TCO DEVELOPMENT

TCO Certified Smartphones 1.0

May 6 2013

TCO DEVELOPMENT

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Support (on this document and certification)

If you would like to certify your products and need support in understanding this document and the certification process, then TCO Development has partners that have laboratories around the world that can clarify this document and assist you with certification in your native language.

Please contact TCO Development for a list of partner laboratories and verifiers: certification@tcodevelopment.com

Or visit the TCO Development webpage for a list of partner laboratories: www.tcodevelopment.com

Introduction

TCO Development has, since the end of the 1980s, influenced the development of IT equipment, particularly Visual Display Units (VDUs). Today, TCO Development's international certification system – TCO Certified – makes it easy to choose sustainably designed and produced IT and office equipment. It is a third party certification, Type 1 eco label according to ISO14024. The point of departure for this product group's criteria is the commitment to sustainability, whereby long term economic gains are dependent on social and environmental considerations. The criteria for TCO Certified include environmental and social aspects, and have been broadened from product focus to also include the production phase. This is a result of increased expectations around the world to respect human rights in the production and development of the products. The social responsibility criteria also cover quality aspects of the product, such as ergonomics, emissions and electrical safety. The criteria related to the environment include, for both product and production, aspects, such as energy consumption, content of hazardous materials, preparation for recycling and environmental management system at production sites.

With every major update of the criteria the aim is to extend and tighten the certification in order to keep in pace with technology innovation and development. All updates are a result of cooperation between key stakeholders, such as purchasers, users, producers, and researchers. This criteria document TCO Certified Smartphones 1.0, is the first version of TCO Development's certification of Smartphones. Going forward, subsequent versions, 1.1, 1.2 etc., might be released. However, these are to be considered only as updates within the first version with improved precision of the mandates and test methods.

It is permitted to quote from these criteria (e.g. in procurements), provided that the source is disclosed and the extent of the quotation is consistent with sound copyright practice. For further information, please visit www.tcodevelopment.com.

Stockholm, May 6, 2013

TCO Development

Niclas Rydell

Director, Product Development and Certification

A Criteria

A.1 General information

Smartphone definition

This document contains requirements, test methods and references for Smartphones for display sizes ≥ 3” to ≤ 6”. The intended use of a Smartphones is portable computing and mobile communication.

For the purpose of this document a **Smartphone** is an electronic device used for long-range communication over a cellular network of specialized base stations known as cell sites. It must also have functionality similar to a wireless, portable computer that is primarily for battery mode usage and has a touch screen interface. Connection to mains via an external power supply is considered to be mainly for battery charging purposes and an onscreen virtual keyboard or a digital pen is in place of a physical keyboard.

The criteria document setup

The aim of this criteria document is to provide relevant test methods and criteria for the actual use of the product. This criteria document has an A- and a B-part. The A-part includes the mandated criteria and the B-part clarifications and test methods.

Some paragraph numbers in this criteria document can be missing and this might seem illogical. The reason is to keep the same paragraph numbers consistent across several criteria documents of different product groups as this simplifies the testing procedure. *(For example, because of this a certain environmental declaration will always have the same paragraph number.)*

Mandate compliance

Compliance to the mandates in this criteria document can be achieved in one of two ways. Those ways are either through a test report or through a verification report.

1. A test report is defined as a report based on:
    - Testing conducted by the laboratory issuing the test report on the product identified in the report.
2. A verification report is defined as a report based on:
    - A test report issued by a different laboratory.
    - Declarations from the Company applying for the certificate.

The alternatives accepted by TCO Development for each criterion can be found under each mandate respectively.

A.1.1 TCO Certified Document

Background

It is necessary that the purchaser of a product that has been certified in accordance with this TCO Certified Smartphones criteria document receives information concerning the quality, the features and capabilities of the product. This information is based on the viewpoint from the user's perspective that TCO Development represents.

Applicability

All Smartphones.

References

The contract between TCO Development and the Applicant/Brand owner.

Mandate A.1.1:

A TCO Certified Document written in English or the native language where the product is to be sold shall accompany the product. The document shall describe why these particular requirements have been chosen for the products within the program of TCO Certified Smartphones and what is expected to be achieved by them. The document may be provided as an electronic file. An English version of the text can be obtained from TCO Development.

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 following information shall be submitted to the verifier at the test laboratory:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a test laboratory approved 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.2 Visual ergonomics

Today displays are an essential tool for users in all kinds of environments. Good visual ergonomics is a very important aspect of quality that can also have a direct effect on the health, comfort and performance of the user.

In developing requirements for visual ergonomics, the possible health effects of various parameters have been taken into account. Other features that characterise good quality displays have also been in focus for developing these criteria.

TCO Development used three main methodologies to determine the suitable level for each requirement and the test methods for the visual ergonomics part of the TCO Certified program. One is based on acceptable visual levels, as determined by scientific research. The second is based on statistics from tests carried out in accordance with TCO Development, ISO, MPR regulations and from specialized VDU tests. The third way is based on manufacturers' knowledge and experience, which is invaluable. Manufacturers, consumer groups and other organisations with interests in the visual ergonomics field have contributed with a great deal of valuable information and ideas throughout the development process.

A.2.2 Luminance characteristics

A.2.2.1 Luminance level

Background

It shall be possible to set the luminance level according to the lighting conditions of the surroundings. Poor luminance can lead to low contrast and consequently affect legibility and colour discrimination and thus lead to misinterpretations. It shall be possible to set a sufficiently high luminance level with respect to the ambient lighting in order to present a comfortable viewing situation and to avoid eyestrain.

Definition

Luminance being emitted from a particular area is a measure of the luminous intensity per unit area of light travelling in a given direction and falls within a given solid angle.

The unit of luminance is cd/m^2.

Applicability

All Smartphones.

Test procedure

See B.2.2.1.

References

1, 2, 18, 22, 28 and 32.

Mandate A.2.2.1:

1. **The maximum white *luminance* shall be ≥200 cd/m^2 at 80% image loading.**
2. **The minimum white *luminance* shall be ≤ 100 cd/m^2 at 80% image loading**

The following information shall be submitted with the application to TCO Development:

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

A.2.2.2 Luminance uniformity

Background

Image quality is badly affected by non-uniform luminance. When poor luminance uniformity is visible, it can locally affect the contrast and consequently the legibility of information on the display. The areas of deviating luminance can have different sizes and cause varying contour sharpness.

Definition

Luminance uniformity is the capacity of the display to maintain the same luminance level over the whole active screen area. The luminance uniformity is defined as the ratio of maximum to minimum luminance within the fully active screen area.

Applicability

All Smartphones.

Test procedure

See B.2.2.2.

References

1, 2, 16, 18, 22, 23, 28, 33 and 34.

Mandate A.2.2.2:

Luminance variation across the active screen, the L_{max} to L_{min} ratio, shall be ≤ 1.20.

The following information shall be submitted with the application to TCO Development:

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

A.2.2.3 Greyscale gamma curve

Background

A TCO certified Smartphone shall be delivered with a sufficiently accurate calibrated gamma curve in default preset since it makes it easier to distinguish between different light levels in the display image. A well-tuned greyscale is the basis for accurate detail rendering of any imaging device. The greyscale rendering is measured via a number of steps in a greyscale in the test image. Each greyscale step, regardless of grey level, shall have a relative luminance close to what is specified by common video standards sRGB and ITU Rec709 in order to give accurate rendering of the greyscale of the original image.

Definition

Greyscale gamma curve is the capability of the imaging device to maintain the original greyscale luminance of a greyscale pattern at all tested greyscale levels.

Applicability

All Smartphones.

Test procedure

See B.2.1.3

References

11, 12, 13 and 14.

Mandate A.2.2.3:

The different grey scale luminance levels shall be within the Max- and Min levels according to the table below, where 100% means the luminance level measured for white, RGB 255, 255, 255.

Grey level	L_{sRGB}	L_{max}	L_{min}
	%	%	%
255	100	100	100
225	75	80	71
195	55	62	48
165	38	47	30
135	24	33	18
105	14	22	9
75	7	13	4
45	3	6	1

The following information shall be submitted with the application to TCO Development:

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

A.2.5 Screen colour characteristics

A.2.5.1 Correlated colour temperature, CCT variation

Background

The colour of a white area in nature could be neutral, warmer or colder dependent of e.g. the weather and lighting conditions. This is called the colour temperature of the white. The colour temperature of the display should be about the same as of the ambient lighting conditions. This makes it possible to more accurately evaluate the colour of an image on the display compared to real scenes or prints. Normal daylight has a correlated colour temperature in the range 5000 – 10000 K.

Definition

The correlated colour temperature (CCT) is the temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions. It is expressed in kelvin (K).

Applicability

All Smartphones.

Test procedure

See B.2.5.1.

References

2, 3, 4, 8, 9, 10, 11, 14, 15, 25, 26, 27, 29, 31 and 35.

Mandate A.2.5.1:

The default *correlated colour temperature* of the active display shall be in the range 5000K to 10000K.

The following information shall be submitted with the application to TCO Development:

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

A.2.5.2 Colour uniformity

Background

The human visual system is very sensitive to changes in colour hue in white and grey areas. Since the white or grey colour hues are the background on which most colours are judged, the white or grey areas are the reference colours on the screen.

Patches of colour variation on an active white or grey screen could reduce the contrast locally, be disturbing and affect the legibility, colour rendering and colour differentiation.

Definition

The *colour uniformity* of a display is the capability to maintain the same colour in any part of the screen.

Applicability

All Smartphones.

Test procedure

See B.2.5.2.

References

2, 8, 14, 15, 24, 26, 30 and 36.

Mandate A.2.5.2:

The maximum colour deviation between measured active areas on the screen that are intended to maintain the same colour shall be $\Delta u'v' \leq 0.012$

The following information shall be submitted with the application to TCO Development:

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

A.2.5.3 RGB settings

Background

Accurate colour rendering is important when realistic colour images or colour presentations are presented on the display. Poor colour rendering can lead to poor legibility and misinterpretation. The u' and v' chromaticity co-ordinates of the primary colours red (R), green (G) and blue (B) of the screen shall aim at values given in international IEC, EBU and ITU standards. The u' and v' chromaticity co-ordinates of the primary colours R, G and B form a triangle in the CIE 1976 uniform chromaticity scale diagram. The larger the area of the triangle, the wider the range of colours the screen is capable of presenting.

The colour characteristics of a display are based on the visual appearance of the displays primary colour stimuli, the R, G, B-stimuli.

Definition

The RGB colour model is an additive colour model in which red, green, and blue light are added together in various ways to reproduce a broad array of colours.

Applicability

All Smartphones.

Test procedure

See B.2.5.3.

References

3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 26, 27, 29, 31 and 35.

Mandate A.2.5.3:

The minimum colour triangle shall have the following co-ordinates:

	Red		Green		Blue	
Co-ordinate	**u'**	**v'**	**u'**	**v'**	**u'**	**v'**
Requirement	**≥0.375**	**≥ 0.503**	**≤0.160**	**≥0.548**	**≥0.135**	**≤0.305**

The following information shall be submitted with the application to TCO Development:

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

A.3 Workload ergonomics

A.3.1 Material Characteristics

Background

Skin allergy, in the form of rash or inflammation, may happen when the skin comes in contact with substance which irritates the skin. It is medically termed as “contact dermatitis”. Nickel is a well-known contact allergen and irritant which may create skin reactions if the skin gets exposed to it. Then there is a risk to get one’s skin feeling itching or irritated and get appearance of rashes or inflammation.

Definition

Normal use is considered as the operation descriptions given in the product’s user manual/guides.

Applicability

All Smartphones.

References

12, 13 and 14

Mandate A.3.1:

The Smartphone shall not release nickel from the surfaces that come in contact with user´s skin during normal use

For the maximum value see B.3.1

The following information shall be submitted to the verifier at the test laboratory:

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

The following information shall be submitted with the application to TCO Development:

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

We hereby guarantee that the above mandatory requirement is fulfilled.

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

A.3.2 Headset

Background

A headsets provide hands-free operation of the smartphone communication. This have many uses especially in call centers and other telephone-intensive jobs and for anybody wishing to have both hands free during a telephone conversation. It also reduces the emissions from the smartphone towards the head as the smartphone may be placed further away from the head while making a phone call.

Definition

A headset is headphones combined with a microphone, or one headphone with a microphone.

Applicability

All Smartphones with the possibility of audio communication.

Mandate A.3.2:

The Smartphone shall be delivered with a headset to be used for audio communication over the cellular network.

The following information shall be submitted to the verifier at the test laboratory:

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

The following information shall be submitted with the application to TCO Development:

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

We hereby guarantee that the above mandatory requirement is fulfilled.

……..……..	……..
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 Smartphones with built-in power supplies as well as any separate power supply intended to be used together with the Smartphone.

Mandate A.5.1:

The Smartphone and the internal or external power supply/supplies shall be certified in accordance with EN/IEC 60 950 or EN/EIC 60065.

The following information shall be submitted with the application to TCO Development:

A copy of the CB certificate or a national certificate from a CB member (NCB)

A.6 Environmental requirements

The TCO Certified requirements combine a unique integrated balance of indoor and outdoor environmental issues. Achieving a good working environment should not be at the expense of the natural environment. This document details the environmental requirements of the TCO Certified criteria.

The Environmental requirements are divided into the following sections:

1. Organisation – requirements focusing on the production phase, environmental management and Corporate Social Responsibility (CSR).
2. Climate – energy consumption, one of the most important issues in the environmental impact of IT products.
3. Hazardous Substances – heavy metals, flame retardants, plastics.
4. Product Lifetime – factors to extend the life of the product.
5. Preparation for Recycling – factors to stimulate recycling.
6. Packaging – hazardous substance content and recycling.

Potential environmental effects are evident at each stage of the product life cycle. Due to the complexity of the production of ICT products, it is often most effective to refer to indirect requirements on the production such as requirements for an environmental management system. Should a more direct quality-assured system for manufacturing processes become possible, then TCO Development would consider that option for future requirements. The environmental requirements TCO Development has focused on are those that we consider most relevant to the product group. They have also proved to be attainable in volume production and are verifiable. Future updates of the criteria will likely focus on hazardous substances, CSR and climate issues.

All requirements except section *A.6.3 Climate* shall be verified by sending the requested information to an environmental verifier at a test laboratory approved by TCO Development. The energy consumption requirements in section A.6.3 shall be tested at a test laboratory approved by TCO Development.

A.6.1 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 environmentally related requirements of Section A.6 and also for information collection.

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

Applicability
All Smartphones and the equipment specified in requirement A.1.1 supplied with them.

Clarification
B.6.1

References
44

Mandate A.6.1:

A product declaration shall be provided for the Smartphone.

The following information shall be submitted to an approved verifier:

1. The declaration below, completed where applicable.

2. A copy of the *marking plate* for the Smartphone and external power supply.

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development and a copy of the marking label.

Product Declaration.

Smartphone	**Information**
Manufacturer	
Brand name	
Brand Owner	
Type/Model name	
Product Family name	

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

Panel	**Information**
Brand name	
Model name	
Size and technology (e.g. TN type)	

External power supply: Brand & model name	**Rating and Class**

Battery: Brand & model name	**Technology (e.g. Li-ion), rating & characteristics**

TCO Certified Certificate Holder……

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

....
Signature Name and title in block capitals

....
Date Company

A.6.2 Organisation

A.6.2.1 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

Company or companies manufacturing the Smartphone.

Clarification

B.6.2.1

References

45 and 46.

Mandate A.6.2.1:

Each *manufacturing plant* must be certified in accordance with ISO 14001, or EMAS registered. If the product is manufactured by a third party, it is this company that shall be certified or registered.

If the *manufacturing plant* does not have an ISO 14001 certificate or EMAS registration at the time of application, the *manufacturing plant* is given a 12-month grace period to obtain ISO14001 certification or EMAS registration.

The following information shall be submitted to an approved verifier:

1. A document showing the names and addresses of the manufacturing plants.

2. Copy of the ISO 14001 certificate or EMAS registration or, when not available, an estimated date of certification/registration.

3. A written guarantee that the certificate/registration is valid and that the mandate above is fulfilled, signed by the responsible person at the applicant company.

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.3 Climate

A.6.3.1 Energy consumption

Background

Energy is the single most important topic in the issue of climate change. Energy efficient equipment is an important and effective way to fight climate change. With an ever-increasing volume of IT equipment in use, the efficiency of each product is vital. To reduce energy consumption from the Smartphone the external power supply (also referred to as power adapter) shall comply with the International Efficiency Marking Protocol for External Power Supplies.

Applicability

All external power supplies

Clarification

B.6.3.1

References

52.

Mandate A.6.3.1:

The external power supply shall meet at least the International Efficiency Protocol requirement for level V

The following information shall be submitted to the verifier at the test laboratory:

A copy of the marking plate for the external power supply

The following information shall be submitted with the application to TCO Development:

A copy of the marking plate for the external power supply

A.6.4 Environmentally hazardous substances

A.6.4.1 Mercury (Hg) free product

Background
The effects of mercury (Hg) are well documented as an environmental hazardous substance. EU regulates mercury in the RoHS directive, however exempting the use of mercury in the backlighting. Today the LED backlight technology makes it possible to go beyond the RoHS Directive and ban the use of mercury altogether.

Applicability
All Smartphones.

Clarification
B.6.4.1

References
54 and 55.

Mandate A.6.4.1:

The Smartphone shall not contain mercury.

For maximum concentration values: see B.6.4.1.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.4.2 Cadmium (Cd), lead (Pb) and hexavalent chromium (Cr6)

Background
The effects of the listed substances are well documented as environmental hazardous substances. EU regulated these substances in the RoHS directive (2002/95/EC).

Applicability
All Smartphones.

Clarification
B.6.4.2

References
54 and 55.

Mandate A.6.4.2:

The Smartphone shall not contain cadmium, lead and hexavalent chromium.

Note: This applies to components, parts, and raw materials in all assemblies and sub-assemblies of the product e.g. paint, surface treatment, plastics and electronic components.

For maximum concentration values: See B.6.4.2

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.4.3 Halogenated substances

Background

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

A series of international elimination activities in respect to brominated and chlorinated flame retardants is currently in progress within several national and international bodies, e.g. EU, OECD, North Sea Conference.

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 metal conductors, are not included in the definition.

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

Applicability

All Smartphones.

Clarification

B.6.4.3

References

55.

Mandate A.6.4.3:

1. *Plastic parts* weighing more than 5 grams shall not contain flame retardants or plasticizers that contain organically bound bromine or chlorine.

Note: The requirement applies to plastic parts in all assemblies and sub-assemblies. Exempted are *printed wiring board laminates*, electronic components and all kinds of cable insulation.

2. The Smartphone shall not contain PBB, PBDE and HBCDD.

Note: 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.

For maximum concentration values: See B.6.4.3

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.4.4 Non-halogenated substances

Background

The purpose of this mandate is to ensure that the phase out of halogenated flame retardants not risk a shift towards substances with other known hazardous effects.

The mandate focuses on 14 hazardous statements. All substances relevant for the IT industry that have been assigned a hazardous statement and where there are less hazardous commercially available alternatives will be restricted from TCO Certified products. The list of these substances is evaluated and revised in each new version of the criteria document.

To date in this version, only harmonized substances found on the European chemical Substance Information System (ESIS) at: http://esis.jrc.ec.europa.eu/ have been restricted. In the future version of the criteria document TCO Development have the ambition to also restrict substances that are not at this time harmonized. An example of such not yet harmonized substances may be found in B.6.4.3.

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 metal conductors, are not included in the definition.

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

Hazardous statements (Risk phrases) according to EU Regulation 1272/2008 (EU Directive 67/548/EEC)

- H340 (R46) (may cause heritable genetic damage)
- H341 (R68) (suspected of causing genetic defects)
- H350 (R45) (may cause cancer)
- H350i (R49) (may cause cancer by inhalation)
- H351 (R40) (limited evidence of a carcinogenic effect)
- H360F (R60) (may impair fertility)
- H360D (R61) (may cause harm to the unborn child)
- H361d (R63) (suspected of damaging the unborn child)
- H361f (R62) (suspected of damaging fertility)
- H362 (R64) (may cause harm to breast-fed children)
- H372 (R48/25/24/23) (danger of serious damage by prolonged exposure)
- H373 (R48/20/21/22) (may cause damage to organs through prolonged exposure)
- H400 and H410 (R50/R53) (very toxic to aquatic organisms / may cause long-term adverse effects in the aquatic environment)
- H411 (R51/53) (Toxic to aquatic life with long-lasting effects)

Applicability

All Smartphones.

Clarification

B.6.4.4

References:

56 and 57.

Mandate A.6.4.4:

The following non halogenated flame retardants shall not be used in plastic parts weighing more than 5 grams:

- **Antimony(III) oxide (Sb2O3), CAS: 1309-64-4**
- **Tri-o-cresyl phosphate, CAS: 78-30-8**

Exempted are *printed wiring board laminates*, electronic components and all kinds of cable insulation.

For maximum concentration values: See B.6.4.4

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.4.5 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 a 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 metal conductors, are not included in the definition.

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

Applicability

All Smartphones.

Clarification

B.6.4.5

References

54 and 58.

Mandate A.6.4.5:

Plastic parts **in the Smartphone weighing more than 5 grams shall not contain chlorine or bromine as a part of the polymer.**

Note that *printed wiring board laminates*, and all kinds of internal and external cable insulation are not considered to be part of *plastic parts* and are therefore not included in the mandate.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.4.6 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 environment requirements in this criteria document.

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 metal conductors, are not included in the definition.

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

Applicability

All Smartphones.

References

55 and 59.

Mandate A.6.4.6:

The material specifications shall be provided for *plastic parts* and *printed wiring board laminates* weighing more than 5 grams. Plasticizers or flame retardants that have concentrations above 1% by weight in the plastic part shall be stated, in accordance with ISO 1043-3 or ISO 1043-4.

The following information shall be submitted to an approved verifier:

The table below shall be completed and the guarantee signed by the responsible person at the applicant company.

Manufacturers of plastic materials who consider such information confidential may submit the information to a verifier approved by TCO Development.

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

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

*) Chemical Abstract Service number www.cas.org
**) Labelling according to ISO 11469

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

....
Signature Name and title in block capitals

....
Date Company

A.6.4.7 Phthalates

Background

Phthalates are esters of phthalic acid and are mainly used as plasticizers (substances added to plastics to increase their flexibility, transparency, durability, and longevity). They are used primarily to soften polyvinyl chloride (PVC). Phthalates are being phased out of many products in the United States, Canada, and European Union over health concerns as several show reproductive toxicity and are suspected endocrine disruptors.

Phthalates are easily released into the environment because there is no covalent bond between the phthalates and plastics in which they are mixed. As plastics age and break down, the release of phthalates accelerates.

Applicability
All Smartphones.

References
7 and 11

Mandate A.6.4.7:

The Smartphone shall not contain diethylhexyl phthalate (DEHP, CAS no. 117-81-7), butyl benzyl phthalate (BBP, CAS no. 85-68-7) dibutyl phthalate (DBP, CAS no. 84-74-2).

Also diisononyl phthalate (DINP, CAS no. 28553-12-0), diisodecyl phthalate (DIDP, CAS no. 26761-40-0) and di-n-octyl phthalate (DNOP, CAS no. 117-84-0)

For maximum concentration values: see B.6.4.7.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.4.8 Batteries

Background

The widespread use of batteries has created many environmental concerns, such as toxic metal pollution as they may have very high amounts of lead, cadmium and mercury. Used batteries also contribute to electronic waste.

In the United States, the Mercury-Containing and Rechargeable Battery Management Act of 1996 banned the sale of mercury-containing batteries, enacted uniform labeling requirements for rechargeable batteries, and required that rechargeable batteries be easily removable. The Battery Directive of the European Union has similar requirements, in addition to requiring increased recycling of batteries.

Batteries shall be easy to exchange by the end user when they lose performance to increase product lifetime.

Applicability
All Smartphones.

References
54

Mandate A.6.4.8:

1. **Batteries shall not contain lead, cadmium and mercury**

   For maximum concentration values: see B.6.4.8.

2. **Batteries shall be rechargeable and when necessary, replaceable by the end user or a qualified professional.**

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.5 Product lifetime

A.6.5.1 Warranty and spare parts

Background

A longer product lifetime has a significant positive contribution to resource use as well as the reduction of air and water pollution. A pre-condition for prolonged lifetime is that the product is of high quality, which is supported by good guarantees. Another requirement is the availability of spare parts for the product once it is taken out of production.

Definitions

Brand owner is the company that owns the brand name visible on the product.

Spare parts are those parts which have the potential to fail during the normal use of the product. Product parts whose life cycle usually exceeds the average usual life of the product need not be provisioned as spare parts.

Applicability

All Smartphones.

Clarification

B.6.5.1

Mandate A.6.5.1:

The *brand owner* shall provide a product warranty for a period of at least one year.

The *brand owner* shall guarantee the availability of *spare parts* for at least three years from the time that production ceases.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……	……
Product brand name	Model name(s) or “All products”
.....	.....
Signature	Name and title in block capitals
.....	.....
Date (Declaration valid 1 year from date)	Brand Owner Company

A.6.6 Preparation for Recycling

A.6.6.1 Material coding 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. With material coding there is a better possibility for plastics to be recycled and used in new IT equipment.

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 metal conductors, are not included in the definition.

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

Applicability
All Smartphones.

Clarification
B.6.6.1

References
56, 59 and 60.

Mandate A.6.6.1:

Plastic parts weighing more than 5 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.6.4.5.

Exempted are *printed wiring board laminates*.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……..
Product brand name and model name

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

A.6.6.3 Take back system

Background

The amount of electronic waste in the world today is enormous and a growing environmental problem. It is important that manufacturers provide mechanisms to take back their equipment at end-of-life under the principle of individual producer responsibility wherein each producer must be financially responsible for managing its own brand products at end-of-life. Currently much electronic waste is being exported to developing countries where it is managed unsustainably and disproportionately burdens developing countries with this global environmental burden. The Basel Convention and its decisions govern the export of many types of electronic waste. However not all countries have properly implemented these decisions. With this mandate TCO Development aims to put more influence into spreading better electronic waste management practice to more countries.

Definition

Brand owner is the company that owns the brand name visible on the product.

Take back system is a system that makes sure that the customer can return used products to be recycled. The system can be with or without a fee.

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 product

Applicability

All Smartphones.

Clarification

B.6.6.3

References

61.

Mandate A.6.6.3

The *brand owner* (or its representative, associated company or affiliate) shall offer their customers the option to return used products for *environmentally acceptable recycling methods* in at least one market where the product is sold and where electronics take back regulation is not in practice at the date of application.

The following information shall be submitted to an approved verifier:

The information stated in the list below shall be submitted and the guarantee signed by the responsible person at the *brand owner* company.

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

The requirement can be fulfilled by one of the following options (to be verified):

☐ 1. Product only sold on markets with WEEE legislation or similar

☐ 2. World-wide product take back*

☐ 3. Take back is offered on one additional market where the product is sold and lacks WEEE legislation*

Name of market…….

*The brand owner shall also submit a short description, to an approved eco-verifier, of the take back system or reference to the representative, associated company or affiliate taking care of the take-back system

We hereby guarantee that the above mandate is fulfilled.

……	……
Product brand name	Model name(s) or “All products”
.....	.....
Signature	Name and title in block capitals
.....	.....
Date (Declaration valid 1 year from date)	Brand Owner Company

A.6.7 Product packaging

A.6.7.1 Hazardous substances in product packaging

Background
Packaging constitutes a well-known environmental problem and is regulated in many countries worldwide. Packaging material has a short lifetime and generates large volumes of waste.

There are three main areas of concern, content of hazardous substances, use of resources and transport volume.

Applicability
All packaging material.

Definition
Brand owner is the company that owns the brand name visible on the product.

Clarification
B.6.7.1

References
62.

Mandate A.6.7.1:

The packaging material shall not contain lead (Pb), cadmium (Cd), mercury (Hg) or hexavalent chromium (Cr6).

Plastic packaging material shall not contain organically bound halogens.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……	……
Product brand name	Model name(s) or ”All products”
.....	.....
Signature	Name and title in block capitals
.....	.....
Date (Declaration valid 1 year from date)	Brand Owner Company

A.6.7.2 Preparation for recycling of product packaging material

Background

Packaging constitutes a well-known environmental problem and is regulated in many countries worldwide. Packaging material has a short lifetime and generates large volumes of waste.

There are three main areas of concern, content of hazardous substances, use of resources and transport volume.

Applicability

All packaging material.

Definition

Brand owner is the company that owns the brand name visible on the product.

Mandate A.6.7.2:

Non-reusable packaging components weighing more than 5 grams shall be possible to separate into single material types without the use of tools.

Exempted is reusable packaging.

The following information shall be submitted to an approved verifier:

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

The following information shall be submitted with the application to TCO Development:

A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……	……
Product brand name	Model name(s) or "All products"
.....	.....
Signature	Name and title in block capitals
.....	.....
Date (Declaration valid 1 year from date)	Brand Owner Company

A.7 Corporate Social Responsibility

A.7.1 Corporate Social Responsibility

Background

Expectations for Corporate Social Responsibility (CSR) performance are increasing from customers and institutions. As part of the development towards being a true sustainability label, TCO Development is now introducing an extended mandate regarding supply chain responsibility.

TCO Development is supporting the OECD Guidelines for Multinational Enterprises ISO 26000 as references for working with social responsibility.

The CSR component of the TCO standard focuses on working conditions in the production of the TCO certified products.

TCO Development is primarily verifying the Brand owner's procedures for promoting legal and human labour standards in the supply chain as specified in the mandate but reserves the right to conduct supplier audits at production facilities. Also, the Brand owner should demonstrate commitment to corporate social responsibility.

Definitions

Brand owner: The company or organization owning or controlling the *Brand Name*.
Brand Name: The name or sign, including but not limited to a trademark or company name, used to identify, amongst users and customers, the manufacturer or seller of a Product.
1st tier production facility: Manufacturing plant where the final assembly of the TCO certified product is taking place.

Applicability

The Brand owner.

Clarification

B.7.1.1 – B.7.1.6

References

48, 49 and 50.

Mandate A.7.1:

The *Brand owner* shall demonstrate the TCO Certified product is manufactured under working practices that promote good labour relations and working conditions by proving accordance with the following:

- ILO:s eight core conventions 29, 87, 98, 100, 105, 111, 138 and 182.
- UN Convention on the Rights of the Child, Article 32.
- the health and safety legislation in force in the country of manufacture, and
- the labour law, including rules on minimum wage and the social security protection in the manufacturing country.

In situations where the right to freedom of association and collective bargaining are restricted under law, workers shall be permitted to freely elect their own representatives.

Reasonable effort shall be made to ensure that the requirements of this standard are being met by suppliers and subcontractors throughout the supply chain.

The brand owner accepts that TCO Development may conduct/commission on-site inspections and receive full audit reports as part of the application to verify that the *Brand owner* is fulfilling its obligations according to this Mandate. For the social audit reports and on-site-inspections, the requirement is limited to the *1st tier production facility*.

The following information shall be submitted to an approved verifier:

1. **The requirement is fulfilled by one of the following options (a-d):**

a) **The *Brand owner* is a member of EICC and provides documented proof of third party audits conducted at production facilities of TCO certified products.**

b) **The *Brand owner* is SA8000 certified or carrying out the production at SA8000 certified facilities and provides documented proof of third party audits conducted at production facilities of TCO certified products.**

c) **The *Brand owner* shall complete the Self-documentation according to a questionnaire provided by TCO Development and provide documented proof of third party audits conducted at production facilities of TCO certified products.**

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

The following information shall be submitted with the application to TCO Development: A copy of a verification report from an approved verifier

Option (to be verified): ☐ a. Member of EICC

☐ b. SA8000 certified

☐ c. Self-documentation/TCO Development questionnaire

We hereby guarantee that the above mandate is fulfilled.

…… ……

Product brand name Model name(s) or ”All products”

....

Signature Name and title in block capitals

....

Date (Declaration valid 1 year from date) Brand Owner Company

A.7.2 Senior Management Representative

Background
It is extremely beneficial that an open and transparent dialogue between the brand owner and TCO Development exist for the monitoring of the standards or when it is otherwise necessary to discuss issues concerning working conditions at manufacturing sites. A contact person responsible for the organization's efforts to enforce the CSR requirements needs to be consistently available for dialogue with TCO Development.

Definitions
Brand owner: The company or organization owning or controlling the *Brand Name*.
Brand Name: The name or sign, including but not limited to a trademark or company name, used to identify, amongst users and customers, the manufacturer or seller of a Product.

Applicability
The Brand owner.

Clarification
B.7.2

Mandate A.7.2:

The Brand owner shall have an appointed senior management representative who, irrespective of other responsibilities, shall ensure that the requirements of this mandate are met. The contact details of this person shall be submitted and the person shall be available for dialogue in English with TCO Development throughout the certification period.

The following information shall be submitted to a verifier approved by TCO Development:

1. **Name, Title, Telephone Number and Email Address of the senior management representative available for dialogue in English with TCO Development around CSR issues.**
2. **A written guarantee that the above mandate is fulfilled. The guarantee shall be signed by the responsible person at the Brand owner company**

The following information shall be submitted with the application to TCO Development: A copy of a verification report from a verifier approved by TCO Development.

We hereby guarantee that the above mandate is fulfilled.

……	……
Product brand name	Model name(s) or ”All products”
……	……
Signature	Name and title in block capitals
……	……
Date (Declaration valid 1 year from date)	Brand Owner Company

R References

International standard organisations referred to in the reference list below and their Web sites.

- ASTM, American Society for Testing and Materials, http://www.astm.org/
- CIE, Commission Internationale de l'Eclairage, International Commission on Illumination, www.cie.co.at/cie/
- DIN, Deutsches Institut für Normung e. V., www2.din.de
- EBU, European Broadcasting Union, http://www.ebu.ch/tech_info.html
- IEC, International Electrotechnical Commission, www.iec.ch
- ISO, International Organization for Standardization, http://www.iso.org/
- ITU, International Telcommunication Union www.itu.int/home/index.html
- SMTPE, Society of Motion Picture Television Engineers, www.smtpe.org
- VESA, Video Electronics Standards Association, www.vesa.org

1. CIE Publication 69 (1987), Methods of characterizing illuminance meters and luminance meters: performance characteristics and specifications.
2. Flat Panel Display Measurements Standard, (M), Version 2.0, VESA - Video Electronics Standards Association Display Metrology Committee. June 1, 2001, CA 95035, Milpitas.
3. http://www.w3.org/Graphics/Color/sRGB.html
4. SMPTE RP 145-1994: SMPTE C Colour Monitor Colourimetry
5. "IARC Monograph, Volume 58". International Agency for Research on Cancer. 1993. Retrieved 18 September 2008.
6. International Programme On Chemical Safety (1990). "Beryllium: ENVIRONMENTAL HEALTH CRITERIA 106". World Health Organization. Retrieved 10 April 2011.
7. GovTrack.us. "H.R. 4040--110th Congress (2007): Consumer Product Safety Improvement Act of 2008, GovTrack.us (database of federal legislation) . Retrieved 14 August 2009.
8. CIE Publication 15.2 (1986), Colourimetry, p. 11, p.27-28 and p. 53-54, table 1.3).
9. IEC 61966-2-1 (1999-10) Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space – sRGB.
10. E.B.U. Standard for chromaticity tolerances for studio monitors Tech. 3213-E August 1975.
11. ECHA Website - Proposal for identification of Substances of Very High Concern
12. European Directive 94/27/EC of 15 December 2004
13. Commission Directive 2009/2/EC of 15 January 2009.
14. REACH 1907/2006
15. Hunt, R.W.G. Measuring colour. 3rd edition (1998), Kingsley-Upon-Thames: Fountain Press.

16. ISO TC130 WD 12646 p. 5 Section 4.7 Chromaticity and luminance of the white and black points and tracking.
17. ISO 3664:2009, Viewing conditions for graphic technology and photography, p. 9 Uniformity of screen luminance.
18. -
19. ISO 3664:2009. Viewing conditions for graphic technology and photography, p. 10 Monitor luminance.
20. ISO 9241-4:1998/Cor 1:2000)
21. Barten, P.G.J., (1999) Contrast sensitivity of the human eye and its effects on image quality, SPIE Optical Engineering Press
22. -
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25. Kokoschka S. (1986). Visibility aspects of VDUs in terms of contrast and luminance. Behaviour and information technology. vol.5, No. 4, pp 309-333.
26. Schenkman, B., and Kjelldahl, L. (1999). Preferred colour temperature on a colour screen. Displays, 20, 73 - 81.
27. Roberts, A., Eng, B., (1995) "A method for the calculation of tolerances for display primary chromaticity coordinates" Research and development Department, Technical Resources, The British Broadcasting Corporation.
28. www.srgb.com
29. Wyszecki, G., Stiles, W.S., (1982) Colour Science: Concepts and methods, quantitative data and formula, Second Edition, John Wiley & Sons, Inc. Chapter 7, Visual thresholds, pp 567-569.
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31. Le Grand, Y. (1957). Light, colour and vision. Chapman and Hall, pp 278-279.
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33. Le Grand, Y. (1957). Light, colour and vision. Chapman and Hall, p. 119
34. Le Grand, Y. (1957). Light, colour and vision. Chapman and Hall, Chapter 11, Luminance difference thresholds, p. 261.
35. Le Grand, Y. (1957). Light, colour and vision. Chapman and Hall, Chapter 11, Luminance difference thresholds.
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37. Fairchild M. D. (1995), "Considering the surround in device-independent colour imaging". www.cis.rit.edu/people/faculty/fairchild/PDFs/Bart.pdf

38. ISO 7779:2010, Acoustics – Measurements of airborne noise emitted by computer and business equipment. This international standard is based on ECMA-74.
39. ISO 3741:2010, Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for reverberation rooms.
40. ISO 3744:2010, Acoustics – Determination of sound power levels of noise sources using sound pressure - Engineering method in an essentially free-field condition over a reflecting plane.
41. ISO 3745:2003, Acoustics – Determination of sound power levels of noise sources – Precision methods for anechoic and semi anechoic rooms.
42. ISO 11201:2010, 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.
43. ISO 9296:1998, Acoustics – Declared noise emission values of computer and business equipment.
44. Standard ECMA-74 8th edition, Measurement of Airborne Noise Emitted by Information Technology and Telecommunications Equipment.
45. EN 60950-1 (IEC 60950-1). Safety of information technology equipment including business equipment.
46. EMAS EU regulation no 761/2001 concerning the voluntary participation of industrial companies in the Union's environmental control and review structure.
47. ISO 14001 Environmental management systems - Specification with guidance for use
48. -
49. TCO Certified Own Work questionnaire and assessment guidlines
50. Electronic Industry Citizenship Coalition (EICC), http://www.eicc.info
51. SA8000, http://www.sa-intl.org
52. www.energystar.gov and (http://www.energystar.gov/index.cfm?c=partners.pt_index)
53. International Efficiency Marking Protocol for External Power Supplies.
54. EU Directive 2006/66/EC on batteries and accumulators containing certain dangerous substances
55. EU Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment
56. Regulation concerning Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), EC 1907/2006
57. EU Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances
58. EU Directive EC 1272/2008 on classification, labelling and packaging of substances and mixtures
59. The EU Green Paper "Environmental questions concerning PVC" KOM (2000) 469
60. ISO 11469:2000 Plastics - Generic identification and marking of plastics products
61. ISO 1043-1, -2, -3, -4 Plastics - Symbols and abbreviated terms
62. EU Directive 2002/96/EC on waste electrical and electronic equipment (WEEE)
63. Directive 94/62/EC on packaging and packaging waste.

B Test Methods and clarifications

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

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

B.0 General test conditions

B.0.1 Definition of a test object

- Test objects covered by this document are Smartphones with visual displays with fixed positions of the pixels.
- A test object with all necessary information for its operation 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 test object shall be provided.
- The performance of the test object shall in all aspects be fully in accordance with the performance of the final product.

B.0.2 Required test object information

- The client shall specify the name(s), type designation(s) and manufacturer for all different exchangeable parts of the test object.
- The client shall specify the operating system and version used.
- The client shall specify the display resolution of the Smartphone display.
- The client shall specify the display panel type, e.g. LCD, OLED
- The client shall specify the default viewing direction if any (portrait or landscape). If no direction is specified the default viewing/testing direction shall be portrait mode.
- The client shall specify the colour depth of the display.

B.0.3 Conditions for the equipment under test

- The Smartphone being tested shall be physically prepared for testing and shall be warmed up (switched on and plugged into the mains supply) for at least 15 min to stabilise the Smartphone at room temperature.
- The Smartphone screen surface shall be clean when tested.
- The Smartphone shall be tested in battery mode unless otherwise specified in the test procedure and may be recharged in between the tests if necessary.
- The Smartphone shall be tested without load on any peripheral interface such as USB, memory card slot, headphones/headsets or similar unless otherwise specified in the test procedure.

B.0.4 Smartphone alignment for testing

The Smartphone display front shall be aligned vertically through the centre-point of the display front.

B.0.5 Instruments used for testing

All instruments used for testing of a Smartphone 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. Calibrations shall be traceable to national standards.

B.0.6 Settings of the Smartphone

- If present, the standard controls of the Smartphone shall be used to configure and adjust the display, e.g. brightness, contrast.
- If possible the Smartphone resolution shall be set to the native resolution and be used for all test parameters.
- The measurement shall be taken with the Smartphone in default CCT. If no default CCT is given or available the colour temperature presented by the recall function (or equivalent function) in the OSD (On Screen Display). If no OSD exists the default CCT on start-up shall be used
- All measurements shall be taken with no adjustments made between the measurements, if not otherwise specified in the test procedure.
- An external control unit that is not a standard part of the Smartphone is not allowed.
- The colour depth (6 or 8 bits per colour channel) of the testing program shall be at least as high as for the sample tested.
- The operating system most likely to be used by an end user should be used for testing. All settings in the operating system shall be the default ones as delivered to the end user or the default as it appears directly after the installation of the operating system unless otherwise specified in the criteria. (The easiest way to achieve this is to reset the phone prior to testing)
- Any picture enhancement or energy saving sensors reacting on ambient light shall be turned off during testing.

B.0.7 Test image/test character

- All test images can be found on the home page of TCO Development, www.tcodevelopment.com.
- A possibility is to use a testing program that shall consist of software commonly used for Smartphones. The program shall be able to produce the text or graphics or pictures required for the test procedures.
- All parts of the tests for a test object shall be conducted using the same font, character size, correlated colour temperature, resolution, operating system and other settings of the Smartphone controls etc., unless otherwise stated in the test procedure.

B.0.8 Test Image and Test Luminance setting

The test image in Figure B.0.8.1, referred to as the TCO Certified Smartphone default test image, has an 80 % image loading. The test image shall fill the whole usable screen that represents the "full screen mode" for photo viewing or movies. If a toolbar always consumes a part of the screen during "full screen" photo viewing and movies then the toolbar may also consume a part of the screen during test. This image shall be used for testing unless otherwise specified in the test procedure.

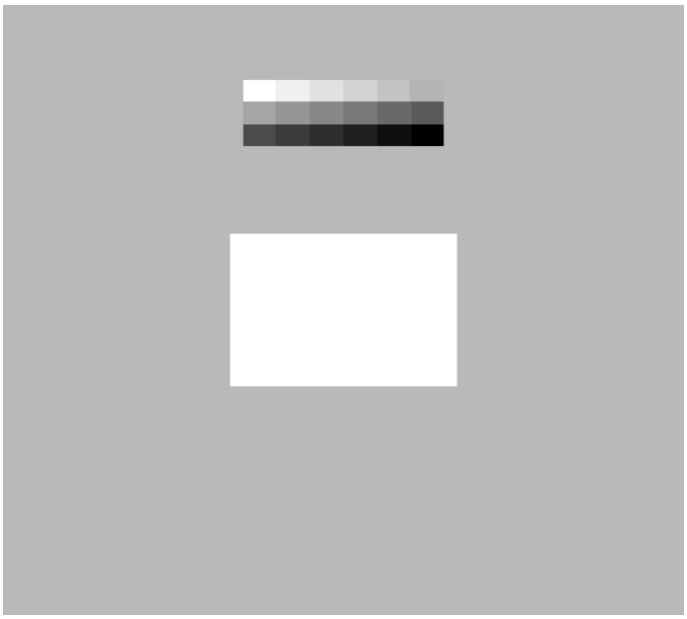

Figure B.0.8.1. The TCO Certified Smartphone default test image with an 18-step greyscale.

Procedure:

- The white area in the centre shall be 25% of the longer side of the screen and 30% of the shorter side. The background colour shall be set to RGB 185, 185, 185 (i.e. equal to 80 % image loading). An 18 step greyscale may be present to visually evaluate the setting of the display. *(The greyscale will almost not affect the image loading as it contains both bright and dark areas).*

Test Luminance setting:

- The test luminance of the Smartphone shall be the highest luminance setting. This setting must be ≥125 cd/m^2 with at least 15 of the 18-step greyscale visible. If this is fulfilled the Smartphone may be tested in this mode. This setting shall be written in the test report.
- If the display does not reach ≥125 cd/m^2 or does not achieve 15 of the 18-step greyscales, other settings may be used. The chosen setting must be written in the test report.
- If no setting fulfils the requirement of ≥125 cd/m2 and 15 of the 18-step greyscales visible the testing is stopped and the engineer shall request a replacement sample.

B.0.9 Test report

The test results are valid only for the presentation form(s) and configuration(s) tested. If other configurations are accepted by the laboratory based on the results of the tested ones it shall be clearly specified in the test report that these configurations have not been tested.

The test report shall include the following information:

- Any changes to the test methods.
- The manufacturer, brand name, model type and serial number (if available).
- The panel brand, full panel number.
- The mode(s) (i.e. horizontal and vertical scan frequency and resolution) used during the test and the aspect ratio.
- The external power supply brand, model number and class shall be stated.
- The degree of uncertainty for each given measurement result.
- The default or chosen display setting
- If present, the setting of contrast, brightness and CCT pre-set used during the test.
- Photographs of the product showing: Front, rear, open panel, a legible panel marking plate and the external power supply with legible marking plate.

B.1 General information

B.1.1 TCO Certified Document

The TCO Certified Document shall accompany the product as provided by TCO Development. No editorial changes without TCO Development's consent are accepted. The Document is available at www.tcodevelopment.com.

If the TCO Certified Document is part of a User's Manual or is provided as an electronic file then it must be separated from other text portions so it is obvious that the Document text is not accountable for the content of the other texts.

The brand name owner may post the TCO Certified Document on its web site, e.g. by showing TCO Certified logos or icons that redirect the visitor by links to the TCO Certified Document

If the product that is to be TCO Certified labelled is branded differently from the applicant name, the applicant company signing the guarantee shall be sure that the brand name holder agrees with the requirement.

B.2 Visual ergonomics

B.2.0 General test conditions for visual ergonomics

B.2.0.1 Basic test requirements

As described in section B.0.
For all tests, the Smartphone screen shall be clean.

B.2.0.2 Photometric laboratory general requirements

Photometric measurements shall be performed under darkroom conditions. This means that measurement data shall in no way be affected by direct light from sources or light reflected from interiors, equipment, clothes etc.

The laboratory shall have a routine for the control of the stray-light level at the Smartphone screen (see also B.2.0.6).

B.2.0.3 Power supply and test room climate requirements for testing

- AC mains voltage* — 230 VAC RMS, tolerance ≤ 1 %
- AC mains frequency* — 50 Hz, tolerance ≤ 2 %
- Test room temperature — 23±3 ºC
- Humidity — 20-75 % RH (non condensing)

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

B.2.0.4 Photometric and spectrometric measurements

Several instruments are to be used when carrying out measurements for visual ergonomics. All instruments shall be recently calibrated and carry a calibration certificate from a certified testing laboratory.

The following instrument types are to be used for testing:

- **Luminance meter**. A luminance meter shall have a sufficiently good V(λ)-sensitivity (Requirements for luminance meters are covered by CIE Publication 69 (1987). Luminance meters of CIE Class L(aboratory) with a combined performance characteristic ≤ 3 % shall be used.) and integrate luminance over a finite measuring field during a finite time. The meter shall be equipped with adjustable optics and always be focused on the measured area. The luminance meter must incorporate a sufficiently long time constant of integration in order to ensure averaging of the pulsation of the light emitted by Smartphones. The sensitivity shall be independent of the polarization of the measured light (often referred to as f_8 error).

  The luminance meter measuring field shall be one degree for all measurements, except for the micro-photometric luminance measurements, see below.

  An automated instrument using collimating optics may be used for testing although the measurement area may differ somewhat from the area covered by the luminance meter. The laboratory shall verify that the area measured by the instrument has the correct size regardless of the instrument used.

- **Spectro-radiometer**. An instrument for the measurement of radiant flux as a function of wavelength shall be used. A spectro-radiometer for the measurement of light and colour is normally equipped with a microprocessor that makes it possible to obtain luminance and colour co-ordinates directly from raw measurement data. A spectro-radiometer can replace the luminance meter when suitable. The wavelength resolution shall be ≤ 4nm for attaining accurate colour measurements. The sensitivity shall be independent of the polarization of the measured light (often referred to as f_8 error).

B.2.0.5 Measurement distance

If possible all measurements shall be carried out through a point, simulating the eye position of the operator. This means 400mm. Eyes are corrected for reading at a close range of 400 mm which could be considered as an absolute minimum viewing distance for comfortable viewing. However, even if the comfortable viewing distance should not be shorter than 400mm, a measuring distance at a shorter distance for Smartphones in order to measure small objects or using a collimated automatic measurement system is acceptable as long as the measurement is made perpendicular to the screen surface and the measurement area is correct. The instrument shall be focused on the presented test image for all measurements.

Independent of the luminance meter and spectroradiometer used and also the measuring distance, the diameter of the measuring area on the screen shall be 1/10 of the screen diagonal. The instrument shall be focused on the presented test image for all measurements.

B.2.0.6 Stray light

Stray light may cause errors which can negatively affect measurement of luminance, contrast and chromaticity coordinates. It is therefore necessary to make an evaluation of stray light influence for the different measurement procedures described in this document.

If it is verified that stray light affect the measurement result it is necessary to take actions to eliminate the source of error. Two possible ways to solve the problem are to equip the luminance meter with a well-designed screening attachment, a frustum or to use a black screening sheet at the Smartphone screen surface.

B.2.0.7 Overall uncertainty

The overall uncertainty of the test laboratory shall be calculated for each measurement procedure in this document and presented in the test report. The uncertainty shall be within the required levels for each criterion. All measurement uncertainties claimed for used instruments shall be referred to traceable calibration reports.

About combining overall uncertainty values during test measurements:

- Criteria are fulfilled without adding or subtracting the overall measurement uncertainty.
- Report the value shown on the instrument without adding or subtracting the overall measurement uncertainty.
- The overall measurement uncertainty of the laboratory is printed in the test report together with the reported value.
- For a Laboratory that has an overall measurement uncertainty higher than the one allowed by TCO Development for a certain criteria, then the test report for that criteria is not valid for TCO certification and the test results will not be accepted by TCO Development.

B.2.2 Luminance characteristics

B.2.2.1 Luminance level

B.2.2.1.1 Preparation of the Smartphone for testing

- All necessary preparations described in B.0 and B.2.0 shall be done.
- The TCO Certified Smartphone default test image with an 18-step greyscale as shown in Figure B.0.8.1 shall be used for luminance level measurement.

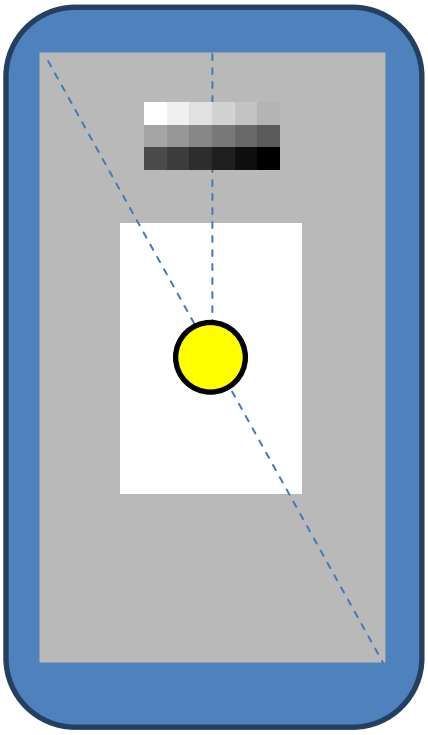

Figure B.2.2.1. Simulation of the measurement area (yellow) on the TCO Certified Smartphone default test image with the 18-step greyscale inserted

Independent of the used luminance meter, spectroradiometer and also the measuring distance, the diameter of the measuring area on the screen shall be 1/10 of the screen diagonal. The instrument shall be focused on the presented test image for all measurements.

- The test image shall be as Figure B.0.8.1
- The yellow circular area in the centre represents the measuring area of the luminance meter or spectroradiometer.

The following evaluations shall be carried out orthogonally to the screen surface

- To achieve the maximum luminance proceed as follows: Adjust the controls for the display to achieve as high luminance as possible with an acceptable image quality. The image quality is considered acceptable when at least 15 of the 18 greyscale steps are visible. At this maximum luminance, test that the display has a luminance $\geq$ 200 cd/m^2.

- To achieve the minimum luminance proceed as follows: Adjust the controls for the display to achieve as low luminance as possible with an acceptable image quality. The image quality is considered acceptable if at least 15 of the 18 grey scale steps are visible. At this minimum luminance check that the display has a luminance ≤ 100 cd/m^2.
- If it is difficult to visually determine if 15 of the 18 grey scale steps are visible, then the display shall comply with the gamma curve criteria (A.2.2.3) in the max and min luminance setting.
- When this test is completed the display shall be adjusted back to the test luminance setting as described under B.0.8. Allow the display to stabilize before other test measurements are made.

B.2.2.1.2 Equipment

Luminance meter.

B.2.2.1.3 Test method

The luminance at the centre of the white test area shall be measured with the luminance meter directed orthogonally to the test area as described in B.2.0.5.

B.2.2.1.4 Test evaluation

The measured luminance is the required value. The luminance shall be reported with no decimal places.

The measured Luminance, and display setting shall be noted in the test report. The CCT in default setting shall also be noted.

B.2.2.1.5 Overall uncertainty

≤ ± 10 % in luminance.
See B.2.0.7.

B.2.2.2 Luminance uniformity

B.2.2.2.1 Preparation of the Smartphone for testing

- All necessary preparations described in B.0 and B.2.0 shall be done.
- The entire active area of the screen shall be white and the Smartphone colour setting shall be RGB 255, 255, 255.

B.2.2.2.2 Equipment:

Luminance meter.

B.2.2.2.3 Test method:

The luminance shall be measured orthogonally to the Smartphone screen plane at the 9 points indicated in Figure B.2.2.2.1.

The luminance uniformity shall also be evaluated visually by the technician in order to find any dark or bright areas except from the 9 default positions. If a significantly bright or dark area is found these measuring points shall also be measured and used to evaluate the luminance uniformity.

The conditions for luminance measurement in the corner positions and the distribution of other measurement points are illustrated in figure B.2.2.2.1

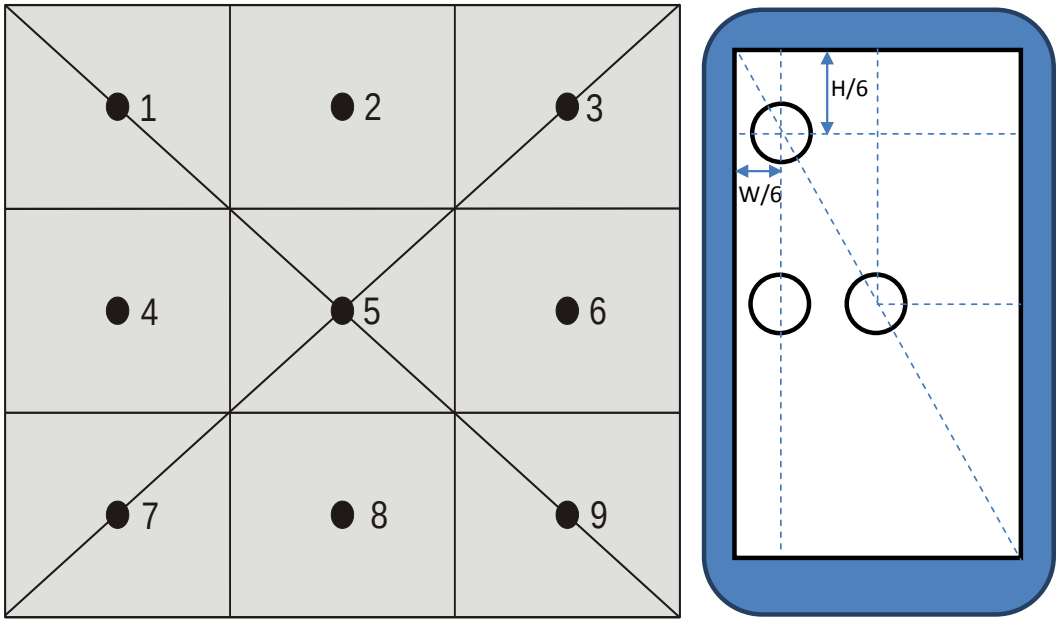

Figure B.2.2.2.1. Measurement positions for the measurement of luminance and colour uniformity.

B.2.2.2.4 Test evaluation

The luminance uniformity shall be reported as the ratio between the highest and the lowest measured luminance values.

The result shall be presented to 2 decimal places.

B.2.2.2.5 Overall uncertainty

≤ ± 10 % in luminance.

≤ ± 0.1 unit in luminance uniformity.

See B.2.0.7.

B.2.2.3 Greyscale gamma curve

B.2.2.3.1 Preparation of the Smartphone for testing

- All necessary preparations described in B.0 and B.2.0 shall be done.
- A TCO Certified Smartphone default test image, as shown in Figure B.0.8.1, shall be used for this measurement.
- The centre square area according to B.0.8.1 shall have each of the following RGB settings: R=G=B= 255, 225, 195, 165, 135, 105, 75 and 45 for each measurement.

B.2.2.3.2 Equipment

Luminance meter or Spectroradiometer.

B.2.2.3.3 Test method

The instrument shall be directed orthogonally towards the different test square centres at the measurement distance described in B.2.0.5. Measurement distance and area for each greyscale step specified above. Change the greyscale of the square for each measurement.

B.2.2.3.4 Test evaluation

The evaluation task is to convert each measured luminance into relative luminance where 100% corresponds to the white luminance in the centre of the displays and make a table corresponding to the example table below. Each row in the table must show how the luminance is decreasing with darker grey levels. $L_{Measured}$ shall be the percentage of the measured luminance for the grey level at that row in relation to the luminance measured at 255 (white).

Table 1 Example of grey level table

Grey level	$L_{Measured}$
	%
255	100
225	75
195	55
165	38
135	24
105	14
75	7
45	3

B.2.2.3.5 Overall uncertainty

≤ ± 10% in luminance.

See B.2.0.7.

B.2.5 Screen colour characteristics

B.2.5.1 Correlated colour temperature (CCT) variation

B.2.5.1.1 Preparation of the Smartphone for testing

- All necessary preparations described in B.0 and B.2.0 shall be done.
- A TCO Certified Smartphone default test image, as shown in Figure B.0.8.1, shall be used for this measurement.

B.2.5.1.2 Equipment

Spectro-radiometer capable of presenting CIE u' and v' chromaticity co-ordinates with at least three decimals.

B.2.5.1.3 Test method

The spectral properties at the centre of the white test square shown in Figure B.0.8.1 shall be measured with a spectro-radiometer.

The spectral data shall then be processed, which is normally done directly in the instrument microprocessor, to give chromaticity co-ordinates. In this case the CIE co-ordinates u' and v' are needed for the test evaluation and are often presented directly by the spectro-radiometer used.

B.2.5.1.4 Test evaluation

The default CCT stated in the report shall be given in Kelvin (K).

B.2.5.1.5 Overall uncertainty

$\leq \pm 0.003$ in u' and v'.

See B.2.0.7.

B.2.5.2 Colour uniformity

B.2.5.2.1 Preparation of the Smartphone for testing

- All necessary preparations described in B.0 and B.2.0 shall be done.
- The entire active area of the screen shall be white with the Smartphone's colour setting at RGB 255, 255, 255.

B.2.5.2.2 Equipment

Spectro-radiometer with a capacity to present u' and v' co-ordinates with at least 3 decimals.

B.2.5.2.3 Test method

The colour uniformity shall be measured orthogonally to the Smartphone screen plane at 9 points as for Figure B.2.2.2.1.

The colour uniformity shall also be evaluated visually by the technician in order to find those areas where the colour varies the most except from the 9 default positions.

The conditions for colour measurement in the corner positions and the distribution of other measurement points are illustrated in Figure B.2.2.2.1.

B.2.5.2.4 Test evaluation

Δu'v' in accordance with the CIE (1976) uniform chromaticity scale diagram shall be calculated for each measured position using the formula

$$\Delta u'v' = \sqrt{(u'_A - u'_B)^2 + (v'_A - v'_B)^2}$$

where A and B are the two points found to have the largest colour difference between them.

The largest difference in Δu'v' value shall be reported.

The result shall be presented to 3 decimal places.

(The evaluation procedure is exemplified below

- Make a table of colour chromaticity values for each measured position

Measurement position no.	**u** [1]	**v** [1]
1	0.190	0.447
2	0.186	0.441
3	0.186	0.437
-	-	-
-	-	-
n-1	0.185	0.434
N	0.186	0.432
Largest difference	**0.005 in this example**	**0.015 in this example**

- The largest u' difference, Δu', is 0.005 (between 0.190 and 0.185) at measurement positions 1 and n-1.
- The largest v' difference, Δv', is 0.015 (between 0.447 and 0.432) at measurement positions 1 and n.
- Since Δv' (= 0.015) is much larger than Δu' (= 0.005), the Δv' value shall be used for the calculation of Δu'v'.
- The corresponding two pairs of u' and v' to be used for the calculation are thus the values found at position 1 and position n and thus become the values used for points A and B such that

  $u'_1 = u'_A = 0.190$ and $v'_1 = v'_A = 0.447$ for point A in this example

  and

  $u'_n = u'_B = 0.186$ and $v'_n = v'_B = 0.432$ for point B in this example

  Hence $\Delta u'v' = \sqrt{0.000016 + 0.000225} = 0.01552$, which shall be reported as 0.016.)

B.2.5.2.5 Overall uncertainty

≤ ± 0.003 in u' and v'.

See B.2.0.7.

B.2.5.3 RGB settings

B.2.5.3.1 Preparation of the Smartphone for testing

- All necessary preparations described in B.0 and B.2.0 shall be done.
- A TCO Certified Smartphone default test image , as shown in Figure B.0.8.1, shall be used for this measurement with the following modification:

The centre squares (see B.2.0.5) shall be changed to have each of the following RGB settings:

(255, 0, 0) for red,
(0, 255, 0) for green,
(0, 0, 255) for blue.

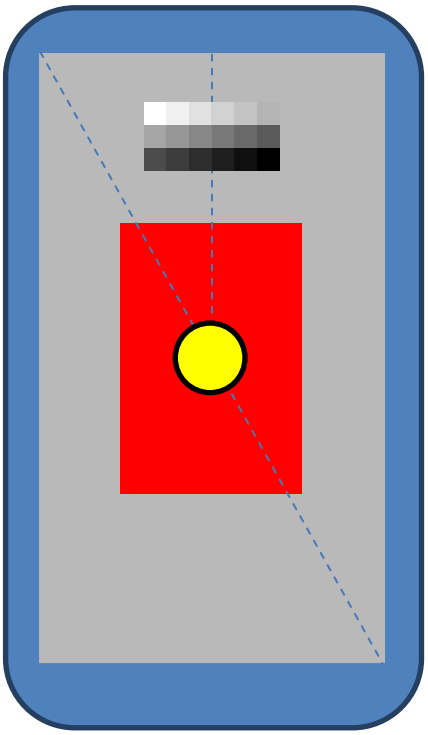

Figure B.2.5.3.1. Test image for red with measurement area showing (yellow)

The yellow circular area in the centre of the above picture represents the measuring area of the spectroradiometer and is not a part of the test image that shall be used.

The red area is changed to green and blue when these colours are measured. If the laboratory can prove in the test report that the display is insensitive to image loading it is ok to fill the whole screen with 100% red, green and blue respectively. *(OLED will be affected by image loading).*

B.2.5.3.2 Equipment

Spectro-radiometer with a capacity to present u' and v' co-ordinates with at least 3 decimals.

B.2.5.3.3 Test method

The instrument shall be directed orthogonally towards the different test square centres at the measurement distance and area described in B.2.0.5. Measure the chromaticity co-ordinates at the centre of the square for each colour setting specified above. Change the colour of the square for each measurement.

B.2.5.3.4 Test evaluation

The recorded chromaticity co-ordinates u' and v' for the red, green and blue squares shall be reported.

The u' and v' shall be presented to 3 decimal places.

B.2.5.3.5 Overall uncertainty

≤ ± 0.003 in u' and v' for red and green.

≤ ± 0.007 in u' and v' for blue.

See B.2.0.7.

B.3 Workload ergonomics

B.3.1 Material Characteristics

The Smartphone shall not release nickel from surfaces that come in contact with user´s skin during normal use. The rate of nickel release shall not be greater than 0.5 µg/cm2/week, in accordance to EN 1811:2011.

B.6 Environmental requirements

B.6.0 General Clarification

B.6.0.1 Signatures

The templates in the ecological declaration shall be sent either with original signatures or as copies of original documents with original signatures. “Copies” are for example telefaxes or pdf-files of scanned signed documents. TCO Development and/or the responsible laboratory may later request the original signed document.

However, copies will not be accepted where the signature has been scanned and pasted into the document.

TCO accepts digital signature as an alternative to traditional signature on test reports and declarations submitted as pdf files. To approve a digital signature it is necessary to also submit a digital key to the eco-verifier to facilitate identification.

B.6.1 Product description

The A.6.1 template shall be completed with the requested information about the Smartphone. This includes the display, panel and external power supply.

The type key that includes an Asterisk (*) for unidentified characters, if any, in the model name and panel identification name shall be submitted to the eco-verifier. Only two * may be used in the model type key and each * must include two or more options. For the most up-to-date information about type keys, see the appropriate product Application Process at www.tcodevelopment.com

B.6.2 Organisation

B.6.2.1 Environmental management system certification

The certificate shall be issued by a certification body that is accredited by an accreditation body covered by the International Accreditation Forum, www.iaf.nu, Multilateral Arrangement on Environmental Management Systems.

For applicants submitting several applications, it is enough to attach an ISO 14001 certificate or EMAS registration with the first application.

The certificate or an appendix to the certificate shall show the scope of the certification.

B.6.3 Climate

B.6.3.1 Energy consumption – external power supply

TCO Development has decided that energy consumption of the external power supply shall follow the U.S. Environmental Protection Agency's (EPA) demands for compliance with The International Efficiency Protocol requirement for level V, equivalent to the Energy Star version 2.0 for external power supplies, also covering battery chargers.

The international efficiency mark consists of a Roman numeral (I – VI) that corresponds to specific minimum Active and No-Load efficiency levels (as well as a power factor requirement for level V) and is printed/applied by the manufacturer on the external power supply marking plate.

A TCO Development laboratory will require to see a copy of the Smartphone's external power supply marking plate there The International Efficiency Protocol requirement for level V symbol is visible as proof of compliance.

B.6.4 Environmentally hazardous substances

B.6.4.1 Mercury (Hg) free

The TCO Development mandate includes FPD lamps which are exempted in RoHs. The maximum concentration value for mercury is 0.1% by weight in homogeneous materials, in accordance with EU Directive 2002/95/EC (RoHS).

B.6.4.2 Cadmium (Cd), lead (Pb) and hexavalent chromium (CrVI)

Exemptions for cadmium, lead and hexavalent chromium are according to EU Directive 2002/95/EC (RoHS) and the documents supporting the directive.

The maximum concentration values tolerated by weight in homogeneous materials for cadmium, mercury, lead and hexavalent chromium are according to EU Directive 2011/65/EU (RoHS) and the documents supporting the directive.

TCO Development supports the use of recycled plastic. To avoid making it more difficult to use recycled plastic, exceptions to this requirement can be accepted. If recycled plastic is used in the product please contact TCO Development for further instructions.

B.6.4.3 Halogenated substances

Mandate 1 applies to plastic components weighing more than 5 g shall not contain flame retardants or plasticizers that contain organically bound chlorine or bromine. LCD panels are included in the requirement. Exempted are printed wiring board laminates, electronic components and all kinds of cable insulation.

Mandate 2 applies to the whole Notebook computer. Printed Wiring Boards are also included in the requirement.

HBCDD has been identified as a Substance of Very High Concern in accordance with EU REACH criteria. The main application of HBCDD in EEE is as a flame retardant in HIPS plastic being used for closures and structural parts of different types of EEE. TCO Development considers that the use of HBCDD in EEE is not

deemed essential as technically suitable alternative substances and materials are available and already used extensively today.
Maximum concentration values tolerated for a restricted substance (including decaBDE) is 0.1 % by weight in homogeneous materials.

TCO Development supports the use of recycled plastic. To avoid making it more difficult to use recycled plastic, exceptions to this requirement can be accepted. If recycled plastic is used in the product please contact TCO Development for further instructions.

B.6.4.4 Non-halogenated substances

Classification, Labelling and Packaging of Substances and Mixtures, known as the CLP Regulation, EC 1272/2008 came into force January 2009. The new regulation will eventually replace the Dangerous Substances Directive 67/548/EEC and Dangerous Preparations Directive 1999/45/EC. The transitional dates from which substance classification & labelling must be consistent with the new rules is 1 December 2010 (2012 if the substance is already on the shelves) and 1 June 2015 (2017) for mixtures (preparations).

Maximum concentration values tolerated for a restricted substance is 0.1 % by weight in homogeneous materials.

TCO Development supports the use of recycled plastic. To avoid making it more difficult to use recycled plastic, exceptions to this requirement can be accepted. If recycled plastic is used in the product please contact TCO Development for further instructions.

It has been indicated to TCO Development that the following substances are associated with the restricted hazard statements under A.6.4.4. In this version, only harmonized substances found on the European chemical Substance Information System have been restricted. TCO Development is currently investigating if any of the substances below should be restricted in the next version of TCO Certified. If you have information regarding this please contribute by contacting TCO Development. *The complete table with references and further information can be provided by TCO Development upon request.*

Likely banned substances in the next version TCO Certified		
English name	**CAS**	**Hazard statements**
Antimony(III) oxide (Sb2O3)	1309-64-4	**H351**
Tri-o-cresyl phosphate	78-30-8	**H411,** H370
Triethyl phosphate	78-40-0	**H341, H350,** H302, H319
Magnesium hydroxide	1309-42-8	H372, H315, H319, H335, H302, H332, H318,
	138265-88-0	**H410, H400**
Zinc borates (2ZnO.3B2O3)	12767-90-7	**H410, H400,** H319
Triphenyl phosphate (TPP)	115-86-6	**H411, H400, H410,** H413, H319
Sodium toluene-4-sulphonate	657-84-1	**H341**, **H351, H400,** H301, H312, H317, H319, H332, H315, H335, H302, H318
Impure products of: Bis phenolA bis (biphenyl) phosphate (BDP)	181028-79-5	Technical grade contains high amount of TPP
Impure products of: (1-methylethylidene)di-4,1-phenylenetetraphenyl diphosphate	5945-33-5	Constituent of BDP, Technical grade contains high amount of TPP
Tri-cresyl phospate	1330-78-5	**H411, H400, H410,** H413, H319, H317, H361, H373, H312, H302, H370
Cresyl diphenyl phosphate	26444-49-5	**H410, H400,** H302
Resorcinol bis (diphenyl diphosphate) (RDP)	57583-54-7	**H411**, H412

B.6.4.5 Plastics with chlorine and bromine as part of the polymer

TCO Development supports the use of recycled plastic. To avoid making it more difficult to use recycled plastic, exceptions to this requirement can be accepted. If recycled plastic is used in the product please contact TCO Development for further instructions.

B.6.4.6 Information regarding plastics and flame retarding agents

PWB laminates contained in LCD panels shall be listed if the conditions set out by the mandate are met.

B.6.4.7 Phthalates

The maximum concentration values are 0.1% by weight in homogeneous materials.

B.6.4.8 Batteries

The maximum concentration values for batteries are 0.002 % cadmium and 0.0005% mercury by weight, according to EU Directive 2006/66/EC.

The maximum concentration value is 0.004 % lead by weight.

B.6.5 Product lifetime

B.6.5.1 Warranty and spare parts

That spare parts shall be available for three years from “the time that production ceases” is only applicable to the production of the specific Smartphone, certified by the brand owner.

Regarding spare parts:

1. If a part of a product is broken (e.g. cover) the end user shall not need to replace the whole product, only the broken part. The broken part shall be possible to replace with an equivalent part (this part does not have to be identical to the broken part).

2. When the cost for replacing a broken part (e.g. panel) exceeds the cost of replacing the whole product, then that part need not be considered as a spare part under this mandate.

B.6.6 Preparation for Recycling

B.6.6.1 Material coding of plastics

If the amount of flame retardant exceeds 1 % by weight the coding shall be complemented in accordance with ISO 1043-4.

The requirements also apply to plastics in the LCD panel, however labelling of the light guide may instead consist of the application of a label in close proximity, for example PLASTIC LIGHT GUIDE:>*plastic type(s)*< or >PLASTIC LIGHT GUIDE:*plastic type(s)*<. Labelling of Plate diffuser (not thin plastic film diffuser) shall follow the same rules as for the light guide.
The requirement does not cover other thin plastic films in the panel due to difficulties in labelling these.

B.6.6.3 Take back system

Tick the box of the option chosen.

If the applicant chooses **option 1** (*Product only sold on markets with WEEE legislation or similar*) and signs the declaration, the requirement is fulfilled.

If **option 2 or 3** (*World-wide product take back* or *One additional market lacking WEEE legislation where product take back is offered*) is chosen, the declaration must be signed and the applicant must provide a short description of how the take-back system on that market works. This can also be done by giving a reference (for example a link to a website) to the representative, associated company or affiliate taking care of the take-back system on that market.

In case of option 3 the applicant must also provide the name of the market (country) where a take back system is provided.

TCO Development has no requirement on the take-back system being free of charge.

It is important to point out that any recycling and waste export control legislation in countries where the applicant company operates must always be met.

B.6.7 Product packaging

B.6.7.1 Hazardous substances in product packaging

Limit values are according to Directive 94/62/EC on packaging and packaging waste.

B.7 Corporate Social Responsibility

B.7.1.1 General Clarifications

TCO Development is from this version of the criteria taking the next step in relation to Corporate Social Responsibility (CSR) by introducing an extended mandate regarding supply chain responsibility, since the way in which products are produced is gaining importance for consumers as well as professional buyers. Within the ICT industry supply chain responsibility is increasingly seen as a hygiene determinant.

We aim to be a sustainability label that assures good products in three relevant areas – environmental, social and ergonomics. We want the label to be proof for compliance with public procurement ethical criteria as well as with private sector CSR polices.

The Social performance criteria are based on the eight ILO core conventions and local legislation. This stipulates minimum standards as for the situation in the production facilities. ILO (International Labour Organization) is a United Nations specialized agency with the aim to promote social justice and humane working conditions. The organization consists of representatives of national states, corporations and labour unions.

It is also important the Brand owner has an appointed senior management representative who, irrespective of other responsibilities, ensures that the requirements of this mandate are met. The contact details of this person shall be submitted and shall be available for dialogue in English with TCO Development throughout the certification period. This aims to create an open and transparent dialogue between TCO Development and the brand owner company.

B.7.1.1.1 Electronic Industry Citizenship Coalition (EICC)

The Electronic Industry Citizenship Coalition (EICC) is a group of companies working together to create a comprehensive set of tools and methods that support credible implementation of the Electronic Industry Code of Conduct throughout the Electronics and Information and Communications Technology (ICT) supply chain.

The Electronic Industry Code of Conduct is a code of best practices adopted and implemented by some of the world's major electronics brands and their suppliers. The goal is to improve conditions in the electronics supply chain. Development of the Code was a multi-stakeholder effort, influenced by internationally-recognized standards. By consolidating and standardizing compliance, audit and reporting efforts, suppliers can focus on achieving the high standards of performance set forth by the Code. This approach is also conducive to fostering a culture of social responsibility throughout the global electronics supply chain. EICC sets forth performance, compliance, auditing and reporting guidelines across five areas of social responsibility:

- Labour
- Health and Safety
- Environmental
- Management System
- Ethics

As documented proof we require:

1. An EICC membership document

2. An annual list (that is not older than 12 months) of all third party audits of compliance with the EICC code of conduct, conducted at the first tier production facilities of TCO certified products.

3. One full report of a third party audit (that is not older than 12 months) conducted at a first tier production facility of TCO certified products. This shall be sent to an approved CSR verifier for review.

More information:
http://www.eicc.info/

B.7.1.1.2 SA8000

SA8000 is a global social accountability standard for decent working conditions, developed and overseen by Social Accountability International (SAI). SAI contracts with a global accreditation agency, Social Accountability Accreditation Services (SAAS) that licences and oversees auditing organisations to award certification to employers that comply with SA8000.

SA8000 is based on the UN Universal Declaration of Human Rights, Convention on the Rights of the Child and various International Labour Organization (ILO) conventions. SA8000 covers the following areas of accountability:

- Child labour: No workers under the age of 15; minimum lowered to 14 for countries operating under the ILO Convention 138 developing-country exception; remediation of any child found to be working.
- Forced labour: No forced labour, including prison or debt bondage labour; no lodging of deposits or identity papers by employers or outside recruiters.
- Workplace safety and health: Provide a safe and healthy work environment; take steps to prevent injuries; regular health and safety worker training; system to detect threats to health and safety; access to bathrooms and potable water.
- Freedom of Association and Right to Collective Bargaining: Respect the right to form and join trade unions and bargain collectively.
- Discrimination: No discrimination based on race, caste, origin, religion, disability, gender, sexual orientation, union or political affiliation, or age; no sexual harassment.
- Discipline: No corporal punishment, mental or physical coercion or verbal abuse.
- Working hours: Comply with the applicable law but, in any event, no more than 48 hours per week with at least one day off for every seven day period; voluntary overtime paid at a premium rate and not to exceed 12 hours per week on a regular basis; overtime may be mandatory if part of a collective bargaining agreement.
- Remuneration: Wages paid for a standard work week must meet the legal and industry standards and be sufficient to meet the basic need of workers and their families; no disciplinary deductions.
- Management system for Human Resources: Facilities seeking to gain and maintain certification must go beyond simple compliance to integrate the standard into their management systems and practices.

As documented proof we require:

1. A valid SA8000 certificate documenting compliance with the standard. The Brand owner shall be SA8000 certified or carrying out production at first tier production facilities that are SA8000 certified. Certificates shall be sent to an approved CSR verifier for review.

2. An annual list (that is not older than 12 months) of all third party audits conducted at the first tier production facilities of TCO certified products.

3. If the SA8000 certificate is not from a production facility, then together with the organisation SA8000 certificate, one full report of a third party audit (that is not older than 12 months) conducted at a first tier production facility of TCO certified products. The SA8000 certificate and Audit report shall be sent to an approved CSR verifier for review.

   Note: If it is the Production facility that has a valid SA8000 certificate, then no audit report needs to be submitted. Production facility SA8000 certificates shall be sent to an approved CSR verifier for review.

More information:
http://www.sa-intl.org/

B.7.1.1.3 Self-documentation

Verification is made through completing a questionnaire provided by TCO Development. There are 10 questions concerning the brand owner's company work with implementing the minimum requirements on working conditions in the production of TCO Certified products. The answers shall be signed by the senior management representative and as far as possible supported by documentation.

To be accepted as fulfilling the TCO Development social criteria the brand owner company shall provide proof of having implemented structured CSR work with their first tier production facilities and make reasonable efforts with respects to suppliers. Our ambition is to ensure that the risk of the production not being in compliance with the requirements is minimized.

The questions cover such areas as the implementation and content of a code of conduct or similar demands on first tier production facilities, auditing and follow up of social criteria, trade union rights and representation, activities to avoid discrimination and the dialogue with suppliers.

As documented proof we require:

1. A completed and by CSR verifier approved TCO Development questionnaire. The Questionnaire and Guidelines for the assessment are public and can be downloaded at: www.tcodevelopment.com. This shall be sent to an approved CSR verifier for review.

2. An annual list (that is not older than 12 months) of all third party audits conducted at the first tier production facilities of TCO certified products.

3. One full report of a third party audit (that is not older than 12 months) conducted at a first tier production facility of TCO certified products. This shall be sent to an approved CSR verifier for review.

B.7.1.1.4 Brand owners not yet having the required CSR process in place (Grace Period).

TCO Development does not automatically accept any grace period for smartphone certification. If the brand owner needs a grace period it is necessary to contact TCO Development to agree on the conditions and if it is possible.

B.7.1.1.5 On-site inspection ordered by the Brand owner (Social revision)

In accordance with the compliance options of a, b or c under A.7.1 the Brand owner shall provide a third party conducted social audit carried out at one of their 1st tier facilities producing TCO Certified products. The following applies:

- The brand may choose the third party Audit firm.
- Third party auditors used by the brand to carry out the factory inspection and issue the report shall have documented experience of carrying out social auditing. The auditor should have undergone the SA8000 Advanced Auditor Training or an equivalent training course
- A third party is considered to be a person or body that is recognised as being independent of the parties involved, as concerns the issue in question. Parties involved are normally the supplier (first party) and purchaser (second party).

Audit report review: Central to the compliance alternatives a, b and c is the review of the factory audit report. The review of the Factory Audit report is conducted by a third party CSR Reviewer approved by TCO Development. Audit reports sent for review shall not be older than 12 months.
CAP: If there were findings during the Factory inspection that violate the TCO Certified A.7.1 mandate criteria then a Corrective action plan (CAP) to rectify the violations shall also be submitted for review. The list of approved CSR reviewers is found at: **www.tcodevelopment.com.**

The CSR reviewer has the responsibility to review the following types of documents; Audit reports, CAPs, production facility SA8000 certificates and self-documentation/TCO Development questionnaires (see B.7.1.1.3).
After the review the CSR verifier issues a CSR Verification to the brand. The brand submits the CSR verification to TCO Development to prove compliance to A.7.1.
A CSR Verification issued by the approved CSR reviewer is valid for 12 months from the date of the brands first issued TCO Certified certificate covering mandate A.7.1. For Smartphone certifications, there no grace period is given, the brand owner shall, before the due date of the next 12 month period, submit an annual factory audit (not older than 12 months), CAP and the questionnaire (if option c is applied) to the accepted reviewer to obtain an updated CSR verification for the next 12 month compliance period.

B.7.1.1.6 On-site inspection instigated by TCO Development (Social revision)

TCO Development reserves the right to require full audit reports and conduct or commission on-site inspections at first tier production facilities to verify that the Brand owner is fulfilling the obligations according to this mandate. The planning of social audits will be done in cooperation with the Senior Management Representative appointed by the brand owner. Audits will be implemented by TCO Developments partner organisation for the actual geographic region. On factory level, inspections should be able to be unannounced visits. Social audits initiated by TCO Development will be realized on a judgement sample basis, in each case decided by and financed by TCO Development.