Prüfbericht-Nr.: *Test Report No.:*	**10046114 001**	**Auftrags-Nr.:** *Order No.:* **114018182**	**Seite 1 von 12** *Page 1 of 12*
Kunden-Referenz-Nr.: *Client Reference No.:*	**TUV13-12**	**Auftragsdatum: 08.Nov.2013** *Order date:*	
Auftraggeber: *Client:*	Top Victory Electronics (Taiwan) Co., Ltd. 10F., No. 230, Liancheng Rd., Zhonghe Dist., New Taipei City, 23553 Taiwan		
Prüfgegenstand: *Test item:*	LCD Monitor		
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	280LM00003		
Auftrags-Inhalt: *Order content:*	new application TCO Certified Displays 6.0		
Prüfgrundlage: *Test specification:*	TCO Certified Displays 6.0 ENERGY STAR® Displays Eligibility Criteria (Ver. 6.0)		

Wareneingangsdatum: *Date of receipt:*	13.Feb.2014	See attached photo documentation.
Prüfmuster-Nr.: *Test sample No.:*	A000037887-001	
Prüfzeitraum: *Testing period:*	07.Mar.2014 - 11.Mar.2014	
Ort der Prüfung: *Place of testing:*	TÜV Rheinland Taiwan Ltd.	
Prüflaboratorium: *Testing laboratory:*	Taipei Laboratory	
Prüfergebnis*: *Test result*:*	Pass	

geprüft / tested by:

07.Mar.2014 Derek Hsu / Senior Project Manager

Datum / *Date*	Name/Stellung / *Name/Position*	Unterschrift / *Signature*

kontrolliert / reviewed by:

11.Mar.2014 Pei-Wen Chan / Project Manager

Datum / *Date*	Name/Stellung / *Name/Position*	Unterschrift / *Signature*

Sonstiges / Other:
LCD-Modul / LCD-Panel: **M280DGJ-L30 (Innolux)**

Above shown model(s) will be market under Brand Name: **AOC**

Zustand des Prüfgegenstandes bei Anlieferung: Test item complete and undamaged
Condition of the test item at delivery: *Prüfmuster vollständig und unbeschädigt*

* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft
P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet

Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor
P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested

VU4

Verwendete Meßgeräte/Prüfmittel

Messung / *measurement*	**Geräte-Ident.-Nummer** *equipment ident. Number*	**nächste Kalibrierung /** *next calibration*
Microvision SS 220 Display Analysis System Luminance, Distance and Color	TW-Ergo-036	Dec-14
SLR-Camera Canon EOS 400D Luminance Contrast	TW-Ergo-119	Sep-14
Processing PC: IBM compatiple HP Vectra VR (Pentium)	TW-Ergo-042	N/A
Combinova EFM-100 Alternating electric field	TW Ergo-044	Jul-14
Combinova MFM-10 Magnetic field band I	TW Ergo-046	Jul-14
Combinova MFM-1000 Magnetic field band II	TW Ergo-045	Jul-14
Glanzgrad-Meßgerät / gloss meter: BYK Gardner Micro-TRI-gloss	TW-Ergo-104	Jul-14
Voltech PM1000+ Digital Power Meter	TW-Ergo-127	Jul-14

Measurement Uncertainty

The reported measurement uncertainty is estimated based on CIPM:
GUIDE TO THE EXPRESSION OF UNCERTAINTY IN MEASUREMENT
(Corrected and Reprinted 1993)

Visual Ergonomics

Coverage Factor k = 2

Confidence Level = 95%

Luminance (cd/m²) = ± 1.08 cd/m² (at 230 cd/m^2)

Gloss = ± 0.9 gloss Units

Color unit (CIE 1976) = ± 0.0028

Distance uncertainty measured with CCD macro lens = ± 0.03 mm

Distance uncertainty not measured with CCD macro lens = ± 2 mm

Energy Saving

Time = ± 0.2 s

Power (W) = ± 2%

Emission

Alternative Electric Field Band I = ±0.54V/m (at 3.58V/m)

Alternative Electric Field Band II = ±0.07V/m (at 0.127V/m)

Alternative Magnetic Field Band I = ±6.1nT (at 14nT)

Alternative Magnetic Field Band II = ±1.9nT (at 3.2nT)

Test sample set up and configuration

VDU:	LCD Monitor
Identification:	280LM00003
Manufacturer:	Top Victory Electronics (Taiwan) Co., Ltd. 10F., No. 230, Liancheng Rd., Zhonghe Dist., New Taipei City, 23553 Taiwan
LCD brand/model:	Innolux / M280DGJ-L30
LCD S/N and Rev.:	Ver 1.0
Surface treatment:	AG type, 3H hard coating, Haze 25
Test mode:	3840 x 2160 (H x V) Font: Arial 12pt Fv: 59.88 Hz Fh: 44.77 kHz Polarity: Positive
Test luminance level:	284.66cd/m² (Visual Ergonomics / Emission)
Brightness setting:	90 / Memory Recall
Contrast setting:	50 / Memory Recall
Color mode setting:	User Preset / Memory Recall
Input port used:	Display port
Ambient Condition:	Dark-room screen illuminance < 2 lux Room temperature: 21°C Relative humidity: 60%
Power Rating:	100-240Vac, 50/60Hz, 1.5A Class I
AC-Adapter:	--
Pivot/Non-Pivot:	Pivot Display
Remark:	LED Backlight White-LED USB 3.0 port connected during the energy saving test.

		ok	fail	N/A
A.2	Visual ergonomics			
A.2.1	Image detail characteristics	☑	☐	☐

A.2.1.1 Native display resolution requirement

Mandate: *The FPD shall have a pixel density ≥ 30 pixel / degree at 1.5 x display diagonal, but no less than 500mm viewing distance.*

Display format:	18.87:16:10
Min amount of horizontal pixels:	972 pixel
Min amount of vertical pixels:	557 pixel

Test result:

Pixel Size (H/V): 0.16mm / 0.16mm	Resolution: 3840 X 2160
Panel size: 27.8 inch	Pixel density: ≥30

		ok	fail	N/A
A.2.2	Luminance characteristics			
A.2.2.1	Luminance Level	☑	☐	☐

Mandate: *The luminance at default setting shall be ≥ 150cd/m²*
The maximum luminance shall be ≥ 200cd/m², and
Minimum luminance shall be ≤ 100cd/m².

Test result:

		Brightnes	Contrast
Maximum Luminance	305 cd/m²	100/100	90/100
Test Luminance	285 cd/m²	90/100	50/100
Minimum Luminance	3 cd/m²	0/100	0/100

A.2.2.2 Luminance uniformity

ok ☑ fail ☐ N/A ☐

Mandate: Luminance variations across the active screen, L_{max} : L_{min} shall be ≤ 1.50:1

Test result:

L_{max}	L_{min}	L_{max} : L_{min}
285.1 cd/m²	196.5 cd/m²	1.45

A.2.2.3 Black level

ok ☑ fail ☐ N/A ☐

Mandate: The luminance of black shall be ≤ 2 cd/m² at a white luminance setting of ≥ 200 cd/m².

Test result:

L_{black}	0.7 cd/m²

A.2.2.4 Luminance uniformity - angular dependence

ok ☑ fail ☐ N/A ☐

Mandate:

1) For FPDs in landscape mode, when the screen is rotated around the vertical axis through the centre of the screen the mean value of the L_{max} to L_{min} ratios at ± 30° shall be ≤ 1.73
$LR_{hor} = ((L_{max+30°}/L_{min+30°}) + (L_{max-30°}/L_{min-30°}))/2 \leq 1.73$

2) For FPDs in landscape mode, when the screen is rotated around the horizontal axis through the centre of the screen, the largest value of the L_{max} to L_{min} ratios at ± 15° shall be ≤ 1.73
$LR_{vert} = Max\ ((L_{max+15°}/L_{min+15°}), (L_{max-15°}/L_{min-15°})) \leq 1.73$

Test result:

1) Pivot and Non-Pivot Displays in landscape mode

$L_{max+30°}$	263.4 cd/m²
$L_{min+30°}$	157.6 cd/m²
$L_{max-30°}$	203.0 cd/m²
$L_{min-30°}$	128.3 cd/m²
LR_{hor}	1.63

2) Pivot and Non-Pivot Displays in portrait mode

$L_{T+15°}$	150.4 cd/m²
$L_{B+15°}$	211.7 cd/m²
$L_{T-15°}$	224.4 cd/m²
$L_{B-15°}$	140.9 cd/m²
LR_{vert}	1.59

A.2.2.5 Greyscale gamma curve

ok ☑ fail ☐ N/A ☐

Mandate: 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	*Accepted level*	
	L_{min} (%)	*L_{max} (%)*
255	*100*	*100*
225	*70*	*93*
195	*46*	*68*
165	*29*	*49*
135	*17*	*36*
105	*8*	*24*
75	*3*	*14*
45	*1*	*7*

Test result:

Grey level	Measured Lum.
	(%)
255	100
225	75
195	53
165	36
135	23
105	13
75	6
45	2

A.2.3 Luminance contrast characteristics

ok ☑ fail ☐ N/A ☐

A.2.3.1 Luminance contrast - characters

Mandate: The FDP shall have a luminance contrast ≥ 0.70 measured orthogonally to the screen.

Test result:

H	C_m (H)	0.91

A.2.3.2 Luminance contrast-angular dependence

ok ☑ fail ☐ N/A ☐

Mandate: For FPDs in landscape mode, the luminance contrast-angular dependence shall be ≥ 0.90 at ± 30° horizontally from the viewing direction.
$C_m = (L_{white} - L_{black})/(L_{white} + L_{black})$

Test result:

	+30°	-30°
L_{white}	258.4 cd/m²	191.6 cd/m²
L_{black}	1.3 cd/m²	1.5 cd/m²
C_m	0.99	0.98

A.2.4 Reflection characteristics

ok	fail	N/A
☑	☐	☐

A.2.4.1 Front frame gloss

Mandate: For displays that have a gloss value G(60°) > 30 gloss units the following consideration note for the placement of the FPD shall be given in the user manual. "For displays with glossy bezels the user should consider the placement of the display as the bezel may cause disturbing reflections from surrounding light and bright surfaces."

Test result:

Front Frame	5 Gloss units

A.2.5 Screen colour characteristics

ok	fail	N/A
☑	☐	☐

A.2.5.1 Correlated colour temperature, CCT, variation

Mandate: The FPD shall have at least two predefined possibilities for pre-set correlated colour temperatures between 5000K and 10000K and one possibility for user to adjust the CCT (total of three settings)
Each pre-set correlated color temperature shall have a color difference $\Delta u'v' \leq 0.012$ when compared to CIE u' and v' for corresponding CCTs"

Extra for media displays
At least one of the predefined pre-set correlated colour temperature shall be 6500K or sRGB. If the pre-set is named something different from the numeric value (e.g."normal) the end-user shall be informed in the user manual of which pre-set CCT corresponds to 6500K or sRGB.

Test result:

Preset Colour Temp.	$\Delta u'v'$	u'	v'
sRGB	0.006	0.194	0.473
Cool	N/A	0.186	0.449
Warm	N/A	0.191	0.479
Normal	N/A	0.191	0.465
User	N/A	0.191	0.478

Remark: Pre-set CCT of this office display is User Preset

A.2.5.2 Colour uniformity

ok	fail	N/A
☑	☐	☐

Mandate: $\Delta u'v' \leq 0.012$ for the maximum colour deviation between measured active areas on the screen that are intended to maintain the same colour.

Test result:

$\Delta u'v'$	0.006

A.2.5.3 RGB Settings

ok	fail	N/A
☑	☐	☐

Mandate: 1. The minumum colour triangle shall be ≥29%.
2. The following tolerances to the sRGB coordinates:

	Red		*Green*		*Blue*	
Co-ordinate	*u´*	*v´*	*u´*	*v´*	*u´*	*v´*
Requirement	*≥0.411*	*≥0.503*	*≤0.140*	*≥0.548*	*≥0.150*	*≤0.210*

Test result: *1.* *Colour triangle:* *31.6%*

2.

	Red		Green		Blue	
	u´	v´	u´	v´	u´	v´
Measured	0.433	0.524	0.126	0.570	0.186	0.159
Deviation	-0.022	-0.021	0.015	-0.022	-0.036	0.051
Pass / Fail	OK	OK	OK	OK	OK	OK

A.2.5.4 Colour uniformity - angular dependence

ok	fail	N/A
☑	☐	☐

Mandate: *For an FDP in landscape mode, the Δu´v´ between areas on the left side and right side of the screen when it is positioned at +30° and -30° horizontally to the screen normal shall be Δu´v´ ≤ 0.025*

Test result:

Δu´v´	0.020

A.2.5.5 Colour greyscale linearity

ok ☑ fail ☐ N/A ☐

Mandate: The Δu´v´ ≤ the maximun allowed difference for each step according to table 2.6.5.

	Maximum Δu´v´ difference							
Greyscale	*255*	*225*	*195*	*165*	*135*	*105*	*75*	*45*
255	*0*							
225	*0.015*	*0*						
195	*0.015*	*0.015*	*0*					
165	*0.020*	*0.020*	*0.020*	*0*				
135	*0.025*	*0.025*	*0.020*	*0.020*	*0*			
105	*0.025*	*0.025*	*0.025*	*0.025*	*0.020*	*0*		
75	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	*0.025*	*0*	
45	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	*0*

Test result:

	Maximum Δu´v´ difference							
Greyscale	255	225	195	165	135	105	75	45
255	0							
225	0.003	0						
195	0.003	0.001	0					
165	0.003	0.000	0.000	0.0				
135	0.002	0.001	0.001	0.001	0			
105	0.002	0.001	0.001	0.001	0.001	0		
75	0.001	0.002	0.002	0.002	0.001	0.001	0	
45	0.002	0.003	0.003	0.003	0.002	0.003	0.002	0

A.3 Work load Ergonomics

ok ☐ fail ☐ N/A ☑

A.3.1 Vertical tilt

Mandate: For FPD's ≤ 26" it shall be possible to easily tilt the FPD in the vertical plane backwards to the extent of 20 degrees or more in one of the height positions.

Test result:

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

A.3.2 Vertical height

ok ☐ fai ☐ N/A ☑

Mandate: FPD's ≤ 26" shall meet at least one of the following mandates:

1. With the display aligned vertically in its lowest point of height adjustment, the distance measured from the underside of the display's foot (work top surface) to the upper edge of the active screen area shall be ≤ 42 cm.

2. The FPD shall have a mounting interface applicable to the VESA mounting interface standard.

Test result:

A written guarantee that the FPD meets either of the above mandates.
The guarantee shall be signed by the responsible person at the applicant company.

A.4 Emission

	ok	fail	N/A
A.4.1 Alternating electric fields	☑	☐	☐

Mandate: *Band I: 5 Hz to 2 kHz, ≤ 10 V/m*
FPDs ≤ 26", measured at 30cm and 50cm in front of the FPD.
FPDs > 26", measured at 50cm in front of the FPD.
Band II: 2 kHz to 400 kHz, ≤ 1.0 V/m
FPDs ≤ 26", measured at 30cm in front of - and 50cm from the rotation point around the FPD.
FPDs > 26", measured at 50cm from the surface of the product around the FPD.

Test result: (values are max. values of landscape and portrait mode- if applicable)

Band I	3840 x 2160@30Hz	3840 x 2160@60Hz	Band II	3840 x 2160@30Hz		3840 x 2160@60Hz	
Distance	center	center	Distance	max. Val.	Angle	max. Val.	Angle
30cm	2.75V/m	2.55V/m	30cm	0.13V/m	0°	0.12V/m	0°
50cm	3.58V/m	3.31V/m	50cm	0.08V/m	270°	0.08V/m	270°
E_{max}	3.58V/m	3.31V/m	E_{max}	0.13V/m	0°	0.12V/m	0°

Note: The resolution and refresh rate at 3840 x 2160@30Hz are generator by Notebook computer, 3840 x 2160@60Hz are generator by Personal computer without ground pin. The full test was made at 3840 x 2160@30Hz instead of native at 3840 x 2160@60Hz.

	ok	fail	N/A
A.4.2 Alternating magnetic fields	☑	☐	☐

Mandate: *Band I: 5 Hz to 2 kHz, ≤ 200nT*
FPDs ≤ 26", measured at 30cm in front of- and at 50cm from the rotation point around the FPD.
FPDs > 26", measured at 50cm from the surface of the product around the FPD.
Band II: 2 kHz to 400 kHz, ≤ 25nT
FPDs ≤ 26", measured at and at 50cm from the rotation point around the FPD.
FPDs > 26", measured at 50cm from the surface of the product around the FPD.

Test result: (values are max. values of landscape and portrait mode- if applicable)

Band I	Measure-ment Distance	Front Center	Max. value	Angle	Height
	30cm	14nT	14nT	0.0°	0cm
	50cm	2nT	9nT	135.0°	0cm

Band II	Measure-ment Distance	Front Center	Max. value	Angle	Height
	50cm	1.4nT	3.2nT	270.0°	0cm

Note: The full test was made resolution and refresh rate at 3840 x 2160@30Hz instead of native resolution and refresh rate at 3840 x 2160@60Hz.

	ok	fail	N/A
A.4.3 Noise	☐	☐	☑

Mandate: *VDUs and NBs with built-in fan.*
The declared A-weighted sound power level (LWAd) shall not exceed in Operating mode 3.9B and in Idling mode 3.5B or, if the product does not emit prominent discrete tones according to procedures specified in ECMA 74 Annex D in Operating mode 4.2B and in Idling mode 3.8B

Test result: No fan built in, no test required

A.6 Environmental requirements

A.6.3.1 Energy consumption

ok	fail	N/A
☑	☐	☐

Mandate: The FPD shall meet the following requirement levels for maximum power consumption, in accordance with ENERGY STAR® Program Requirements for Displays Eligibility Criteria (Version 6.0):

diagonal screen size	*27.8 inch*
resolution in Megapixels	*8.2 MP*
On-Mode	*≤ 63 Watt*
Sleep mode (low power)	*≤ 1.2 Watt*
Standby (Off-mode)	*≤ 0.5 Watt*

Test result:

Luminance level set to	202 cd/m²
	Brightness: 50/100
	Contrast: 100/100

Supply Voltage / Frequency	230V/50Hz	115V/60Hz	100V/60Hz	100V/50Hz
On Mode	51.5Watt	51.0Watt		
Sleep mode	0.48Watt	0.33Watt		
Off mode	0.38Watt	0.24Watt		