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DXOMARK

TCL TV 85X925 PRO 85’’ MINILED 8K

VISUAL PERFORMANCE & OPTICAL CONSTRUCTION ANALYSIS

2022 Product Brochure

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AUTHORS OF THE REPORT

Marc Leconte: Innovation Leader, Optical System Architect at PISÉO

Marc Leconte is in charge of optical system innovation projects for illumination and detection for all types of applications within PISÉO. He holds an engineering degree in optics from the Institut d'Optique Graduate School (IOGS) and has more than 25 years of experience in the detection of defects in hollow glass components using optical processes at the world leader in this field. In this context, he has designed detection systems combining lighting and imaging to reveal defects hidden by the ambient noise caused by the environment.

Matthieu Verstraete : Senior Electronics Analyst at PISÉO

Matthieu Verstraete is in charge of R&D studies and expertise at PISÉO. He has a degree in electronics engineering and about 20 years of experience, mainly within the Philips group. Based for several years in the Netherlands, he participated in the 2000s in the development of advanced digital decoding systems and embedded electronics for the optical systems of the first DVD+RW recorders. He then joined the lighting division of the Philips group, where he was in charge of specifying and developing the driver portfolio for professional LED luminaires worldwide. Before joining PISÉO, he held the role of Global Platform Outdoor Architect for all optical and electronic solutions integrated into Philips outdoor lighting fixtures worldwide. Thanks to his expertise in electronics and embedded software, he is an innovator for customer projects with strong electronic and software requirements and supports all projects requiring expertise in his field.

Thibault Cabana: Product Owner & Display R&D Leader at DXOMARK

Thibault Cabana is head of the display team at DXOMARK, leading the R&D of display laboratories and protocols. Since joining the company in 2020, he has contributed significantly to developing and implementing DXOMARK's first display testing protocol. He now also leads consulting services with the major players in the smartphone industry. Previously, he worked in the automotive sector, designing interior optical systems for the French company Valeo. His work there focused on display image quality, display integration in the control panel, and display innovation-related works (for which he filed a patent). He holds an engineering degree in optics from the Institut d'Optique Graduate School (IOGS) in France.

EXECUTIVE SUMMARY

- After several years and many announcements, MiniLED backlights are coming to the market. According to manufacturers' claims, these will allow LCD displays to offer a contrast similar to OLEDs, while providing high brightness. All of this while offering reduced power consumption, a very thin form factor (thickness), and cost/price competitiveness with OLED.
- With its 85X925 PRO MiniLED 8K, TCL claims to provide the only 8K MiniLED OD ZERO in the world. It combines a direct OD ZERO MiniLED backlight, quantum dots, 8K HDR Premium, and 100Hz Motion Clarity Pro for the best 8K HDR performance.
- To evaluate the benefits of this new type of backlight, DXOMARK and PISÉO – leaders in the assessment of consumer electronics quality and photonic system architecture, respectively – have teamed up to produce this report.
- To evaluate the display quality of the TCL TV 85X925 Pro 85" MiniLED 8K, DXOMARK carried out visual performance measurements. This report presents the test results and the performance comparison.
- In order to understand the technology of the TCL TV 85X925 Pro 85" backlight, the optical architecture of the unit was analyzed by PISÉO and is presented here. This includes a description of the six optical films integrated between the MiniLED array and the LCD panel.
- Based on their own analyses, DXOMARK and PISÉO carried out a cross-analysis to show the links between the user experience and backlight optical construction.
- MiniLED displays, and the future microLED displays, are clearly a disruption for the display industry. This is both in terms of performance, as analyzed in this report, and also in terms of supply chain. All the major consumer electronics manufacturers, such as Apple, Samsung, TCL, and Skyworth, as well as display device manufacturers, are testing the market with new products and adapting their supply chains. They are also trying to find differentiation in terms of design and choice of the right display architecture, as well as choice of the right components and modules.

WHAT'S IN THE REPORT

Key features

- Measurement and analysis of brightness, brightness uniformity, contrast, EOTF, color, color uniformity, angular performance, halo in video, and high and standard dynamic range (HDR and SDR) formats.
- Measurement and analysis of artifacts such as screen reflectance and flicker.
- Description of the MiniLED-based backlight unit technology.
- Details about LED emission characteristics.
- Main characteristics and roles of the different films in the optical stack.
- Backlight unit operation when displaying a simple scene.
- PISÉO's and DXOMARK's opinion on TCL TV 85X925 Pro 85" MiniLED 8K performance.

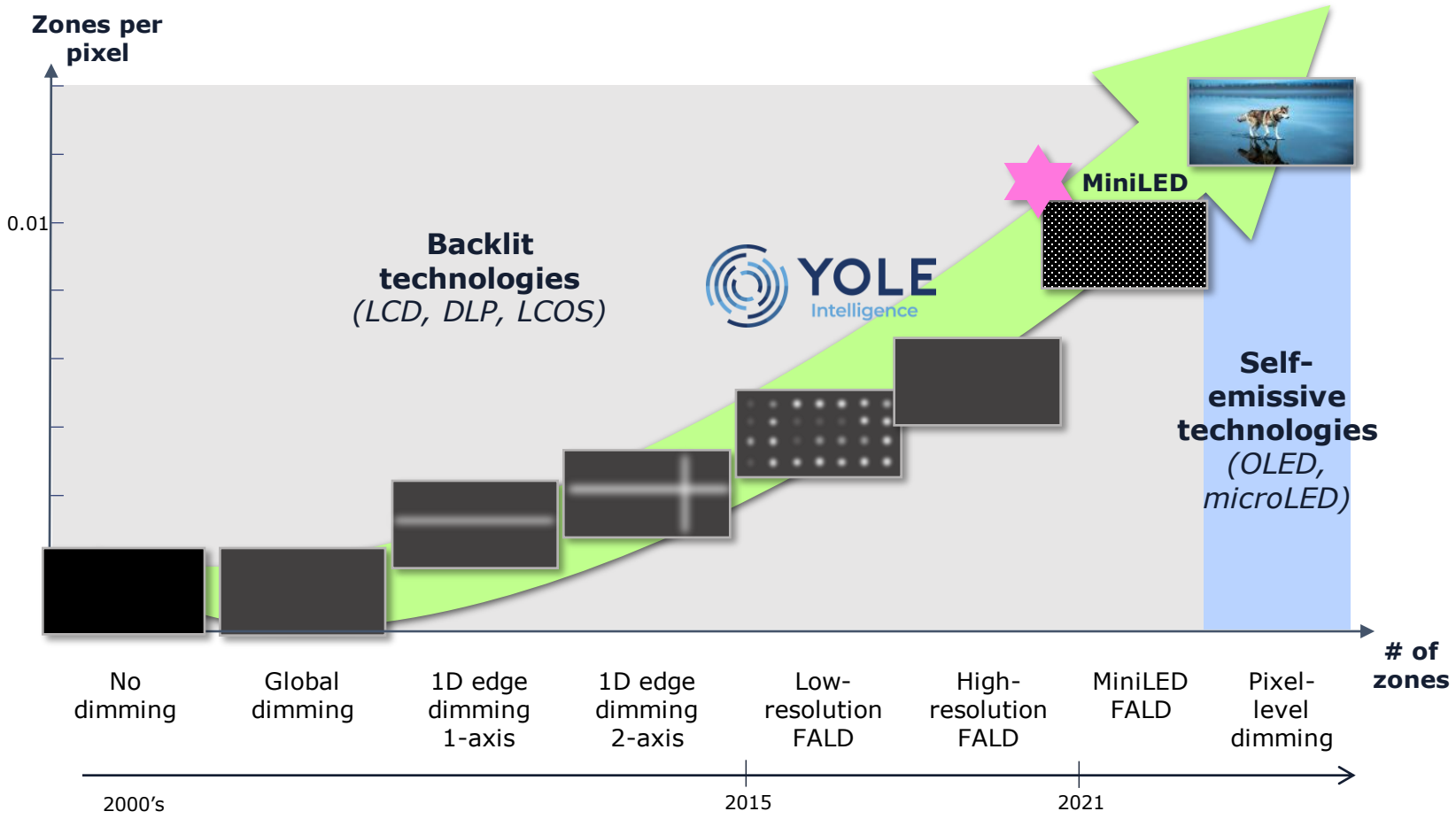
COMPANIES CITED IN THE REPORT

- 3M
- Apple
- MNtech
- Samsung
- Shinwha
- TCL
- Zeonor

LOCAL DIMMING EVOLUTION

From no dimming to pixel-level dimming.

MiniLED technology is a solution for full array local dimming (FALD).

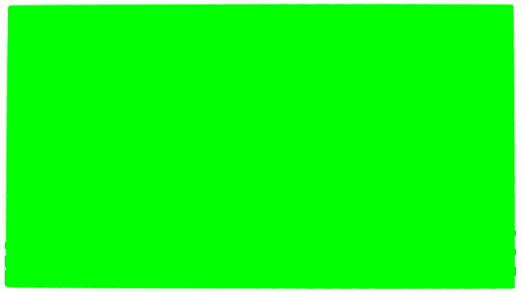


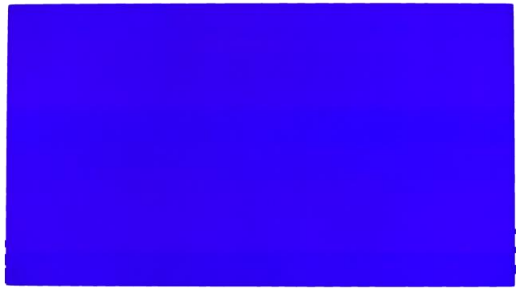
source: Yole Intelligence

VIDEO CONTENT – COLOR UNIFORMITY

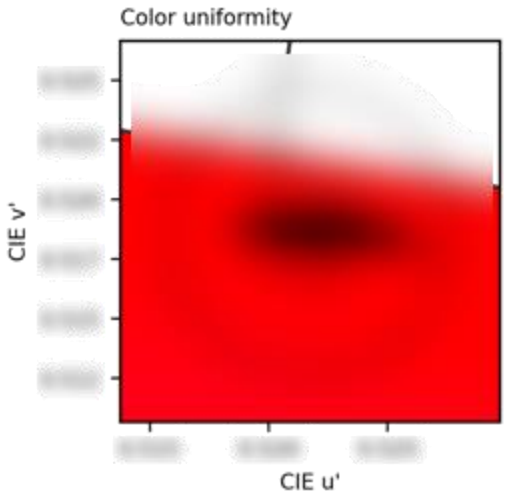
The color non-uniformity of a display is the difference in hue across the screen when a uniform pattern is displayed.

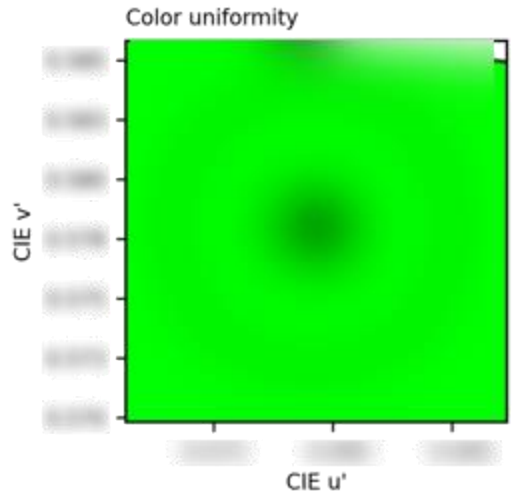
Conclusion:

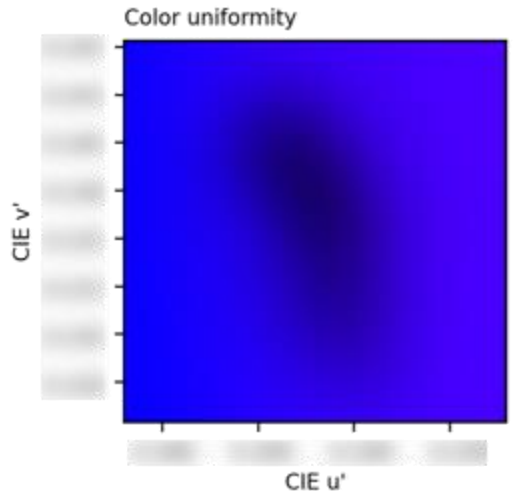




The black circles represent, respectively, 1 and 3 JNCD (Just Noticeable Color Difference). Above 3 JNCD, color differences become visible to most people.

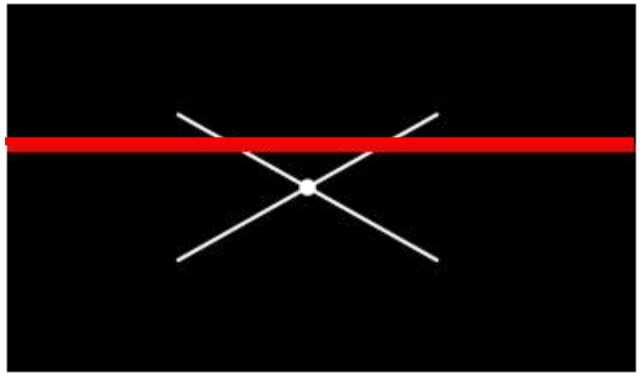




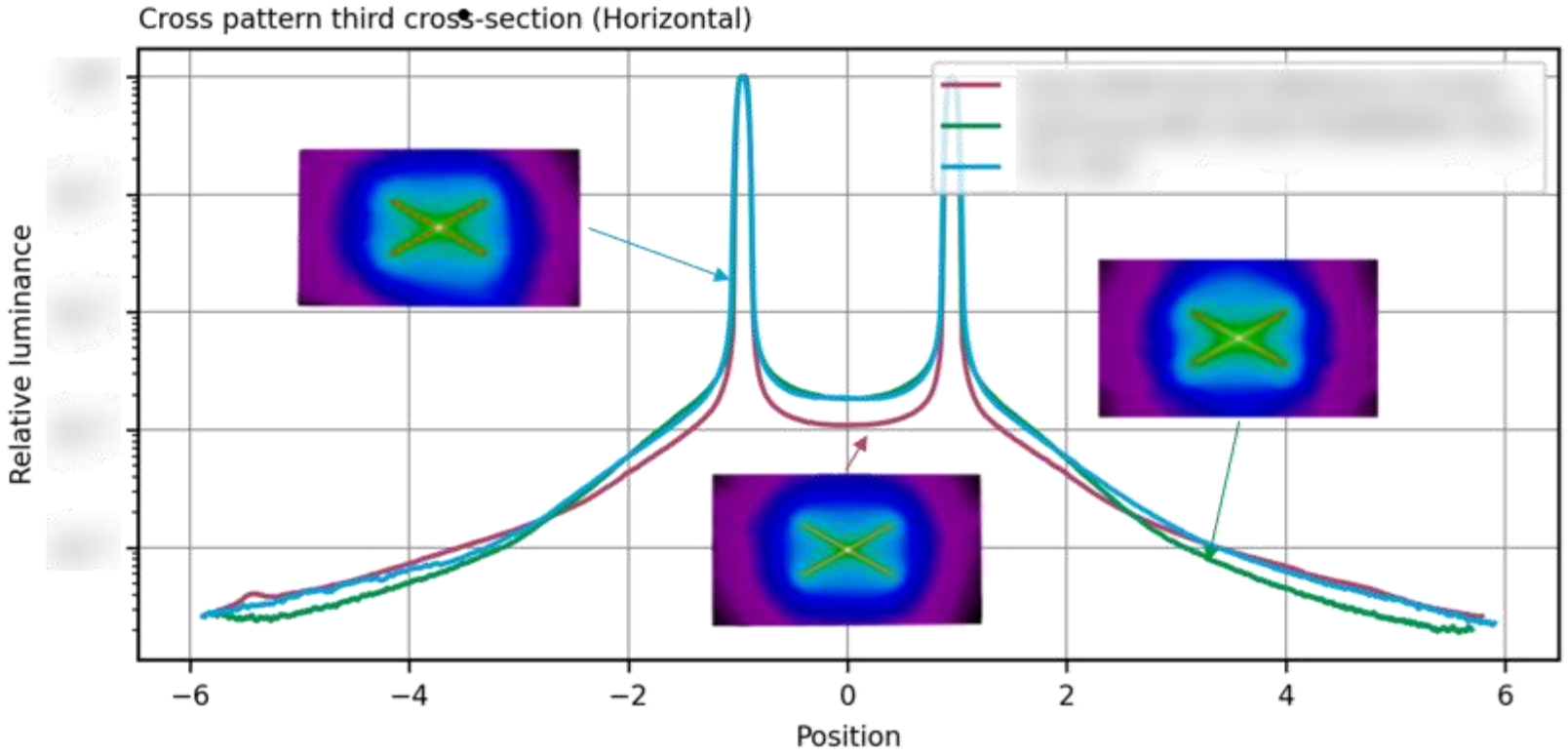


VIDEO CONTENT – HALO

- Refer to the horizontal cross-section below.
- [illegible]
- [illegible]



Horizontal cross-section
(red line)

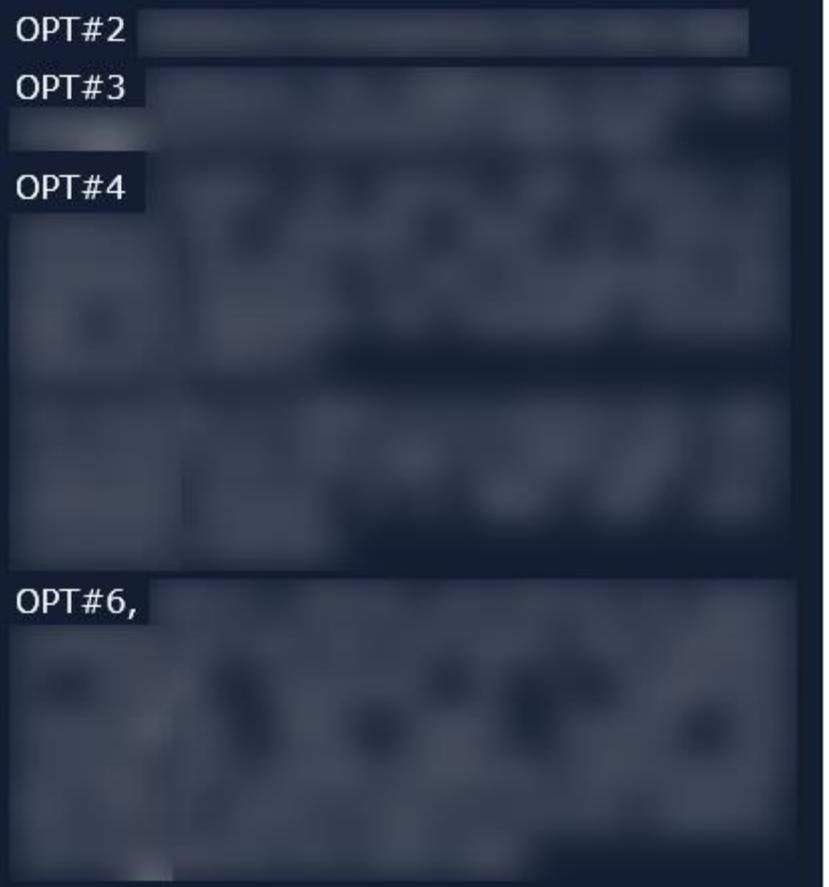


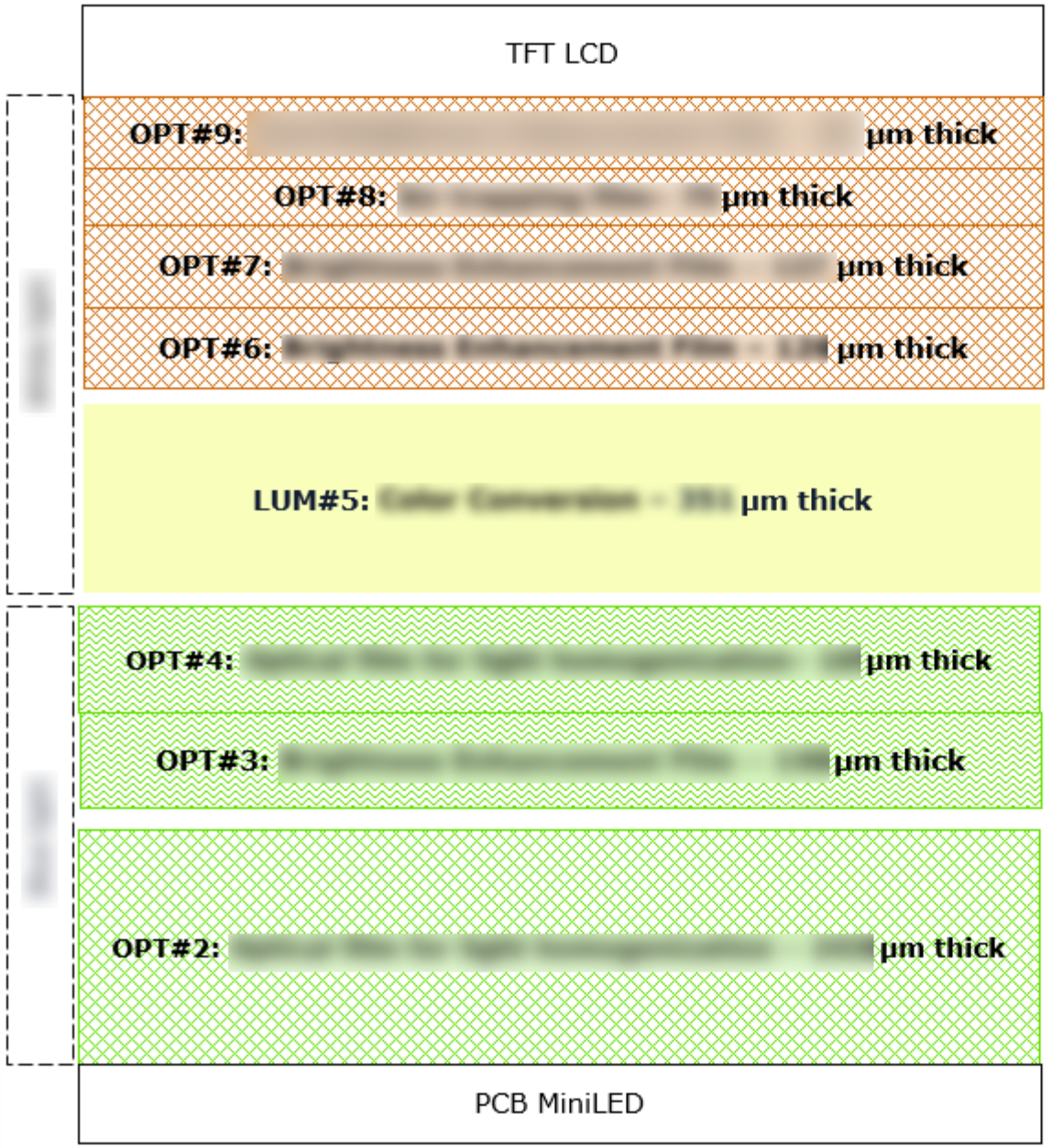
SUMMARY – OVERALL TAKEAWAYS

#	Subject	Detail
1	Brightness	
2	EOTF	
3	Uniformity	
4	Color	
5	Angular performance	
6	Halo	
7	Flicker	
8	Reflectance	

BLU – OPTICAL STACK

The PCB with MiniLEDs is covered with eight optical films.





Source: PISÉO

Microscopic profile views of optical films

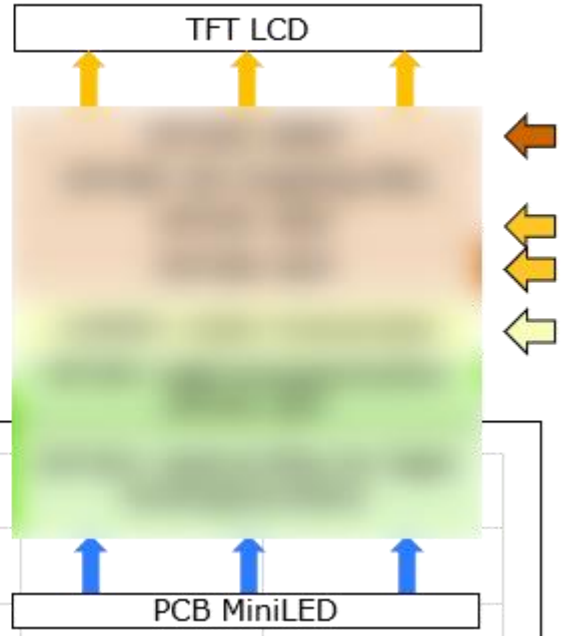
Source: PISÉO

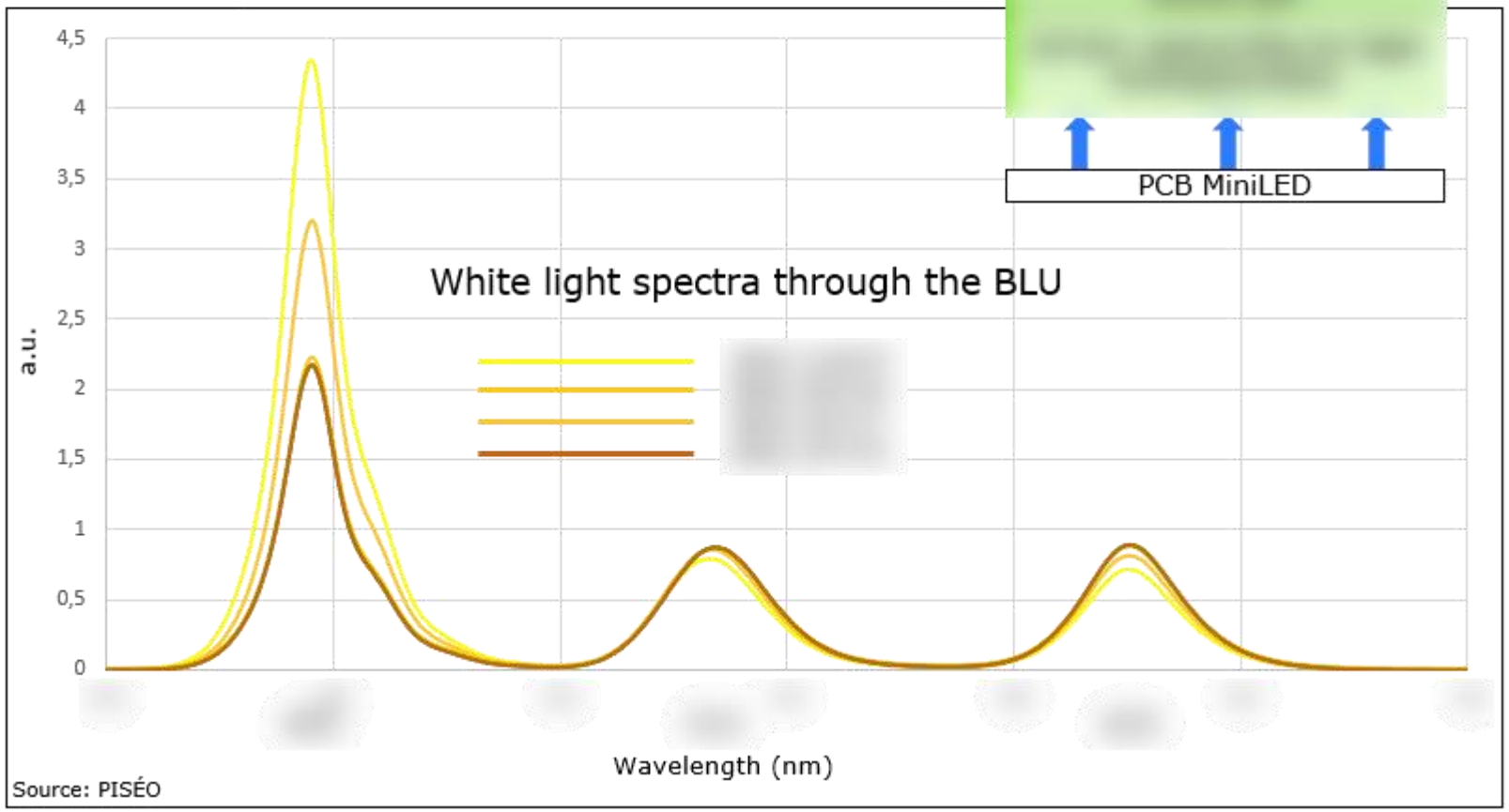
BLU – EMISSION SPECTRUM

The conversion efficiency is

Proportion of RGB components of the white light through BLU

	Blue light	Green light	Red light

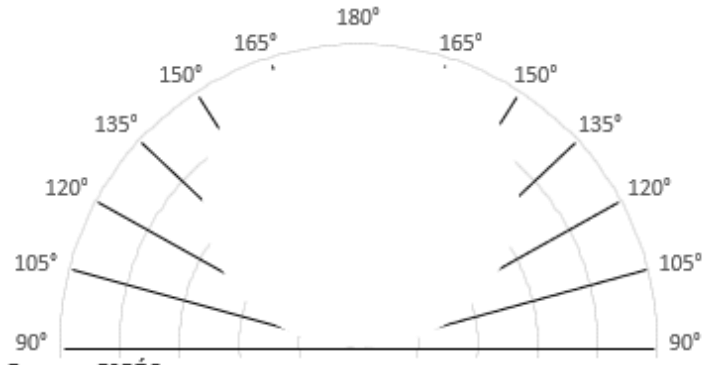




GONIOPHOTOMETRY

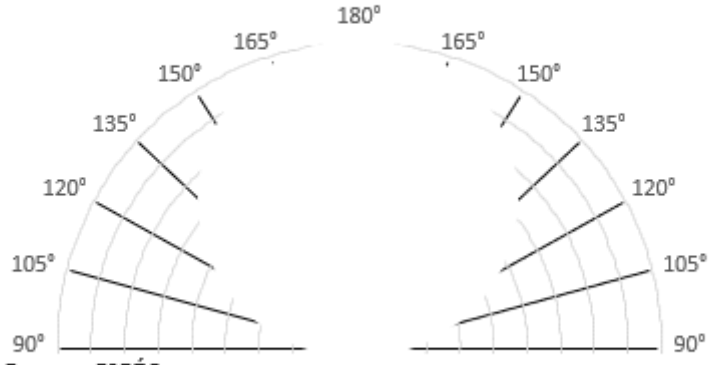
The intensity diagram in polar coordinates, measured using the goniophotometer, shows that the emission of light by the MiniLED is almost Lambertian.

MiniLED PCB and the stacking of optical films



Source: PISÉO

MiniLED PCB alone



Source: PISÉO

RELATED PRODUCTS

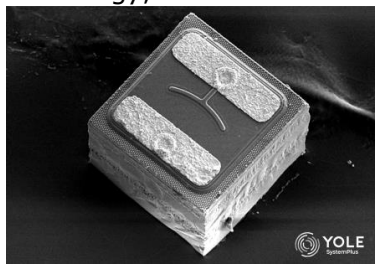
[Apple iPad Pro MiniLED 12.9”]
Visual performance & optical construction analysis

[Samsung TV NEO QLED 65QN900A]
Visual performance & optical construction analysis

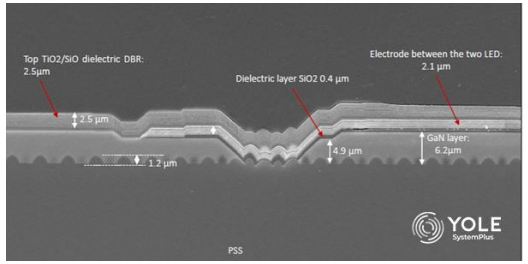
[TCL TV 85X925 Pro 85” MiniLED 8K]
Visual performance & optical construction analysis

[MiniLED 2022: LCD Backlights and Direct View LED Displays]
Market and Technology Trends

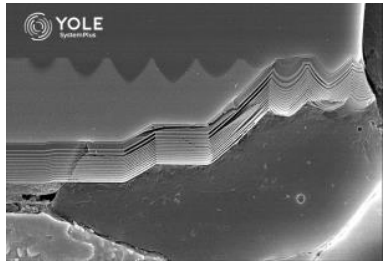
[MiniLED backlight in iPad Pro]
Technology, Process and Cost



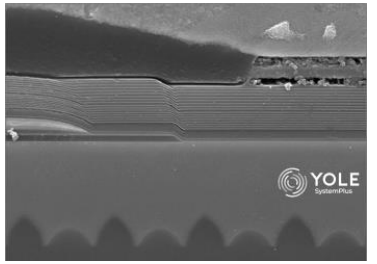
[MiniLED backlight unit in Odyssey Neo G9 49” Samsung Monitor]
Technology, Process and Cost



[TCL MiniLED X9 TV 85”]
Technology, Process and Cost



[MiniLED backlight unit in Samsung neo QLED TV]
Technology, Process and Cost

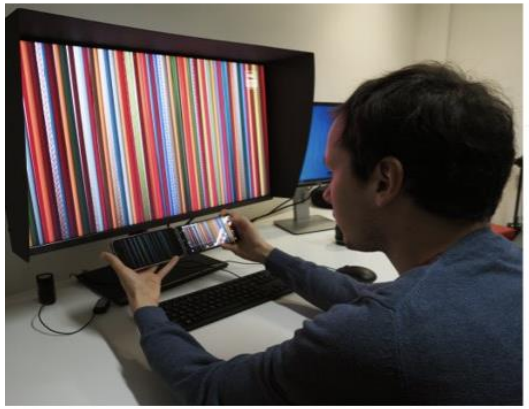


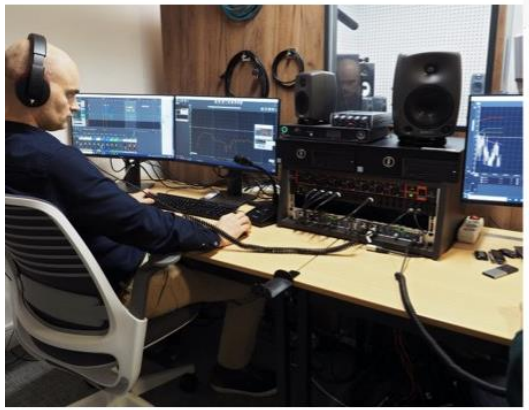
ABOUT DXOMARK

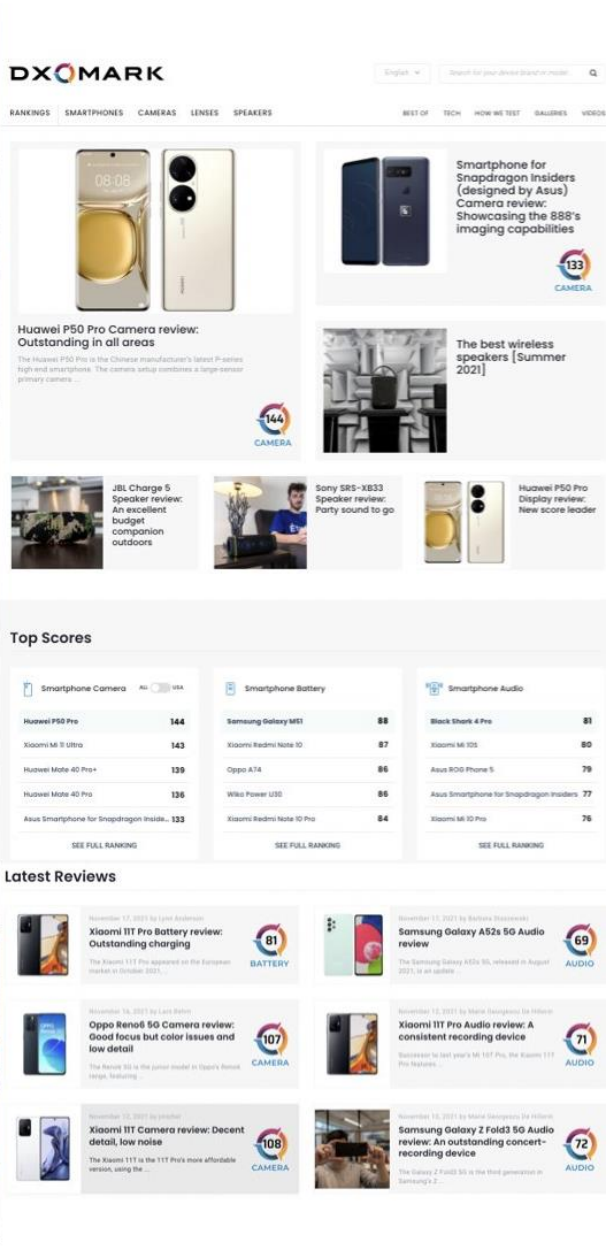
Independent French technology company with multiple laboratories

International leader in quality assessment of cameras, displays, audio, and batteries.

Editor of dxomark.com, an online quality benchmark database.



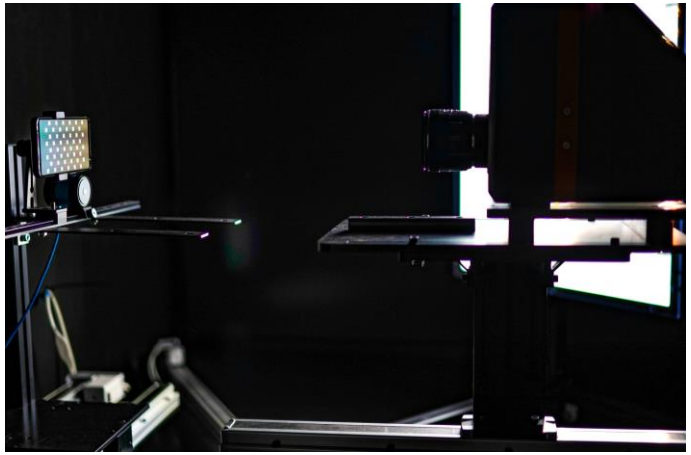




DXOMARK DISPLAY TESTING LAB – MAIN SETUPS

Video Analysis Kit

Use a representative set of SDR and HDR10 reference videos displayed on a professional monitor to perform video perceptual analysis.



Display Bench

Photometric measurements under controlled lighting that simulates real-life ambient light conditions, using an easily automated workflow.

Touch Bench

Measure touch interface performance (reaction time, smoothness, accuracy) in real-life scenarios, including browsing, zooming, and gaming.

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source: PISÉO, Olivier Ramonteu

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DESIGN AND INDUSTRIALIZATION OF INNOVATIVE SYSTEMS

TECHNOLOGICAL MARKETS, REGULATION WATCH

TRAINING

- **PUBLICATION OF TECHNICAL REPORTS**

COMPONENTS

SYSTEMS

source: PISÉO, Olivier Ramonteu

HEALTHCARE, ENVIRONMENT, LIGHTING, AUTOMOTIVE, AERONAUTICS, RAILWAYS, DEFENSE, TELECOM, PROCESSES…

MARKETS AND PRODUCT TYPES

PISÉO, IN BRIEF

- **10 years old**.
- **8 shareholders,** including Yole Développement, GIL-Syndicat du luminaire, Syndicat de l'éclairage, Serma Group, and Cluster Lumière.
- Electro-optical characterization **laboratory ISO 17025 accredited** by COFRAC (scope available on www.cofrac.fr).
- **150+ customers** (Start-ups, SMEs, large groups) in France and abroad.
- **17 employees** highly qualified from the industry.
- **5000+** tests carried out.
- **300+** customer projects successfully completed.
- Based in **Lyon**, France.

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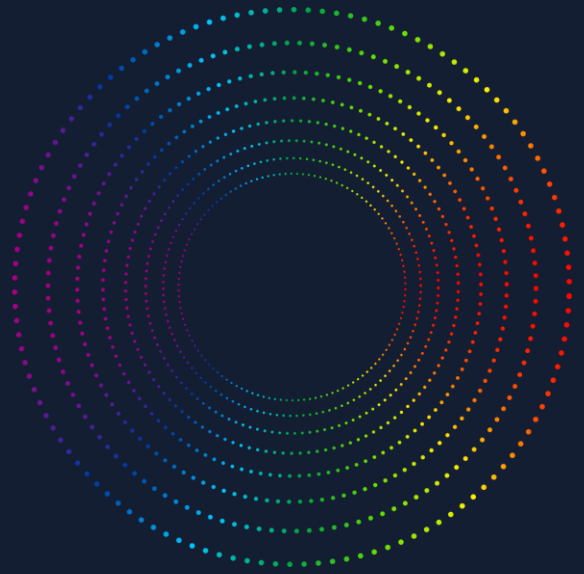

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