

A.2 視覺人體工學 Visual ergonomics FPD

A.2.1 解析度要求 Pixel array

指令: 強制性要求

在圖像顯示單元的像素密度必須 ≥ 30 像素/每度視角(在50公分視在距離)或解析度有符合下列要求:

15" $\geq 1024 \times 768$

16" $\geq 1024 \times 768$

17" $\geq 1280 \times 1024$

18" $\geq 1280 \times 1024$

19" $\geq 1280 \times 1024$

21" $\geq 1600 \times 1200$

其它規格的請自行計算

A.2.2 畫面幾何學 Screen geometry

A.2.2.1 線性 Linearity

Not applicable for FPD.

A.2.2.2 矩形 Orthogonality

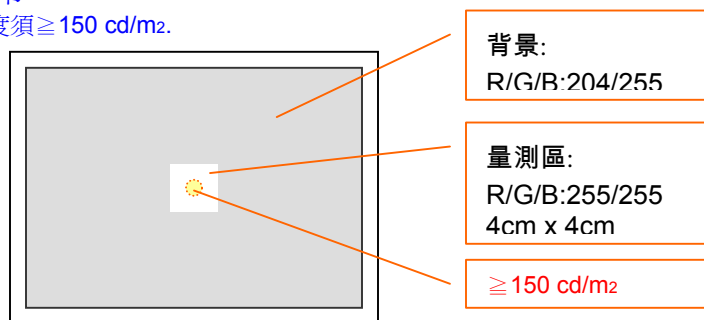
Not applicable for FPD.

A.2.3 發光特性 Luminance characteristics

A.2.3.1 發光亮度 Luminance level

指令:

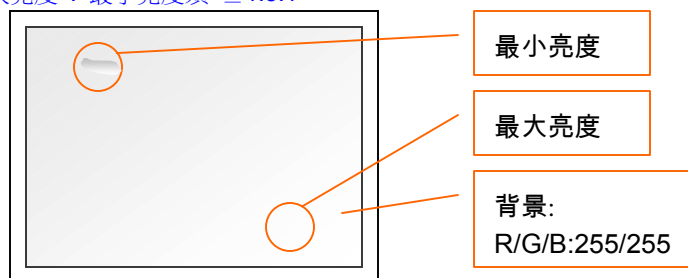
亮度須 $\geq 150 \text{ cd/m}^2$.



A.2.3.2 發光均勻度 Luminance uniformity

指令: 強制性要求

最大亮度 : 最小亮度須 $\leq 1.5:1$



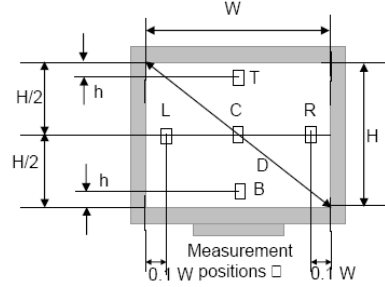
A.2.3.3 圖像下載容量 Image loading capacity

Not applicable for FPD.

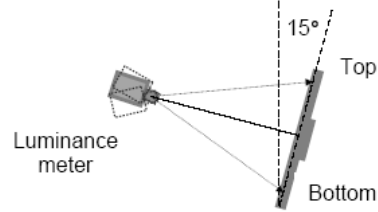
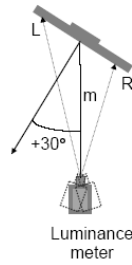
A.2.3.4 發光均勻度(依照視角而定)Luminance uniformity - angular-dependence

指令: 強制性要求

Method:



$L_{max,+30^\circ}$ and $L_{min,+30^\circ}$



量測距離 (cm) = $D \times 1.5$ with a minimum distance: $md = 50$ cm
 $L_{max} : L_{min} \leq 1.7:1$

水平方向 $L_{max+30} / L_{min+30} \leq 1.7:1$ and $L_{max-30} / L_{min-30} \leq 1.7:1$
 垂直方向 $L_{max+15} / L_{min+15} \leq 1.7:1$ and $L_{max-15} / L_{min-15} \leq 1.7:1$

A.2.4 亮度對比Luminance contrast

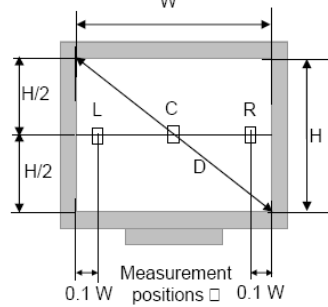
A.2.4.1 亮度對比Luminance contrast

Not applicable for FPD.

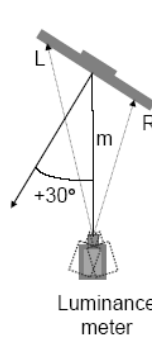
A.2.4.2 亮度對比(依照視角而定)Luminance contrast – angular-dependence

指令: 強制性要求

Method:



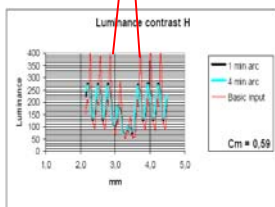
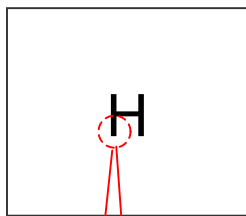
$L_{white,+30^\circ}$ and $L_{black,+30^\circ}$



$$C_{m+30} = (L_{white+30} - L_{black+30}) / (L_{white+30} + L_{black+30}) \geq 0.8$$

$$C_{m-30} = (L_{white-30} - L_{black-30}) / (L_{white-30} + L_{black-30}) \geq 0.8$$

A.2.4.3 亮度對比(依照符號而定)Luminance contrast – characters



指令: 強制性要求

使用“H”字型:Arial,字型大小:12 R/G/B:0/0/0,背景: R/G/B:255/255/255

量測開口孔徑2"

量測最小面積 $\geq 1/3$ 高度“H”

$L_{max}=1$ 分鐘平均曲線最大值

$L_{min}=4$ 分鐘平均曲線最小值

$$C_m = (L_{max} - L_{min}) / (L_{max} + L_{min}) \geq 0.7 \text{ at } 90 \text{ degrees.}$$

A.2.5 前面板反射係數 Front frame reflectance

A.2.5.1 前面板擴散反射係數 Front frame diffuse reflectance

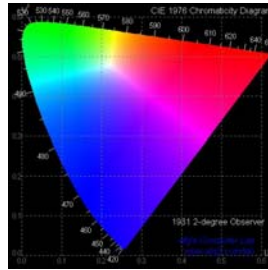
指令: 強制性要求

擴散反射係數: 20%~80%

A.2.5.2 前面板光澤度 Front frame gloss

指令: 強制性要求

gloss value ≤ 30 gloss units (在60°時)



A.2.6 畫面色度 Screen

A.2.6.1 色溫調整 Colour

指令: 強制性要求

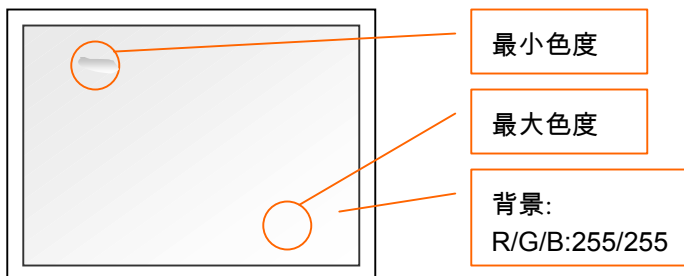
colour
temperature variation

CCT in K	x	y	u'k	v'k
9300	0.283	0.297	0.189	0.446
7500	0.299	0.315	0.194	0.459
6500	0.313	0.329	0.198	0.469
5500	0.333	0.348	0.204	0.481
5000	0.346	0.359	0.209	0.488

依照上表所示五種色溫值, 判定依據: $\Delta u'v' \leq 0.01$

A.2.6.2 色度均勻度 Colour uniformity

指令: 強制性要求



$\Delta u'v' \leq 0.01$

A.2.6.3 RGB settings

指令: 強制性要求

請參照下表所要求

Red		Green		Blue	
u'	v'	u'	v'	u'	v'
Min 0,411	Min 0,503	Max 0,140	Min 0,548	Min 0,150	Max 0,224

A.2.6.4 色度均勻度(依照視角而定)Colour uniformity – angular dependence

指令: 強制性要求

$$\Delta u'v' = ((u'k - u'm)^2 + (v'k - v'm)^2)^{0.5}$$

“L”及“R”的位置量測色度 $\Delta u'v'$ 必須 ≤ 0.025 (在 $\pm 30^\circ$ 時)

A.2.6.5 灰階色度線性Colour greyscale linearity

指令: 強制性要求

請依照下列表格量測之

Grey level	Luminance	u'	v'
255			
225			
195			
165			
135			
105			
Difference			

判定依據: $\Delta u'v' \leq 0.02$

A.2.7 圖像穩定度Image stability

A.2.7.1 Periodic luminance variation

Not applicable for FPD.

A.2.7.2 Positional instability (jitter)

Not applicable for FPD.

A.3 實際工作人體工學Work load Ergonomics

A.3.1 垂直擺幅Vertical tilt

指令: 強制性要求

圖像顯示單元的垂直擺幅必須 $\geq 20^\circ$

A.3.2 垂直高度調整Vertical height adjustment

指令: 強制性要求

圖像顯示單元必須符合以下兩點要求:

1. 圖像顯示單元的機構部份必須具有調整高度的基本功能.
2. 圖像顯示單元的基座設計必須符合“VESA mounting interface”的要求.

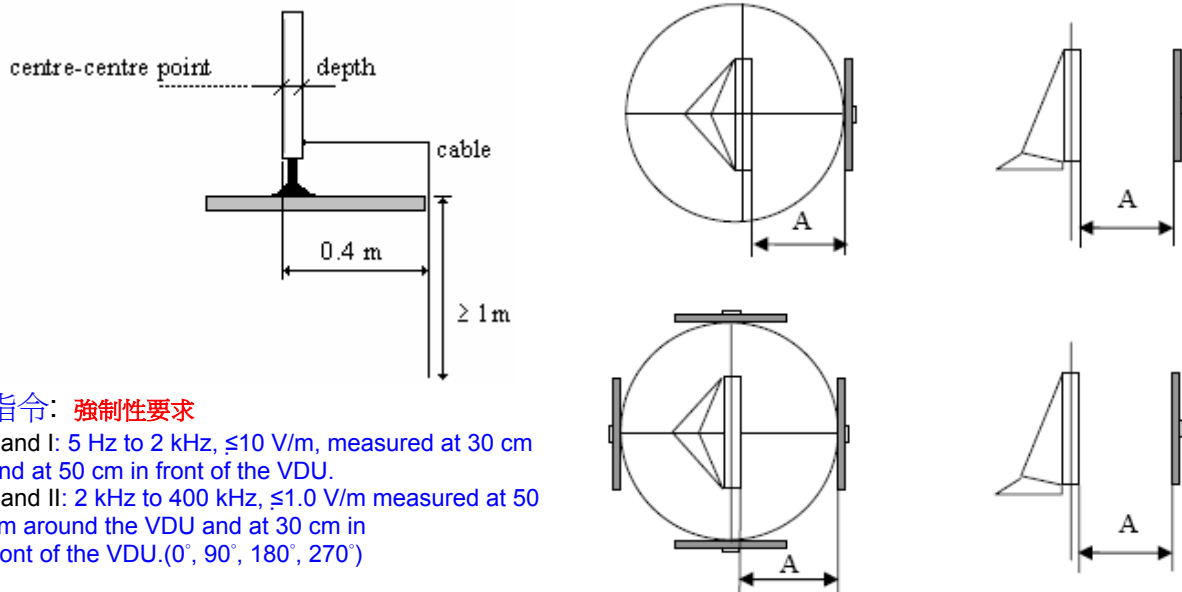
產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.4 放射線Emissions

A.4.1 靜電可能性Electrostatic potential

Not applicable for FPD.

A.4.2 交流電場Alternating electric fields



指令: 強制性要求

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

Band II: 2 kHz to 400 kHz, ≤ 1.0 V/m measured at 50 cm around the VDU and at 30 cm in front of the VDU.(0°, 90°, 180°, 270°)

Frequency band I

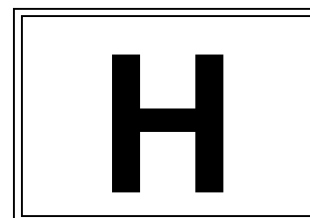
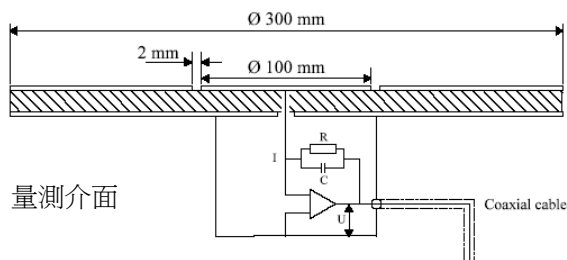
Frequency	< 5 Hz	5 Hz	100 Hz	2 kHz	> 2 kHz
Attenuation	> 80 dB/decade	3 dB	0 dB	3 dB	> 40 dB/decade

Frequency band II

Frequency	< 2 kHz	2 kHz	30 kHz	400 kHz	> 400 kHz
Attenuation	> 80 dB/decade	3 dB	0 dB	3 dB	> 40 dB/decade

Calibration frequencies and amplitudes

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



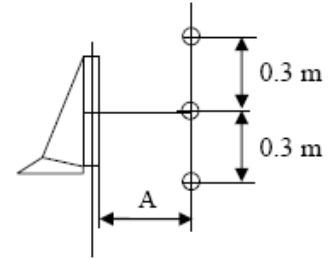
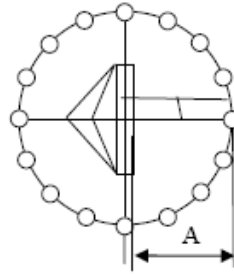
量測畫面

A.4.3 交流磁場 Alternating magnetic fields

指令: 強制性要求

Band I: 5 Hz to 2 kHz, ≤ 200 nT, measured at 30 cm in front of the VDU and at 50 cm around the VDU.

Band II: 2 kHz to 400 kHz, ≤ 25 nT measured at 50 cm around the VDU.



Frequency band I

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

Frequency band II

Frequency	< 2 kHz	2 kHz	30 kHz	400 kHz	> 400 kHz
Attenuation	> 80 dB/decade	3 dB	0 dB	3 dB	> 40 dB/decade

Calibration frequencies and amplitudes

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

A.4.4 聲音干擾 Acoustic noise

指令: 強制性要求

以下規定必須公佈:

音壓位準 *Sound pressure level*:

必須在使用者的位置依照以下情形量測加權音壓位準, 記錄成報表, 並公佈之:

- . 待機狀況
- . 分別驅動硬碟, 軟碟, CD, DVD

假如有出現傳動異音或者有不規則頻率的變化, 須記錄下來

噪音位準 *Sound power level*:

必須依照以下情形量測加權噪音位準 dB 值, 也必須不超過以下值:

- 待機狀況: 4.8 dB
- . 施於最高音壓時的操作環境: 5.5 dB

A copy of a test report from a test laboratory accredited according to ISO 7779 and ISO 9296

A.5 電氣安規 Electrical safety

A.5.1 Electrical safety

指令: 強制性要求

必須遵照 IEC 60950 的規定要求.

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

A.6 環境保護Ecology

A.6.1 環境保護的管理系統認證Environmental management system certification

指令: 強制性要求

每一個製造商(三人以上)所用的設備必須符合環保的認證ISO 14001, or EMAS

The certification authority shall be accredited in accordance with ISO/IEC Guide 66, and shall meet the provisions of ISO/IEC Guide 61.

1. A document holding the names and addresses of the manufacturers.
2. Copies of the ISO 14001 or EMAS certificates.
3. 產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.6.2 有關環境的危險Environmental hazards

A.6.2.1 鎘和汞Cadmium (Cd) and mercury (Hg)

指令: 強制性要求

圖像顯示單元的塗漆,亮光漆,塑料,連接器,電池,焊錫必須不包含鎘和汞:

最小限制值: 鎘比重:5 ppm和汞比重:2 ppm

產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.6.2.2 鉛Lead (Pb)

指令: 強制性要求

圖像顯示單元的塗漆,亮光漆,塑料,電池,連接線,連接頭必須不包含鉛:

最小限制值: 鉛比重:50 ppm

產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.6.2.3 溴氯化合劑Brominated and chlorinated flame retarding agents

指令: 強制性要求

取樣塑料重量大於25g時,必須不包含溴氯化合劑:

最小限制值: 溴氯化合劑比重:0.5%

產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.6.2.4 化合劑資料Information regarding flame retarding agents

指令: 強制性要求

取樣塑料重量大於25g, 化合劑濃度大於0.5%時,必須完整填寫以下表格

1. The below table shall be filled and be signed by the responsible person at the applicant company.
2. Part of the information in the below table can for secrecy reason be sent directly from the plastic manufacturer to TCO certified lab.

Plastic component name	Weight (grams)	Type of plastic	Plastic brand name	Plastic model name	Flame retardant type	Flame retardant CAS-number	Plastic labelling text

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A.6.2.5 塑料溴氯化合劑規定Brominated and chlorinated plastics

指令: 強制性要求

大於25g的塑料重量,必須不含溴氯化合劑

產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.6.3 回收準備Preparation for Recycling

A.6.3.1 塑料辨識碼Material coding of plastics

指令: 強制性要求

塑料重量大於25g時,編碼必須符合ISO 11469, ISO 1043-1, -2, -3, -4 and listed using the table in A.6.2.4.

產品保證書上必須記載以上要求內容,也必須記載設計的公司及設計者名字

A.6.3.2 回收設計Design for recycling - Mercury lamps

Mandate:

. Connections to be separated during the disassembly of FPD must be easy to take apart in order to not damage the mercury lamps. This means that gluing and welding must not be used to bond parts and make removal of the lamps complicated.

. The total amount of mercury in the lamps shall be declared in the table below.

The following information shall be submitted:

. A written guarantee that the above mandate is fulfilled together with a description of the method by means of which the lamps shall be removed. The guarantee shall be signed by the responsible person at the applicant company.

. The mercury lamp suppliers, the lamp ID code, the average, maximum and minimum amount of mercury in each lamp, the total number of lamps and the FP ID code, FP and manufacture company shall be declared.

Product (monitor) name:.....

Product (monitor) type:

FPD size:.....

Number of lamps:

Mercury lamp supplier:	Lamp ID code:	Average mg Hg/lamp:	Max. mg Hg/lamp:	Min. mg Hg/lamp:

LCD identification code	LCD manufacturing company

A 6.3.3 Variety of plastics

Mandate:

No more than two different types of plastic materials are accepted for parts weighing more than 100 grams regardless of their location in the product.

The following information shall be submitted:

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

A.6.3.4 Metallization of plastic housing

Mandate:

No internal or external metallization or moulded-in or glued metal parts in the plastic housing shall be used.

The following information shall be submitted:

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

A.6.3.5 Recycling information for customers

Mandate:

The TCO'03 certificate holder (or his representative, associated company or affiliate) shall inform its customers of the possibility to dispose of the VDU by environmentally acceptable recycling.

The information shall be made available to customers in the geographical markets in the following way:

1. For VDUs sold in Europe: Customers in at least three countries or if less than all countries where the VDU is sold.
2. For VDUs sold in Asia: For customers in at least one Asian country.
3. For VDUs sold in America (North and South): For customers in at least one country or one state in the USA.

The following information shall be submitted:

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

A copy of the description of the customer information in English and/or local language .
Written information of how the customer gets the information

A.7 Energy

A.7.1 Energy saving

Mandate:

The VDU shall meet the requirements either for alternative 1 or alternative 2 below. A test report from a test laboratory accepted by TCO Development shall be submitted.

An energy declaration sheet showing power consumption in active mode, saving mode(s), and off mode shall be signed and submitted by the responsible person at the applicant company.

There shall be a description, from the user's point of view, how the VDU is brought into energy mode(s) and how this is indicated on the VDU. The description shall be signed by the responsible person at the applicant company submitted by the responsible person at the applicant company"

Energy declaration and power indication shall be included in user's manual.

VDU	Alternative 1		Alternative 2	2nd step
	1st step		One step	
Power	≤15 W	≤5 W	≤5 W	
Readable screen	≤3 sec	No wake-up time requirement	No wake-up time requirement	