plastic. There are however other plastics that contain chlorine or bromine in the plastic itself. As the requirement concerning permissible flame retardants tightens, the risk increases that halogenated plastics will become more common. TCO Development sees a future environmental risk with such development.

PVC is a much-debated plastic that can pose environmental problems in most parts of its life cycle. The magnitude of the environmental problems relating to PVC differs depending on the environmental status of a particular manufacturing facility and the uses of additives. At present there are very limited possibilities to distinguish between harmful and less harmful production facilities for PVC.

#### Definitions

*Plastic parts* are parts made mainly of plastics, e.g. the housing. Parts containing other materials in any significant amounts, e.g. cables with their metal conductors, are not included in the requirements.

#### Applicability

All Desktop computers.

#### References

16, 26.

#### Mandate:

Plastic parts weighing more than 25 grams shall not contain chlorine or bromine as a part of the polymer.

#### The following information shall be submitted:

A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the responsible person at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

Product brand name and model/type

..... Signature	..... Name and title in block capitals
..... Date	..... Company



## A.6.3 Preparation for Recycling

### A.6.3.1 Material coding of plastics

#### Background

Within the EU the problem of electronic waste has been a major issue for many years. The EU has now brought out a set of rules for dealing with environmental questions related to electronic items in waste. There are large volumes of Desktop computers all over the world. Recycling and the handling of harmful substances is therefore an important environmental area.

#### Definitions

*Plastic parts* are parts made mainly of plastics, e.g. the housing. Parts containing other materials in any significant amounts, e.g. cables with their metal conductors, are not included in the requirements.

*Printed wiring board (PWB)* is a printed board that provides point-to-point connections but not printed components in a predetermined arrangement on a common base.

#### Applicability

All Desktop computers.

#### References

16, 21, 22, 27, 40.

#### Mandate:

***Plastic parts* weighing more than 25 grams shall be material coded in accordance with ISO 11469 and ISO 1043-1, -2, -3, -4. Such parts shall be listed in the table at Section A.6.2.3.**

Exempted are *printed wiring board* laminates.

#### The following information shall be submitted:

**A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the responsible person at the applicant company.**

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

### **A 6.3.2 Design for Recycling – Mercury lamps**

**Not applicable**

### A 6.3.3 Variety of plastics

#### Background

Recycling of used electronic products is an important environmental issue. Material recycling and reuse are the best options from an environmental point of view. Therefore TCO Development presents requirements that facilitate material recycling.

#### Applicability

All Desktop computers.

#### Definitions

*Types of plastic material* (using the abbreviation terms, symbols and concepts for plastics in ISO 1043 Part 1, 2, 3, and 4) are:

- Basic polymers
- Mixtures of polymers
- Basic polymers with flame retardants
- Mixtures of polymers with flame retardants

#### References

21.

**Mandate:**

No more than two different *types of plastic material* are accepted for parts weighing more than 100 grams.

**The following information shall be submitted:**

A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the person responsible at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

#### A.6.3.4 Moulded-in metal parts and metallization of plastic housing

##### Background

Recycling of used electronic products is an important environmental issue. Material recycling and reuse are the best options from an environmental point of view. Therefore TCO Development presents requirements that facilitate material recycling.

##### Definition

*Metallization* is a surface deposition process whereby a metallic layer is applied to the surface of a completed shaped plastic part. Examples of metallization processes are chemical coating and ion vapour deposition.

##### Applicability

All Desktop computers.

##### Mandate:

1. There shall be no internal or external *metallization* of the Desktop computer outer plastic housing.
2. Moulded-in or glued metal parts are not accepted in the Desktop computer outer plastic housing.

##### The following information shall be submitted:

A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the responsible person at the applicant company.

We hereby guarantee that the above mandate is fulfilled.

---

Product brand name and model/type

.....  
Signature

.....  
Name and title in block capitals

.....  
Date

.....  
Company

### **A.6.3.5 Recycling information for customers**

#### **Background**

Within the EU the problem of electronic waste has been a major issue for many years. The EU has decided upon legislation for dealing with electronics waste and several European countries have already imposed legislation for product take-back and recycling. A proposal for an EU Directive also requires that all batteries and accumulators shall be collected and recycled. There are large volumes of Desktop computers and batteries in the world and it is very important to get these products into a closed loop to avoid the entry of harmful substances into the environment.

#### **Definition**

*Environmentally acceptable recycling methods are:*

- Product and component reuse.
- Material recycling with secured handling of hazardous chemicals and heavy metals.
- Pollution-controlled energy recovery of parts of the Desktop computer.
- The recycling company or companies shall work in compliance with the Basle Convention when exporting Desktop computers or parts of Desktop computers.

Placement in landfills of whole products is not acceptable.

#### **Applicability**

All Desktop computers.

#### **References**

27.

**Mandate:**

The TCO'05 Desktop computer brand name holder (or its representative, associated company or affiliate) shall inform its customers in the user's manual of the possibility to dispose of the Desktop computer by *environmentally acceptable recycling*. The information shall be made available to customers in the various geographical markets in the following way:

1. For Desktop computers sold in Europe: In the countries within the European Union where the Desktop computer is sold and where the EU directive 2002/96/EC (WEEE) is applicable.
2. For Desktop computers sold in Asia: In at least one Asian country.
3. For Desktop computers sold in USA: In the state/states where the Desktop computer is sold.
4. For Desktop computers sold in Canada: In the state/states where the Desktop computer is sold.
5. For Desktop computers sold in Australia and New Zealand: In the state/states and territories where the Desktop computer is sold.

**The following information shall be submitted:**

A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the person responsible at the applicant company.

A copy of the description of the customer information. If this is provided in the local language, a translation into English shall be submitted as well.

We hereby guarantee that the above mandate is fulfilled.

\_\_\_\_\_

Product brand name and model/type

.....

Signature	Name and title in block capitals
-----------	----------------------------------

.....

Date	Company
------	---------

## A.7 Energy

There are both indoor and outdoor environmental aspects that concern the energy consumption of Desktop computers. Most of the electrical energy consumed by a Desktop computer is converted into heat energy which warms up the surrounding room. If the room must as a result be cooled down, even more energy is needed.

An important global environmental goal is to reduce energy consumption to counteract the current trend for global warming.

TCO Development has the ambition to harmonise the energy criteria with Energy Star. When revised Energy Star criteria for computers (currently under review) are released, TCO Development may decide to change the energy criteria in TCO'05 Desktop and will then give notice 6 months before the changed criteria become mandatory.

### A.7.1 Energy consumption

#### Background

These criteria concern the power consumption levels for sleep mode and off mode.

#### Applicability

All Desktop computers.

#### Test procedure

See B.7

#### References

41.

#### Mandate:

The Desktop computer shall meet the following requirement levels for maximum power consumption:

Desktop computer	Sleep mode	Off/Stand by mode
Maximum power consumption	≤ 5W	≤ 2 W

The following information shall be submitted:

An energy declaration sheet, showing power consumption in sleep mode and off mode from a test laboratory accepted by TCO Development.

# R References

1. TCO'03 Displays, CRT Displays, Version 2.0
2. Nordic Guidelines for Computer Accessibility, Second edition, 1998. Nordic Co-operation on Disability. Editor: Claes Thorén.
3. ISO 7779:1999, (EN ISO 7779:2001 and 2003), Acoustics – Measurements of airborne noise emitted by computer and business equipment. This international standard is based on ECMA-74.
4. ISO 3741:1999/Cor.1:2002, (EN ISO 3741:1999/AC2002), Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for reverberation rooms.
5. ISO 3744:1994, (EN ISO 3744:1995), Acoustics – Determination of sound power levels of noise sources using sound pressure - Engineering method in an essentially free-field condition over a reflecting plane.
6. ISO 3745:2003, (EN ISO 3745:2003), Acoustics – Determination of sound power levels of noise sources – Precision methods for anechoic and semi anechoic rooms.
7. ISO 11201:1995, (EN ISO 11201:1995), Acoustics – Noise emitted by machinery and equipment – Measurement of emission sound pressure levels at a work station and other specified positions – Engineering method in an essentially free field over a reflecting plane.
8. ISO 9296:1998, Acoustics – Declared noise emission values of computer and business equipment.
9. Standard ECMA-74 8th edition, December 2003. Measurement of Airborne Noise Emitted by Information Technology and Telecommunications Equipment
10. EN 60950 (IEC 60950). Safety of information technology equipment including business equipment.
11. CLRTAP; the UN/ECE Convention on Long-range Transboundary Air Pollution: “The 1998 Aarhus Protocol on Heavy Metals”
12. EMAS EU regulation no 761/2001 concerning the voluntary participation of industrial companies in the Union’s environmental control and review structure.
13. Esbjerg declaration – 4th North Sea Conference 1995
14. EU Directive 91/157/EEC and amendments on batteries and accumulators containing certain dangerous substances
15. EU Directive (76/769/EEC) on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations
16. EU Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment
17. EU Directive 91/155/EEC and amendments defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations
18. EU Directive 93/793/EEC on the evaluation and control of the risks of existing substances
19. Proposal for an EU Directive 2003/0256-0257. Regulation concerning Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
20. HELCOM article 5, annex I



21. ISO 1043-1, -2, -3, -4 Plastics - Symbols and abbreviated terms
22. ISO 11469 Plastics - Generic identification and marking of plastics products
23. ISO 14001 Environmental management systems - Specification with guidance for use
24. OSPAR Strategy with regard to Hazardous Substances (1998-16)
25. Risk Reduction Monograph no. 3 (OECD Environment Monograph series no 102)
26. The EU Green Paper "Environmental questions concerning PVC" KOM (2000) 469
27. EU Directive 2002/96/EC on waste electrical and electronic equipment (WEEE)
28. EU Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances
29. Proposal for an EU Directive 2003/0282 (COD) on batteries and accumulators and spent batteries and accumulators
30. JPCA-ES-01
31. ISO 11734 Water quality -- Evaluation of the "ultimate" anaerobic biodegradability of organic compounds in digested sludge -- Method by measurement of the biogas production
32. ISO 14592-11 Water quality -- Evaluation of the aerobic biodegradability of organic compounds at low concentrations -- Part 1: Shake-flask batch test with surface water or surface water/sediment suspensions
33. ISO 14592-2 Water quality -- Evaluation of the aerobic biodegradability of organic compounds at low concentrations -- Part 2: Continuous flow river model with attached biomass
34. OECD 107 Partition Coefficient (n-octanol/water): Shake Flask Method
35. OECD 117 Partition Coefficient (n-octanol/water), HPLC Method
36. OECD 201 Alga, Growth Inhibition Test
37. OECD 202 Daphnia sp. Acute Immobilisation Test and Reproduction Test
38. OECD 203 Fish, Acute Toxicity Test
39. OECD 301 A-F, Ready Biodegradability
40. IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits, the Institute for Interconnecting and Packaging Electronic Circuits (IPC).
41. Energy Star, EPA - <http://www.energystar.gov>
42. TCO'05 Guidelines, available at <http://www.tcodevelopment.com>

---

<sup>1</sup> This standard test is expected shortly to be incorporated in OECD Guidelines for the Testing of Chemicals with the number 309

# B Test Methods

The following definitions, test conditions, requested specifications, and other information apply to the test methods described in this document.

The test results are valid only for the presentation form(s) and configuration(s) tested.

## B.1 General test conditions

### B.1.1 Definition of a test object

- There are two different styles of Desktop computers. These are  
Desktop  
Desk-side (Tower)  
The testing procedures are the same and so as to simplify the instructions in this Section of the document, both styles will be referred to as Equipment under Test, EUT.
- A Desktop computer shall be delivered to the test laboratory in test-ready condition including any required accessories. All necessary information about how to operate and adjust the Desktop computer shall be provided.
- The performance of the tested Desktop computer shall in all aspects be fully in accordance with the performance of the final product.

### B.1.2 Required test object information

- The client shall specify the name(s), type designation(s) and manufacturer for all different parts of the test object.
- The client shall specify the name, type designation and manufacturer of the graphics card. This information shall be written in the test report.
- The graphics card used for testing shall not be used for more than the test object during the test, if not stated by the client.
- The desktop computer (EUT) used to run the CRT/FPD monitor shall not use any unnecessary software or hardware that could influence the test.

### **B.1.3 Conditions for the equipment under test**

- The Desktop computer being tested shall be physically prepared for testing and shall be warmed up until it is fully stabilised.
- Testing shall be performed with the Desktop computer connected to a VDU of FPD type certified in accordance with the most recent version of TCO'03 Displays, Flat Panel Displays for the emission and energy saving measurements. For the visual ergonomics measurements a VDU of CRT type certified in accordance with the most recent version of TCO'03 Displays, CRT Displays shall be used. The monitor shall be adjusted and display an image as specified in each relevant part of the most recent version of TCO'03 Displays, Flat Panel Displays or TCO'03 Displays, CRT Displays respectively. See B.2.3.
- The wiring connecting the desktop computer with the CRT/FPD monitor, and the monitor's power supply arrangements shall be arranged in a way that the influence on the performed measurements is minimized.
- An external control unit that is not a standard part of the Desktop computer is not allowed.
- The Desktop computer shall be tested under nominal conditions of input voltage, current, etc.

## **B.1.4 Instruments used for testing**

All instruments used for testing of a Desktop computer shall be of good quality and validated by a recent test certificate from a certified testing laboratory. Any necessary instrument calibration shall be done before the tests are performed.

## **B.1.5 Settings of the desktop computer**

- The computer shall be run with a default installation of a recent version of Microsoft Windows.
- The test images can be generated as specified in the relevant part of the most recent version of TCO'03 Displays, Flat Panel Displays or TCO'03 Displays, CRT Displays respectively. See B.2.3.
- Only equipment that is necessary for the functionality of the Desktop computer should be connected to such external ports as USB and Fire Wire, unless stated by the manufacturer.
- No programs to enhance the image quality or in any other way improve the results should be run on the desktop computer during test unless they are also shipped with the final product.
- The CPU, GPU and memory clock frequencies should be set by the manufacturer as intended for the end user.
- All chassis modifications such as dust filters, perspex windows or extra fans are to be installed as intended for the end user.

## **B.1.6 Test report**

- The test results are valid only for the presentation form(s) and configuration(s) tested.
- The manufacturer, brand name, type/model name and serial number shall be stated in the test report.
- The supply voltage and frequency used during the test and the electrical safety classification CLASS I or CLASS III shall be stated in the test report.
- The degree of uncertainty for each given measurement result shall be stated in the test report.
- The client shall specify the name, type designation and manufacturer of the graphics card. This information shall be written in the test report.

## B.2 Visual ergonomics

When a set of TCO'03 products are connected together all of them should perform with their expected quality. The image quality of a TCO'03 certified CRT monitor should not be reduced when connected to a TCO'05 desktop computer because the computer has a poor output video signal. The test is performed on a CRT monitor instead of a FPD monitor because a CRT is more sensitive to a poor graphics card.

### B.2.1 Basic test requirements

- As described in section B.1.
- The desktop computer and the CRT monitor shall be warmed up for a minimum of 20 minutes prior to testing.
- The client shall inform the test laboratory if any anti-aliasing is used on the graphics card. The anti-aliasing can arbitrarily influence the results, making the test laboratories question the results and thereby causing delays.

### B.2.2 Equipment

- Refer to the visual ergonomics part of the most recent version of TCO'03 Displays, CRT Displays.

### B.2.3 Test Method

- A visual ergonomics test shall be performed on an CRT monitor connected to the desktop computer. The test shall be performed in accordance with the most recent version of TCO'03 Displays, CRT Displays.

The Desktop computer analogue output shall be used during the tests.

The following tests shall be performed and comply with the demands in the most recent version of TCO'03 Displays, CRT Displays.

A.2.3.1 Luminance level

A.2.3.3 Image loading capacity

A.2.4.1 Luminance contrast – characters

- The monitor has to be already certified in accordance with the most recent version of TCO'03 Displays, CRT Displays. It has to be proved stable and repeatable. The values for all the visual ergonomics parameters have to be well known and documented.

## **B.2.4 Test evaluation**

- The CRT monitor has to pass the three visual ergonomics tests in accordance with the most recent version of TCO'03 Displays, CRT Displays when it is connected to the Desktop computer (EUT).

## **B.2.5 Overall uncertainty**

Refer to the visual ergonomics part of the most recent version of TCO'03 Displays, CRT Displays.

# **B.4 Emissions**

## **B.4.0 General test conditions for emissions**

### **B.4.0.1 Basic test requirements**

As described in section B.1.

For the test methods for emissions described in this document the following conditions apply:

- AC mains voltage\* 230 VAC RMS, tolerance  $\leq 1\%$
- AC mains frequency\* 50 Hz, tolerance  $\leq 2\%$

The EUT shall be connected to phase and neutral.

\* – or other voltage and frequency combination specified by the client.

### **B.4.0.2 Conditions and set up for the test object**

The EUT shall be connected to mains via a mains cord. The measurement shall be performed with a non-shielded mains cord of normal type, (connected to earth for a CLASS I device).

EUT without an external power supply shall be connected to mains via the above mentioned power cable, which shall run from the point of its connection on the EUT horizontally straight to a point 0.4 m behind the front of the EUT. The cable shall then from this point run downwards at least 1 m. – see figure B.4.2.1.

However, the cable should never be closer than 0.1 m to the back of the EUT so for EUT with a depth (front to back)  $\geq 0.3$  m the distance 0.1 m from the back is used instead of 0.4 from the front.

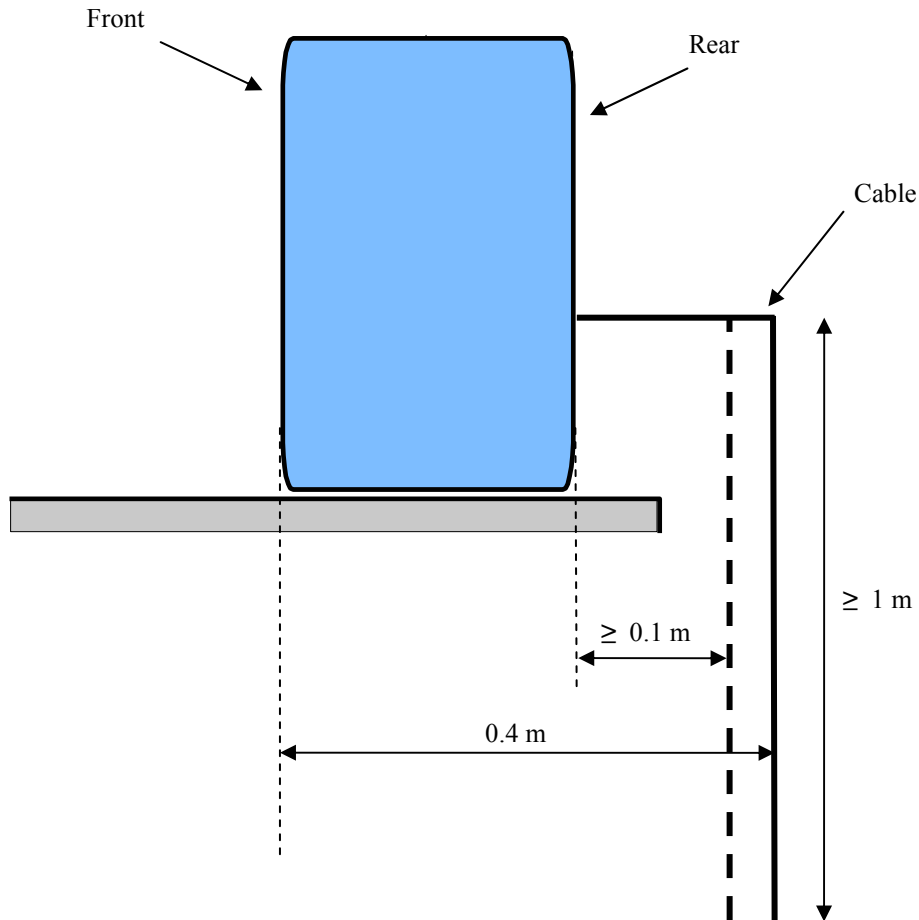


Figure B.4.0.1 EUT without external power supply.

For EUT with an external power supply unit, the external power supply unit will contribute to the electromagnetic and alternating electric fields around the EUT. Power supply units, which are connected via a primary cable to the outlet, shall be positioned centrally, directly behind the test sample, on the (turn)table, with the secondary side towards the EUT, see Figure B.4.0.2. The primary cable shall extend horizontally, on the (turn)table to a point 0.4 m behind the front of the EUT. The cable shall then, from this point run downwards for at least 1 m. However, the cable should never be closer than 0.1 m to the back of the EUT, so for a large EUT the distance 0.1 m from the back is used instead of 0.4 from the front. If it is not clear which side of the power supply is supposed to be placed upwards, it shall be tested in all positions and the worst case shall be used.

The secondary cable of the power supply shall run the shortest distance from the point of its connection on the EUT to the secondary side of the power supply. The unused portion of the secondary cable, if any, shall be bundled together with the power supply unit. The bundle loops shall have a length equal to the longest dimension of the power supply. For supply units with dimensions less than 10 cm, a 10 cm bundle loop length shall be used.

For power supply units which are designed to be put directly in the outlet, without a primary cable, the secondary cable shall run horizontally straight to a point 0.4

m behind the front of the EUT. The cable shall then from this point run downwards at least 1 m. – see figure B.4.2.1. However, the cable should never be closer than 0.1 m from the back of the EUT so for EUT with a depth (front to back)  $\geq 0.3$  m the distance 0.1 m from the back is used instead of 0.4 from the front.

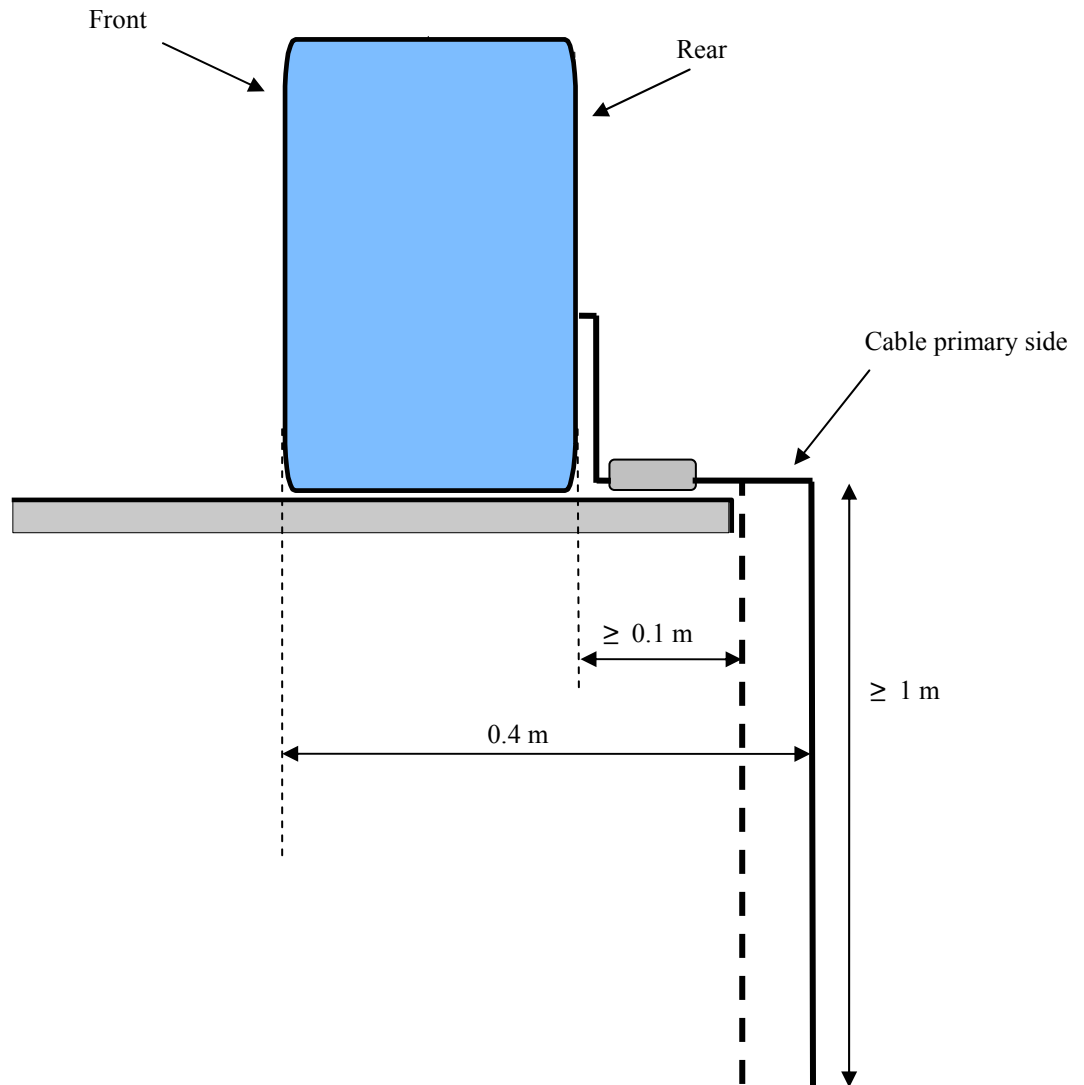


Figure B.4.0.2 EUT with external power supply.

If positioning in accordance with the above rules is not possible, the positioning of the supply unit and cables shall be described in the test report.



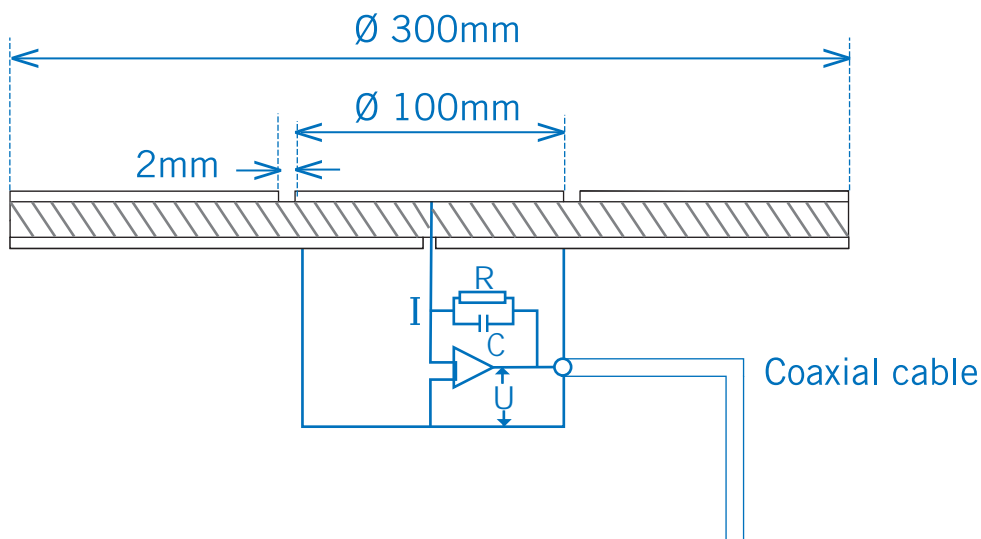
### B.4.0.3 Emission measurement instruments

The instruments used for emission testing shall comply with the requirements and calibration procedures described below:

#### Alternating electric field meter

The alternating electrical field emission from the EUT under test shall be determined by measuring the displacement current passing a given surface of the measuring probe. The probe consists of a disc of double sided printed circuit board laminate with a diameter of 300 mm. On the front of the board the copper layer is removed in the annulus between radii 50 and 52 mm, see Figure B.4.0.3.1.

The copper foil surrounded by the annulus is the active measuring surface. It is connected to one input terminal of an operational amplifier, with capacitive feedback. The other input terminal of the operational amplifier, the copper ring outside the active surface, and the back of the board are connected to ground. The output voltage ( $U$ ) from the probe (active surface with area ( $A$ )) is related to the incident electrical field,  $E$ , averaged over the active surface in accordance with  $U = \varepsilon \cdot E \cdot A/C$  where  $C$  is the capacitance in the feedback loop of the operational amplifier and  $\varepsilon$  is the permittivity for a vacuum.



**Figure B.4.0.3.1 Sketch and circuit principle of the Alternating electric field meter for alternating electrical field measurements. The feedback circuit of the operational amplifier is a capacitance  $C$  in parallel with a high value resistor  $R$  to ensure that there is no DC voltage across the plates of the capacitor  $C$ .**

The specifications for the frequency response of the alternating electric field meter are given by the calibration procedure. The signals from the probe shall be filtered by high-pass and low-pass filters. The specification of the filters is given in Table B.4.0.3.1.

**Table B.4.0.3.1 Filter specifications**

<b>Frequency Band I</b>					
<b>Frequency</b>	< 5 Hz	5 Hz	100 Hz	2 kHz	> 2 kHz
<b>Attenuation</b>	> 80 dB/decade	3 dB	0 dB	3 dB	> 40 dB/decade

<b>Frequency Band II</b>					
<b>Frequency</b>	< 2 Hz	2 Hz	30 kHz	400 kHz	> 400 kHz
<b>Attenuation</b>	> 80 dB/decade	3 dB	0 dB	3 dB	> 40 dB/decade

After amplification and filtering the output voltage of the measuring probe shall be used to determine the r.m.s. value of the electric field strength in both frequency bands.

The measuring time shall be sufficiently long to enable measurements with an accuracy of  $\pm 5\%$  at 50/60 Hz.

The measuring system shall be capable of measuring at least down to 2.0 V/m in Band I and down to 0.20 V/m in Band II.

The measuring probe shall be calibrated using a parallel plate capacitor (air dielectric) consisting of the measuring probe and a metal plate of at least 300 mm diameter. The distance between the surface of the probe and the plate shall be 30 mm.

The calibration shall be performed with sinusoidal fields at the amplitudes and frequencies specified in Table B.4.0.3.2.

**Table B.4.0.3.2 Calibration frequencies and amplitudes**

	<b>Frequencies</b>	<b>Amplitude</b>
<b>Band I</b>	50, 100, 500, 1000 Hz	10, 25 V/m
<b>Band II</b>	15, 30, 60, 120 kHz	1.0, 2.5, 10 V/m

Recorded values at these calibration points shall be within  $\pm 5\%$  of the nominal value. Due to the nature of the specified filters the deviation shall be calculated at 1 kHz from 9.5 and 22.5 V/m and at 120 kHz from 0.95, 2.4 and 9.5 V/m.

**Alternating magnetic field meter in Band I and Band II**

The magnetic field shall be measured with two coil systems, one covering Band I and the other Band II. Each coil system shall consist of three mutually perpendicular concentric circular coils each with an area of 0.01 m<sup>2</sup>. The coils

may depart from a circular shape where they intersect. The minimum inner diameter shall be 110 mm and the maximum outer diameter 116 mm. The measuring coils shall not be sensitive to electric fields.

The resonance frequency of each coil appropriately connected to cables and amplifiers shall be greater than 12 kHz for Band I and greater than 2.5 MHz for Band II. The resonances shall be suppressed by resistive loading of each coil.

Amplifiers and integrating networks to make the output voltage proportional to the magnetic flux density and independent of frequency shall follow each coil. The specifications in respect of the frequency response are given in the calibration procedure.

High-pass and low-pass filters shall filter the signals from the coil systems. The specifications of the filters are given in Table B.4.0.3.1.

After amplification, integration and filtering, the signals from the three coils in each coil set shall be used as input values for calculating the r.m.s. values of the amplitudes of the magnetic flux density vectors in both frequency bands. It is permissible to calculate the r.m.s. value for each of the coil signals and use the root of the squared sum of those r.m.s. values as the test result.

The measuring time shall be sufficiently long to enable measurement with an accuracy of  $\pm 5\%$  at 50/60 Hz.

The alternating magnetic field meter in Band I and Band II shall be capable of measuring down to at least 40 nT in Band I and down to 5.0 nT in Band II.

The alternating magnetic field meter in Band I and Band II shall be calibrated using a Helmholtz-type calibration coil as shown in the Figure B.4.0.3.2.

**Calibration set-up.**

Calibration shall be performed with sinusoidal fields at the amplitudes and frequencies specified in Table B.4.0.3.3.

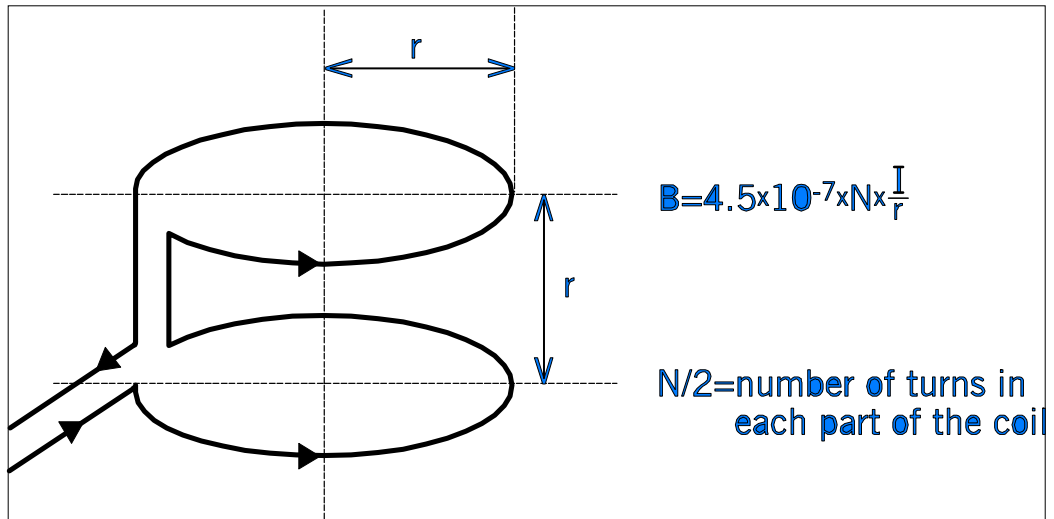


Figure B.4.0.3.2. Calibration using a Helmholtz-type calibration coil.

**Table B.4.0.3.3 Calibration frequencies and amplitudes**

	Frequencies	Amplitudes
<b>Band I</b>	60, 100, 500, 1000 Hz	200, 2000 nT
<b>Band II</b>	15, 30, 60, 120 kHz	25, 250 nT

Recorded values for these calibrations shall not deviate more than  $\pm 5\%$  from the nominal value. Due to the nature of the specified filters the deviation at 1 kHz shall be calculated from 180 nT and 1800 nT and at 120 kHz from 24 nT and 240 nT.

The calibration shall be performed for each of the three individual coils separately exposed and for one situation where approximately the same flux density passes through all three coils.

## **B.4.1 Alternating electrical fields**

### **B.4.1.0 Test laboratory requirements**

Background electric field strengths in the test laboratory, including disturbances transmitted by power lines and internally generated noise in the measuring system, shall together not exceed 2.0 V/m in Band I and 0.20 V/m in Band II.

The mains voltage to the EUT under test shall be within  $\pm 3$  % of its nominal value.

### **B.4.1.1 Preparation of the EUT for testing**

All necessary preparations described in B.1 and B.4.0 shall be done.

### **B.4.1.2 Equipment**

Alternating electric field meter

### **B.4.1.3 Test Method**

The EUT and the FPD shall be set up in accordance with clause B.4.0.1 or 2 in the most recent version of TCO'03 Displays, Flat Panel Displays.

The true r.m.s. value of the amplitude of the electric field strength, at the surface of the measuring probe, is measured in front of the test object in Band I and in four azimuths in Band II. The frequency ranges are selected by means of filters in the measuring equipment.

The EUT shall be positioned such that the tangential plane, to the centre-centre point of the EUT, is at a right angle to the horizontal plane. The distance between the centre-centre points of the EUT and the back of the EUT, including, where used, any part of a stand holder, along the normal to this tangential plane is called L, see Figure B.4.1.3.1.

The origin of the cylindrical co-ordinate system is chosen to be situated at a distance  $L/2$  behind the front of the EUT on the normal to the tangential plane through the centre-centre point. The z-axis is chosen to be at a right angle to the horizontal plane. The angular reference direction is along the above mentioned normal in the direction pointing outwards from the front. An angle ( $^\circ$ ) is positive in the counter-clockwise direction.

Measurements shall be made at all points which have a minimum clearance of 0.25 m to the outer surface of the EUT and with co-ordinates according to:

$$z = 0$$

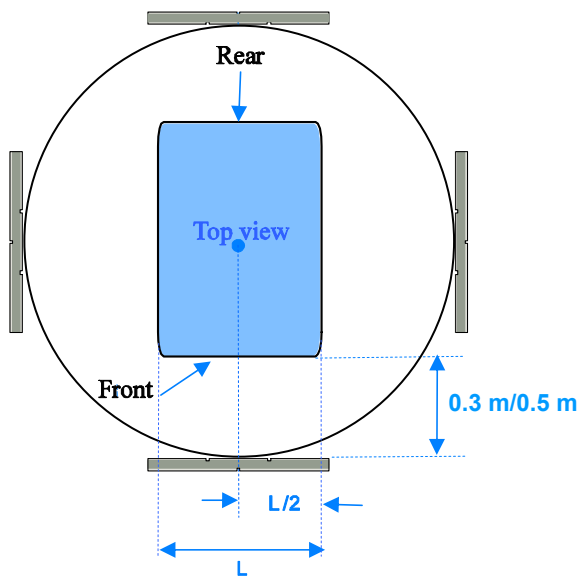
$$r = (L/2 + 0.5) \text{ m (at the front also } (L/2 + 0.3) \text{ m)}$$

$$\varphi = 0^\circ \text{ for Band I}$$

$$\varphi = 0^\circ, 90^\circ, 180^\circ \text{ and } 270^\circ \text{ for Band II}$$

In case of less than 0.25 m clearance the instrument shall be moved out radially until 0.25 m clearance is achieved.

Distances are given in meters and angles in degrees. The co-ordinates are given for the centre of the measuring probe. The surface of the probe shall be perpendicular, within  $\pm 5^\circ$ , to the radial axis.



**Figure B.4.1.3.1. Measurement geometry for both Band I and Band II for the EUT.**

The EUT and the measuring probe shall be positioned at least 1 m from all significant metallic structures and objects.

Additional units and connecting cables necessary for the operation of the EUT, which are not part of the test, shall be placed so far away from the measuring setup that the fields they emit do not influence the measurement. Shielding may be added to these units and cables, as long as the 1 m clearance is maintained.

The measuring probe shall be connected to ground. Any cables that may run between the measuring probe and the measuring instrument shall be positioned in such a way that they do not influence the measured value.

The power cable of the EUT shall be connected to the phase and the neutral conductors of the mains power supply. If the mains power supply plug permits an interchange of the live and neutral conductors, measurements shall be taken with the connection that gives the highest reading in Band I.

#### **B.4.1.4 Test evaluation**

Results shall be presented as r.m.s. values of the alternating electric field expressed in volt per meter (V/m). For Band I, results shall be presented as the

measured values at 30 cm and 50 cm for normal and stand-by operations if they differ. For Band II, the measured values in front of the EUT and the maximum value at rotation shall be presented for normal and stand-by operations if they differ.

If the measured values are less than 10.0 V/m in Band I or less than 1.0 V/m in Band II the result shall be reported as “<\_10.0 V/m” or “<\_1.0 V/m”, respectively.

(The mandate in accordance with clause A.4.1 is as follows:

Band I: 5 Hz to 2 kHz,  $\leq 10$  V/m, measured at 30 cm and at 50 cm in front of the EUT.

Band II: 2 kHz to 400 kHz,  $\leq 1.0$  V/m measured at 50 cm around the EUT and at 30 cm in front of the EUT. )

#### **B.4.1.5 Overall uncertainty**

The test shall be performed in such a way that the total extended uncertainty in the test result will be less than  $\pm$  (10 % of the reading + 1.5 V/m) for Band I and  $\pm$  (10 % of the reading + 0.1 V/m) for Band II.

## B.4.2 Alternating magnetic fields

### B.4.2.0 Test laboratory requirements

Background magnetic fields in the test laboratory, including disturbances transmitted along the power line and internally generated noise in the measuring system, shall together not exceed 40 nT in Band I and 5 nT in Band II.

### B.4.2.1 Preparation of the EUT for testing

All necessary preparations described in B.1 and B.4.0 shall be done.

### B.4.2.2 Equipment

Alternating magnetic field meter in Band I and Band II

### B.4.2.3 Method

The EUT and the FPD shall be set up in accordance with clause B.4.0.1 or 2 in the most recent version of TCO'03 Displays, Flat Panel Displays.

The true r.m.s. value of the amplitude of the magnetic flux density vector is measured at 48 points on a cylindrical surface around the test object in the two frequency ranges, Band I and Band II. The frequency ranges are selected by specified filters in the alternating magnetic field meter.

The measuring geometry is illustrated in Figure B.4.2.3.1. The measurement points are mathematically defined in the following way.

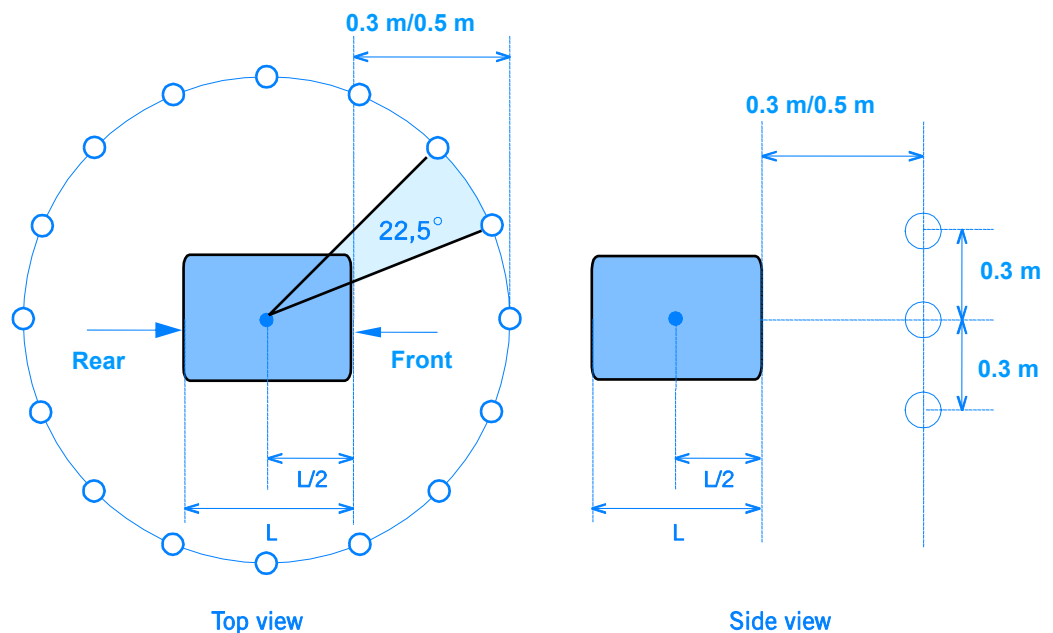


Figure B.4.2.3.1. Measurement geometry for the EUT.



The EUT shall be positioned such that the tangential plane, to the centre-centre point of the EUT surface, is at a right angle to the horizontal plane. The distance between the centre-centre points of the EUT and the back of the EUT, including, where used, any part of a stand holder, along the normal to this tangential plane is called L.

The origin of the cylindrical co-ordinate system is chosen to be situated at a distance  $L/2$  behind the surface on the normal to the tangential plane through the centre-centre point. The z-axis is chosen to be at a right angle to the horizontal plane. The angular reference direction is along the above-mentioned normal in the direction pointing outwards from the EUT. An angle ( $\theta$ ) is positive in the counter-clockwise direction. Measurements shall be made at all points which have a minimum clearance of 0.25 m to the outer surface of the EUT and with co-ordinates according to:

$$z = -0.3 \text{ m}, z = 0 \text{ and } z = +0.3 \text{ m}$$

$$r = (L/2 + 0.5) \text{ m (at the front also } (L/2 + 0.3) \text{ m in Band I)}$$

$$\theta = p \cdot 22.5^\circ \text{ where } p \text{ represents all integers in the range } 1 \leq p \leq 15.$$

In case of less than 0.25 m clearance the instrument shall be moved out radially until 0.25 m clearance is achieved.

Distances are given in metres and angles in degrees.

The measuring coils shall be stationary during the measurements.

The power cable of the test object shall be connected to the phase and the neutral conductors of the mains power supply. The EUT does not need to be measured with the phase and neutral interchanged in this case, as the magnetic fields are not influenced by such a change.

#### **B.4.2.4 Test evaluation**

Results shall be presented as r.m.s. values of the magnetic flux density expressed in nanotesla (nT) for the two frequency Bands. The values in front of the EUT and the maximum value and its position shall be given both for normal and for standby operation if they differ. If measured values are less than 200 nT in Band I or less than 25.0 nT in Band II the result shall be reported as “<200 nT” and “<25.0 nT” respectively.

(The mandate in accordance with clause A.4.2 is the following:

Band I: 5 Hz to 2 kHz,  $\leq 200$  nT, measured at 30 cm in front of the EUT and at 50 cm around the EUT.

Band II: 2 kHz to 400 kHz,  $\leq 25$  nT measured at 50 cm around the EUT.

#### **B.4.2.5 Overall uncertainty**

The test shall be performed in such a way that the total extended uncertainty in the test result will be less than  $\pm(10\%$  of the reading + 30 nT) for Band I and  $\pm(10\%$  of the reading + 1.5 nT) for Band II.

**Note**

The uncertainties given are worst case limits. In many cases it will be possible to obtain better accuracy, especially in Band II.

## B.6 Ecology

### B.6.2.5 Information regarding flame retarding agents

The following test methods shall be used when fulfilling mandate A.6.2.5. The tests results can be obtained from flame retardant and/or plastic manufacturers.

#### **Bioaccumulation**

The bioaccumulation of a substance can be calculated with a QSAR-algorithm<sup>2</sup>. The bio concentration factor, BCF, is calculated from the structure of the substance and the partition coefficient for octanol and water:  $P_{ow}$ . The  $P_{ow}$  value shall be derived from tests 107 or 117, OECD Guidelines for the Testing of Chemicals.

Existing experimental values for BCF can replace calculated values.

#### **Toxicity in a water environment**

Test values for toxicity must be presented for at least one aquatic organism.

For algae it shall be a value derived from a growth inhibition test with a test period of 72 hours. The test should be performed in accordance with 201, OECD Guidelines for the Testing of Chemicals. The value shall be given as the concentration in mg/l of the substance giving growth inhibition to 50 % of the test population:  $EC_{50}$ .

For Daphnia it shall be a value derived from an acute immobilisation test with a test period of 48 hours. The test should be performed in accordance with 202, OECD Guidelines for the Testing of Chemicals. The value shall be given as the concentration in mg/l of the substance giving acute immobilisation to 50 % of the test population:  $EC_{50}$ .

For fish it shall be a value derived from an acute toxicity test with a test period of 96 hours. The test should be performed in accordance with 203, OECD Guidelines for the Testing of Chemicals. The value shall be given as the concentration in mg/l of the substance causing death to 50 % of the test population:  $LC_{50}$ .

$EC_{50}$  means the concentration whereby 50 % of the test population shows the studied effect.

$LC_{50}$  is the lethal concentration for 50% of the test population.

#### **Persistence**

To assess whether the substance is persistent or not it shall be tested either in accordance with:

301 A-F, OECD Guidelines for the Testing of Chemicals or with ISO 11734 and ISO 14592.

---

<sup>2</sup> The calculation can be done with the freely available program BCFWINNT.EXE from EPA It can be downloaded from <http://www.epa.gov/oppt/exposure/docs/episuitedl.htm>

### OECD 301 A-F, Ready Biodegradability

To assess whether the substance is persistent or not, OECD 301 consists of the following tests.

A: DOC Die-Away Test

B: CO<sub>2</sub> Evolution Test

C: Modified MITI Test (I)

D: Closed Bottle Test

E: Modified OECD Screening Test

F: Manometric Respirometry Test

### ISO 11734, Anaerobic degradation

ISO 11734 assesses whether the substance is anaerobically degradable or not. If the substance is not degraded anaerobically it can be deposited in sediment and stay there for a very long time even if it is degradable in an aerobic environment.

The test is run for 60 days unless the biodegradation curve has reached the plateau phase before that and that it indicates a degradation of at least 50 %. The degradation shall be given as 10 % intervals, such as 30 – 40 %.

### ISO/DIS 14592, Aerobic degradation

ISO 14592 evaluates whether the substance is aerobically degradable or not.

There are two main variants:

ISO 14592-1<sup>3</sup>, Shake flask batch test. This can be performed in accordance with two subvariants: with or without added sediment

ISO 14592-2, Continuous flow river model with attached biomass.

One of these tests will suffice. The speed of the degradation shall be given as the half life ( $t_{1/2}$ ) of the substance.

---

<sup>3</sup> This standard test is expected shortly to be incorporated in OECD Guidelines for the Testing of Chemicals with the number 309

# B.7 Energy

## B.7.0 General test conditions for Power measurements

### B.7.0.1 Basic test requirements

As described in section B.1.

The EUT shall be warmed-up for a minimum of 20 minutes.

#### B.7.0.1.1 Definitions

##### **Sleep Mode/Low Power**

The reduced power state that the EUT enters after receiving instructions from the software or via other functions.

##### **Off Mode/Standby Power**

The lowest power consumption mode which cannot be switched off by the user and that may persist for an indefinite time when EUT is connected to the main electricity supply. Off mode is the power state when EUT is connected to a power source, produces no images and is waiting to be switched to the On Mode by a direct signal from a user.

### B.7.0.2 Test laboratory general requirements

### B.7.0.3 Test conditions, general criteria

- AC mains voltage\* 230 VAC RMS, tolerance  $\pm 1\%$  [1]
- AC mains frequency\* 50 Hz, tolerance  $\pm 0.5$  Hz [2]
- Line impedance 0.25  $\Omega$  [3]
- Total harmonic distortion  $< 2\%$
- Test room temperature  $23\pm 3^{\circ}\text{C}$  [4]
- Humidity 20-75 % RH (non-condensing) [5]

\* – or other voltage and frequency combination specified by the client.

#### Notes

- [1] Energy Star states 115 VAC RMS tolerance  $\pm 1\%$ .
- [2] Energy Star states 60 Hz  $\pm 3$  Hz.
- [3] Same as Energy Star.
- [4] Energy Star states  $25\pm 3^{\circ}\text{C}$ .
- [5] Energy Star states no requirement concerning humidity.

#### **B.7.0.4 Power measurements**

Several instruments are to be used when carrying out measurements for power as well as the prerequisite luminance and brightness levels. All instruments shall be within their calibrated period and bear a calibration certificate from a certified laboratory.

The following instrument types are to be used for testing:

- RMS power meter

The RMS power meter shall have a crest factor of at least five, and a frequency response of at least 3 kHz.

#### **B.7.0.5 Measurement stability**

Measurements shall be taken after a stable Wattage value has been obtained over a three-minute period. Values are considered to be stable when variations in Wattage values are 1% or less for the duration of the three minute period.

### **B.7.1 Energy Requirements**

#### **B.7.1.1 Preparation of the Desktop computer for testing**

#### **B.7.1.2 Equipment**

- RMS power meter

#### **B.7.1.3 Test method**

The following are the test steps for measuring the true power requirements of the EUT in Sleep Mode/Low Power and Off Mode/Standby Power.

##### **Sleep Mode/Low power**

Connect the EUT to the power meter. After running the EUT in On Mode/Active Power mode, initiate the EUT Sleep Mode/Low Power. Apply power to all test equipment and properly adjust the operating range.

Allow the EUT to remain in Sleep Mode/Low Power until stable power readings are measured. Measurements are considered stable if the Wattage reading does not vary by more than 1% for the duration of a three-minute period.

Record the test conditions and results. The measurement time shall be sufficiently long to measure the correct average value (i.e. not peak or instantaneous power).

If the device has different Sleep Modes that can be manually selected, the measurements should be taken with the device in the mode that consumes most energy. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.

##### **Off Mode/Standby Power (Power switched off)**

At the conclusion of the Sleep Mode/Low Power test, initiate the EUTs Off Mode/Standby Power.

Allow the EUT to remain in Off Mode/Standby Power until stable power readings

are measured. Measurements are considered stable if the Wattage reading does not vary by more than 1% for the duration of a three-minute period.

#### **B.7.1.4 Test evaluation**

Record the test conditions and test results as specified for each mode in section B.7.1.3.

An energy declaration sheet, showing power consumption in sleep mode and off mode from a test laboratory accepted by TCO Development shall be submitted. There shall be a description, from the user's point of view, of how the EUT is brought into its energy mode(s) and how this is indicated on the EUT. The description shall be signed by the responsible person at the applicant company and be submitted by the responsible person at the applicant company.

#### **B.7.1.5 Overall uncertainty**

The uncertainty in the test results shall be better than  $\pm 5\%$ .