TÜVRheinland® Precisely Right. | eyesafe

The Future of Low Blue Light Displays

FEATURING

BOE AUO INNOLUX TCL 华星光电 CSOT wistron IVO

Email questions to: thefuture@eyesafe.com

eyesafe®

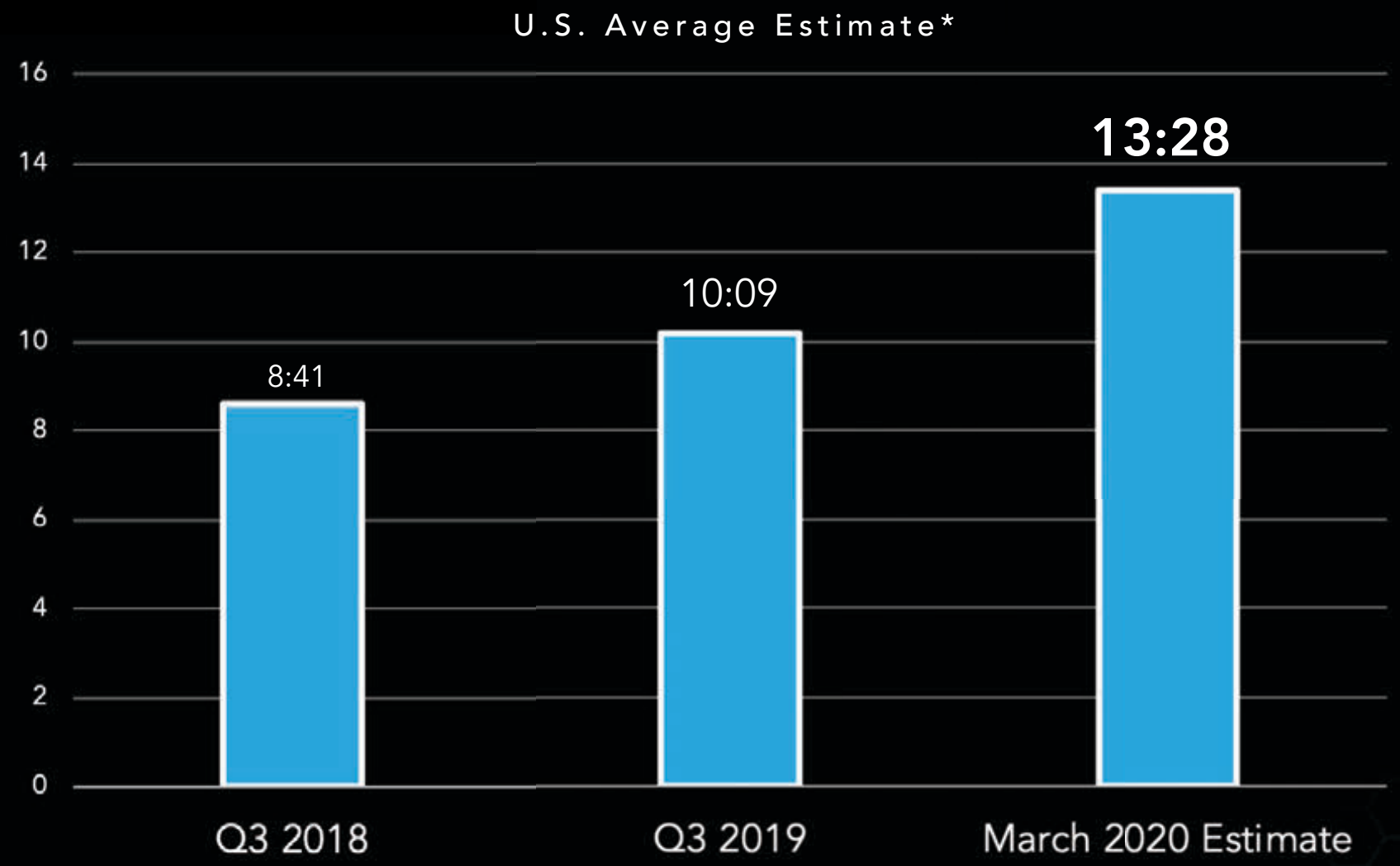
Welcome to the Future of Low Blue Light Displays

JUSTIN BARRETT

Eyesafe CEO

Email questions to: thefuture@eyesafe.com

Screen Time Per Day



** Eyesafe estimate based upon Nielsen Q3 2019 Total Audience Report and 60% increase in TV/Game Console media and 14% increase in mobile and work-related devices*

A Major Global Health Issue

59%

Report experiencing symptoms of digital eye strain*

2,065,000,000

Estimated globally impacted**

* *The Vision Council:* https://www.thevisioncouncil.org/content/digital-eye-strain
** *Statista:* https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

Adoption by the Market Leaders

60%+

Estimated
Market share

The Future of Low Blue Light Displays is Now

1. Based in human health and display performance
2. Made with world leaders in the display industry
3. Certified to consumer-friendly requirements

TÜVRheinland®
Precisely Right.

Next Generation Health Requirements and Certification

KALYAN VARMA

TÜV Rheinland Group
Vice President

Email questions to: thefuture@eyesafe.com

Our Mission

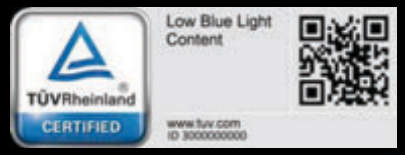
To develop health driven research and standards for certification of the healthiest displays in the world

Evolution to Eyesafe Display

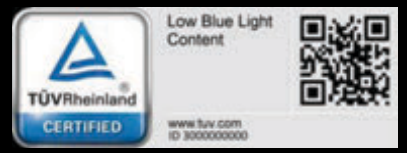
Health & Safety Parameters

Evolution of Low Blue Light

TUV Method 1
2014



TUV Method 2
2016



TUV Hardware & Software
2020

Eyesafe Display
2020

The Future of Low Blue Light

TÜV Rheinland Certification is now the largest low blue light certification program in the world

eyesafe®

Bringing Health Requirements to Electronics

DAVID FRIESS, OD, FAAO

Eyesafe Vision Health
Advisory Board

Email questions to: thefuture@eyesafe.com

Eyesafe Vision Health Advisory Board World Includes Leaders in Optometry and Ophthalmology

RALPH CHU, MD

H. BURKHARD DICK, MD, PHD

CHAD DOCKTER, OD

DAVID FRIESS, OD

GARY HEITING, OD

MITCHELL JACKSON, MD

PAUL KARPECKI, OD

RICHARD LINDSTROM, MD

SHERI ROWEN, MD

VANCE THOMPSON, MD

WILLIAM TRATTLER, MD

ROBERT WEINSTOCK, MD

VISION HEALTH ADVISORY BOARD

The distinguished ophthalmologists and optometrists who comprise the Eyesafe® Vision Health Advisory Board help guide research regarding the effects of blue light on the eyes and visual system and the development of Eyesafe® standards to protect public health.

Screen Time & Cumulative Blue Light Exposure is Impacting Global Health

- Dry, irritated eyes
- Impact to sleep and circadian rhythms
- Blurred vision
- Reduced attention span
- Irritability and difficulty concentrating

Key Guiding Health Research

Short Term Impact

- Digital Eye strain and Dry Eye
- Circadian rhythm and sleep disruption

Higher risk population

- Children and infants
- Population with preexisting conditions such as dry eyes.

"The absorption spectrum of the lens changes with age. In young children, more than 65% of blue light is transmitted to the retina. At around 25 years, only 20% of the light between 400 and 460 nm and 50% of wavelengths between 400 and 500 nm are transmitted"
Light-emitting diodes (LED) for domestic lighting: Any risks for the eye? F. Behar-Cohen, C. Martinsons, F. Viénot, G. Zissis, et al., *Progress in Retinal and Eye Research, 2011. 30(4): p. 239-257*

Key Guiding Health Research

Long Term Impact

- Cumulative impact
- In Vitro cell studies
- Generation of reactive oxidative species

*"light-induced retinal photoreceptor cell damage, the **viability of 661W** with different duration (1, 2, and 3 days) and luminance (100, 200, and 300 nits) of LCD exposure. [..] **Cell viability decreased significantly** on day 3 after exposure to **300 nits LCD**. No significant cell death was observed upon exposure to LCDs with lower luminance."*
Effects of the Emitted Light Spectrum of Liquid Crystal Displays on Light-Induced Retinal Photoreceptor Cell Damage. C.-W. Lin, C.-M. Yang and C.-H. Yang, *International journal of molecular sciences*, 2019. 20(9): p. 2318.

*"**long-term exposure** to blue light from portable devices emitting blue light from a short distance **may cause potential damage to ocular health,** especially in **high-risk populations, s**uch as people with DED, contact lens users, the malnourished and the elderly, due to **accumulated oxidative stress** that is a result of an imbalance between reactive oxidative species (ROS) generation and scavenging."*
Protective effects of blue light-blocking shades on phototoxicity in human ocular surface cells, Niwano et al. *BMJ Open Ophthalmology* 2019 ;4:e000217

*"**Blue light has cumulative damaging effects**, but the damage can be halted upon removal of this type of stress, provided that it does not accumulate beyond a certain irreversible threshold that causes death."*
Daily blue-light exposure shortens lifespan and causes brain neurodegeneration in Drosophila. T.R. Nash, et al., *npj Aging and Mechanisms of Disease*, 2019. 5(1): 8

Announcing Salus University Screen Time & Blue Light Consumption Research

SALUS UNIVERSITY | eyesafe®

LOUPVENTURES

Predictions for the Future of the Display Industry

GENE MUNSTER

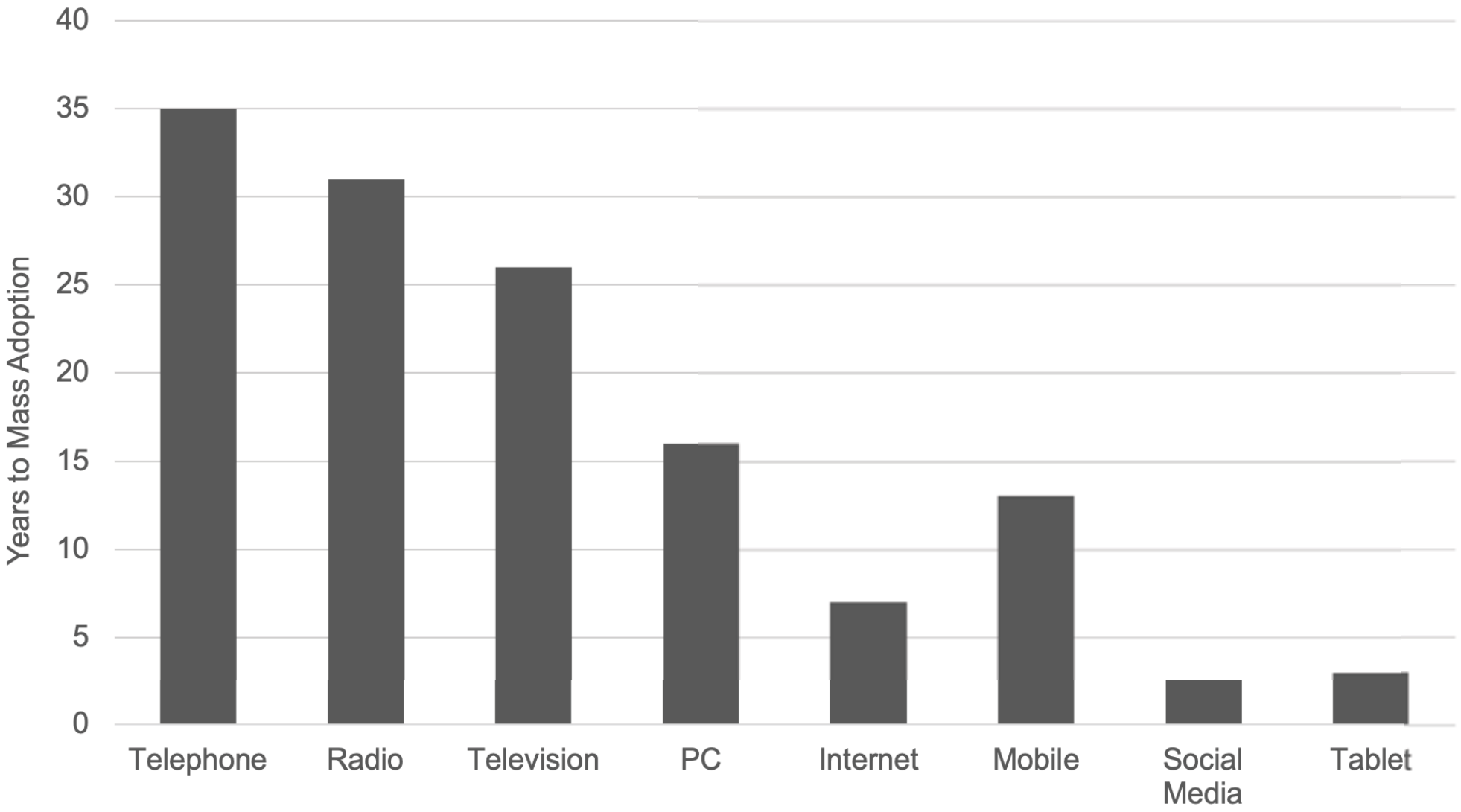
Loup Ventures

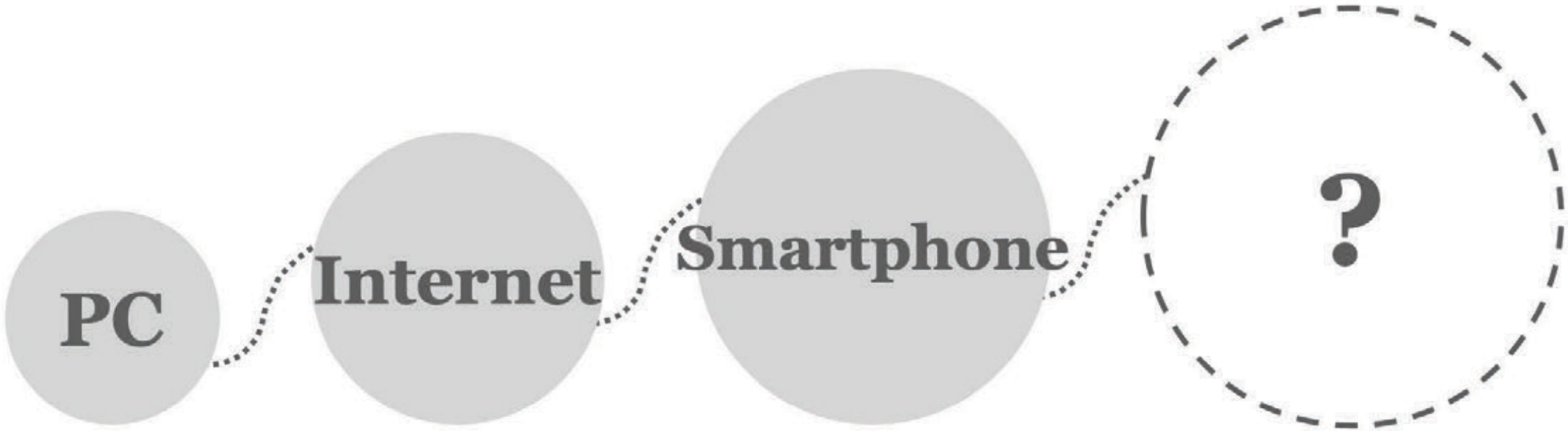
Email questions to: thefuture@eyesafe.com

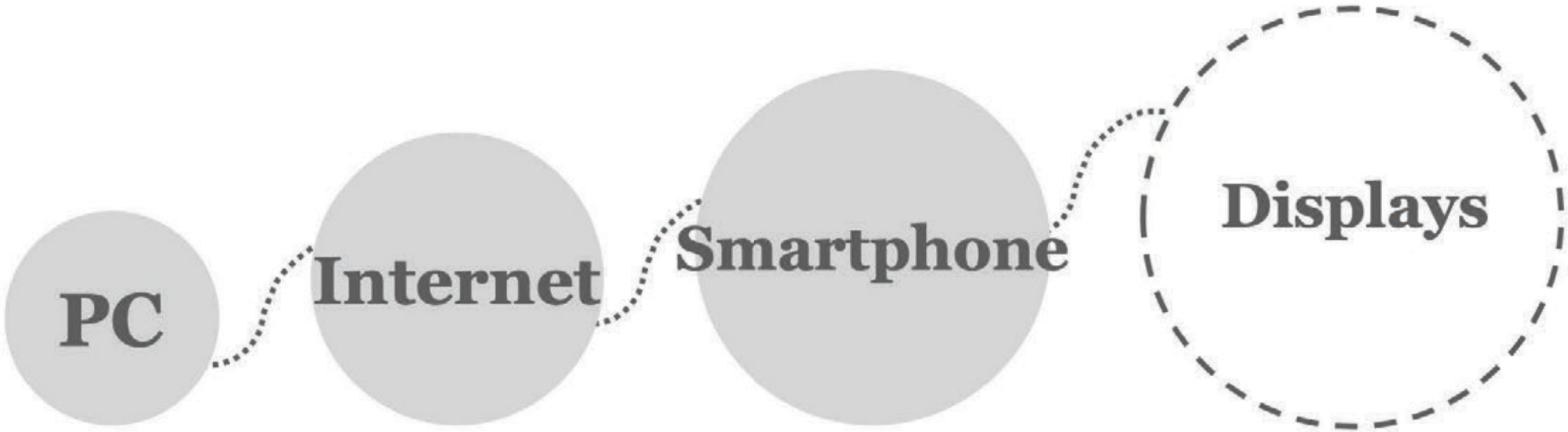
LOUPVENTURES

The pace of tech is accelerating.

The Pace of Tech is Accelerating




PC
Internet
Smartphone
?


PC
Internet
Smartphone
Displays


P
192 mi
OPEN
OPEN
Navigate
Redondo Beach Rd
Thane Ave
Half Moon Bay, CA
88.5
KQED Public Radio
KQED FM
70°
70°
MANUAL


HIGH SCORES


JUL
2030

Display Install Base
in millions

	2020	2030
Smartphone	3500	5000
Computer	2000	2000
Tablets	1500	2000
Smartwatch	125	1000
VR Headset	10	500
AR Glasses	0	750
Car	5	250
Smart Home	2	50
Total	7142	11550
Growth		**62%**

Source: Loup Ventures

1.3B

1 inch of the eye

Consumer Friendly Safe Display Standard

TÜVRheinland®
Precisely Right.

TÜV Rheinland & Eyesafe Standard Certification Announcements

STANLEY LIU

TÜV Rheinland Group
Technical Competence Center Director

Email questions to: thefuture@eyesafe.com

The New Industry Mark and Requirements

	Items	Requirements
 High-Energy Blue Light	Blue light emission in the 415 to 455nm toxic region	The ratio of light in the range from 415-455nm compared to 400-500nm must be less than 50%
	Weighted blue light toxicity emissions based on ICNIRP Guidelines	The Blue light toxicity of weighted blue light vs total lux must be less than 0.085
 Maximum Energy	Photobiological Safety requirement based on IEC/EN 62471	The blue light emission of the product must meet exempt group limits (Must be lower than 100 W.m-2.str-1)
 Color Performance	Color Gamut Coverage %	For product with sRGB color mode: ≥95% of standard sRGB color space in CIE 1931; For product with Adobe RGB color mode: ≥90% of standard Adobe RGB color space in CIE 1931; For product with DCI-P3 color mode: ≥90% of standard DCI-P3 color space in CIE 1931; For product with NTSC color mode: ≥72% of standard NTSC color space in CIE 1931
	Color Temperature	The Correlated Color Temperature (CCT) shall be within the range of 5500K and 7000K

Developed with world leaders in healthcare to signify achievement of industry leading health and safety requirements. Certification allows access to the TUV Eyesafe Display mark:

TÜVRheinland® CERTIFIED

eyesafe DISPLAY

LOW BLUE LIGHT COLOR ACCURATE

eyesafe

Eyesafe Display Certificate (example)


Zertifikat Certificate

TÜV Low Blue Light Certificate


CERTIFICATE of Conformity

Registration No.: AK 50467317 0001

Report No.: 60389936 001

Holder: BOE Technology Group Co., Ltd. No.12 Xihuan Middle Road, Yizhuang Economic and Technological Development Zone, 100176 Beijing P.R. China

Product:

Identification:

Tested acc. to:

TÜV Rheinland LGA Products GmbH · Tillystraße 2 · 90431 Nürnberg

Appendix No.: 1.0

TÜV Eyesafe Display Certificate


Certificate of Achievement

BOE | eyesafe

This acknowledges that BOE has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

THE FOLLOWING PRODUCTS ARE EYESAFE CERTIFIED:

NE140FHM-N46 EYESAFE NOTEBOOK	14"	MV240WUM-N51 EYESAFE MONITOR	24"
MV215FHM-N71 EYESAFE MONITOR	21.5"	MV270FHM-N41 EYESAFE MONITOR	27"
MV230FHM-N41 EYESAFE MONITOR	23"	MV270QHM-N61 EYESAFE MONITOR	27"
MV238QHM-N12 EYESAFE MONITOR	23.8"		

CERTIFICATE # ES0519017

May 19, 2020

MONTH, DAY, YEAR

SIGNED

JUSTIN BARRETT, CEO, Eyesafe

Eyesafe Certificate of Achievement

eyesafe TÜVRheinland® Precisely Right.

BOE | eyesafe®

Yanbing Wu

VGM, MNT SBU

Email questions to: thefuture@eyesafe.com

Introducing BOE Innovation

BOE EYESAFE MONITOR

TÜVRheinland®
CERTIFIED

eyesafe
DISPLAY
LOW BLUE LIGHT
COLOR ACCURATE

BOE has achieved Eyesafe Display certification by meeting the industry leading requirements for low blue light and high color performance

BOE Eyesafe Panels Available in 2020

BOE has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

BOE Eyesafe Certified Model	Size	Format	Availability
NE140FHM-N46	14"	Eyesafe Notebook	2021, Q1
MV215FHM-N71	21.5"	Eyesafe Monitor	2020, Q3
MV230FHM-N41	23"	Eyesafe Monitor	2020, Q3
MV238QHM-N12	23.8"	Eyesafe Monitor	2020, Q3
MV240WUM-N51	24"	Eyesafe Monitor	2020, Q3
MV270FHM-N41	27"	Eyesafe Monitor	2020, Q3
MV270QHM-N61	27"	Eyesafe Monitor	2020, Q3

> More at eyesafe.com/boe

TCL 华星光电 CSOT | eyesafe®

Jeffrey Li

VGM, TCL CSOT(Wuhan)

Email questions to: thefuture@eyesafe.com

TCL 华星光电 CSOT | eyesafe®

Mingjong Jou

Director, CID TCL CSOT

Email questions to: thefuture@eyesafe.com

TCL CSOT Innovation

TCL CSOT EYESAFE
MONITOR

TCL CSOT EYESAFE
TABLET

TCL CSOT EYESAFE
NOTEBOOK

TÜVRheinland®
CERTIFIED

eyesafe
DISPLAY
LOW BLUE LIGHT
COLOR ACCURATE

TCL CSOT has achieved Eyesafe Display certification by meeting the industry leading requirements for low blue light and high color performance

TCL CSOT Panels Available in 2020

TCL CSOT has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

TCL CSOT Eyesafe Certified Model	Size	Format	Availability
CSOT 10.X WQXGA	11”	Eyesafe Tablet	2020
CSOT 14.0 UHD	14”	Eyesafe Notebook	2020
MG2701B01	27”	Eyesafe Monitor	2020

> More at eyesafe.com/csot

INNOLUX | eyesafe

P.H. Wu

ITI General Director, Innolux

Email questions to: thefuture@eyesafe.com

Innolux Innovation

INNOLUX EYESAFE MONITOR

TÜVRheinland®
CERTIFIED

eyesafe
DISPLAY
LOW BLUE LIGHT
COLOR ACCURATE

Innolux has achieved Eyesafe Display certification by meeting the industry leading requirements for low blue light and high color performance

Innolux Panels Available in 2020

Innolux has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

Innolux Eyesafe Certified Model	Size	Format	Availability
M238HCA-L5Z	23.8”	Eyesafe Monitor	2020, Q2

> More at eyesafe.com/innolux

IVO | eyesafe

June Qiu

Director, IT Business Unit

Email questions to: thefuture@eyesafe.com

IVO Innovation

IVO EYESAFE NOTEBOOK

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CERTIFIED

eyesafe
DISPLAY
LOW BLUE LIGHT
COLOR ACCURATE

IVO has achieved Eyesafe Display certification by meeting the industry leading requirements for low blue light and high color performance

IVO Eyesafe Panels Available in 2020

IVO has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

IVO Eyesafe Certified Model	Size	Format	Availability
M140NWHE R0	14”	Eyesafe Notebook	2020, Q3

> More at eyesafe.com/ivo

wistron | eyesafe

Tony LT Chen

Deputy GM, Wistron Display BU

Email questions to: thefuture@eyesafe.com

Wistron is Proud to Announce

WISTRON EYESAFE MONITOR

TÜVRheinland®
CERTIFIED

eyesafe
DISPLAY
LOW BLUE LIGHT
COLOR ACCURATE

Wistron has achieved Eyesafe certification by meeting the industry leading requirements for low blue light and high color performance

Wistron Eyesafe Panels Available in 2020

Wistron has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

Wistron Eyesafe Certified Model	Size	Format	Availability
W238HIAP1-LWD02	23.8"	Eyesafe Monitor	2020, Q2
W238HBAP1-PWD03	23.8”	Eyesafe Monitor	2020, Q2

> More at eyesafe.com/wistron

AUO | eyesafe

Email questions to: thefuture@eyesafe.com

M270DAN07.1

QHD / sRGB / Bezel-less

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CERTIFIED

eyesafe
DISPLAY
LOW BLUE LIGHT
COLOR ACCURATE

AUO has achieved Eyesafe Display certification by meeting the industry leading requirements for low blue light and high color performance

AUO Panels Available in 2020

AUO has successfully achieved Eyesafe Display Certification by meeting the industry leading low blue light and high color performance requirements.

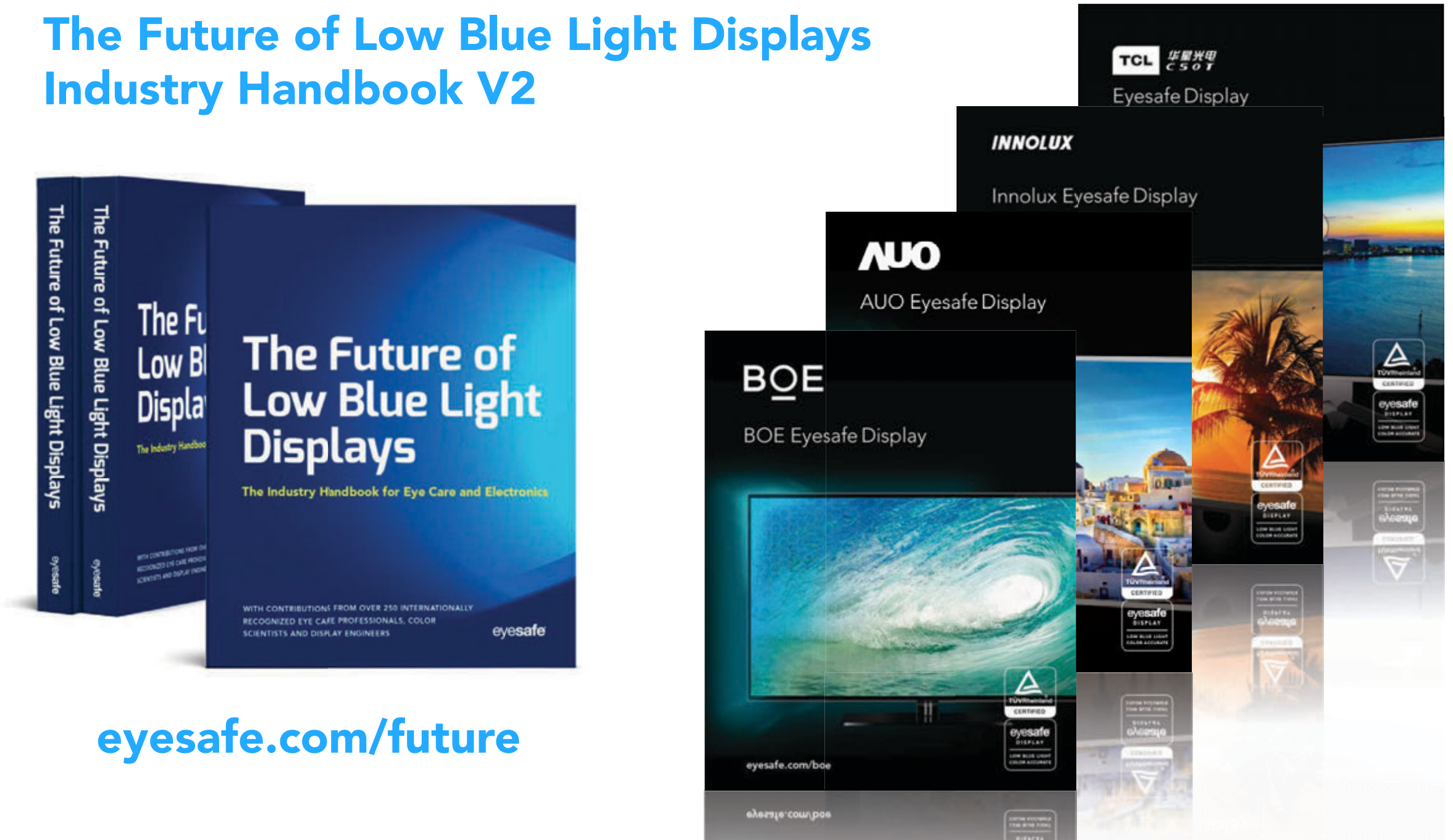
AUO Eyesafe Certified Model	Size	Format	Availability
M270DAN07.1	27.0”	Eyesafe Monitor	2020, Q2

> More at eyesafe.com/auo

Eyesafe Display Certified Panels

Customer	Panel type			Model Information		
	Monitor	Laptop	Tablet	Model #	Size (in Inch)	Resolution
BOE	X			MV215FHM-N71	21.5"	1920 x 1080
	X			MV230FHM-N41	23"	1920 x 1080
	X			MV238QHM-N12	23.8"	2560 x 1440
	X			MV240WUM-N51	24"	1920 x 1200
	X			MV270FHM-N41	27"	1920 x 1080
	X			MV270QHM-N61	27"	2560 x 1440
		X		NE140FHM-N46	14"	1920 x 1080
TCL CSOT	X			MG2701B01-X	27"	1920 x 1080
			X	CSOT 10.X WQXGA Tablet	11"	2560 x 1600
		X		CSOT 14.0 UHD Notebook	14"	3840 x 2160
Wistron	X			W238HIAP1-LWD02	23.8"	1920 x 1080
	X			W238HBAP1-PWD03	23.8"	1920 x 1080
Innolux	X			M238HCA-L5Z	23.8”	1920 x 1080
AUO	X			M270DAN07.1	27.0"	1920 x 1080
IVO		X		M140NWHE R0	14.0"	2240 x 1400

The Future of Low Blue Light Displays Industry Handbook V2



eyesafe.com/future

eyesafe®

Requirements Roadmap

Amir Soleimanpour, PhD

Director of Research

Email questions to: thefuture@eyesafe.com

Requirement Roadmap

What's the Driving Force?

- Research, www.eyesafe.com/Research
- High device use - Average user spend more than 13 hours looking at screens.
- Display technology: LCD, OLED (High peak in blue light region)
- Popularity of using bright displays in smartphone, TV and VR

Eyesafe Display Requirement

- High Energy Blue light
- Maximum Energy
- Color Performance

What's next?

- Higher risk population
- Cumulative exposure impact
  - Short term exposure: Sleep disruption, Digital eye strain
  - Long term exposure: In vitro cell studies, Generation of reactive oxidative species

What's Next?

Eyesafe Display

Eyesafe Display Requirement

- High Energy Blue light
- Maximum Energy
- Color Performance

Next considerations

- Cumulative Exposure Limit
- Age Based Recommendations

Eyesafe Display

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Blue light Committee

Blue Light Committee

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Purpose:

Joint Standard Development

Members:

- Industry Partners
- Health Vision Advisory Board

Timeframe:

Second Half of 2020

Invitation will be sent in July 2020

eyesafe®

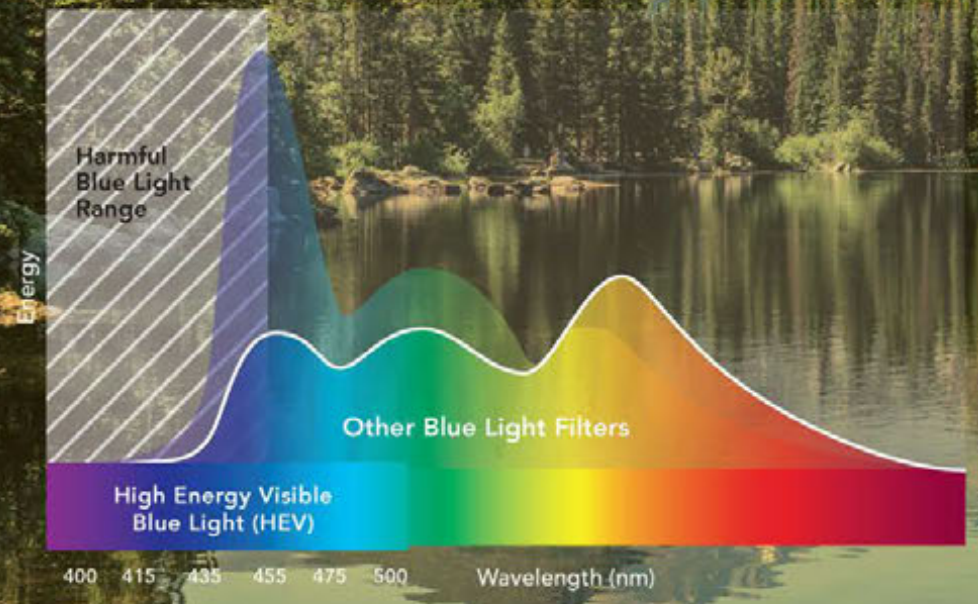
Display Solutions

Derek Harris, PhD

VP Research & Development

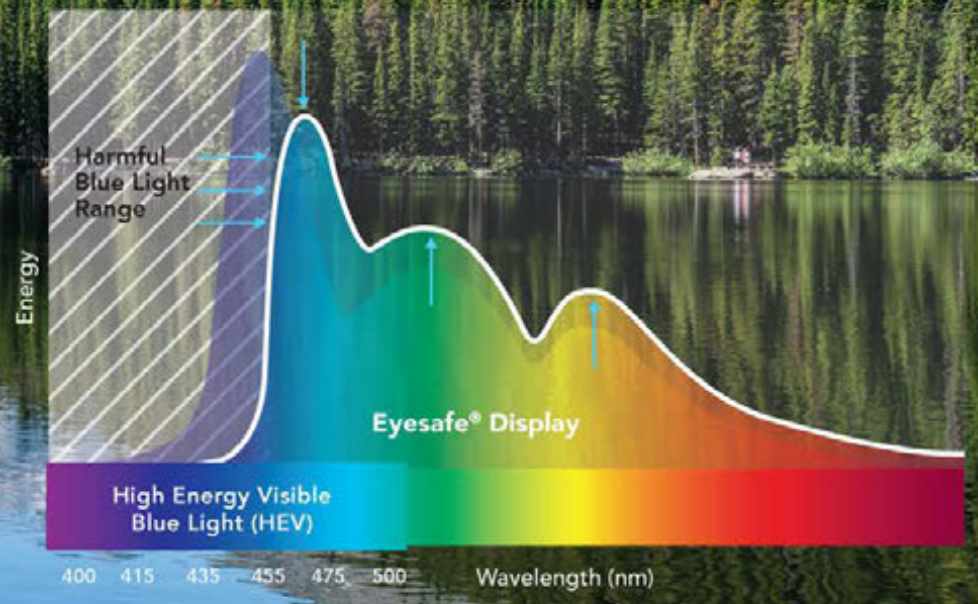
Email questions to: thefuture@eyesafe.com

OTHER BLUE LIGHT FILTERS



Others adjust the blue light by shifting color to warmer hues which impacts color

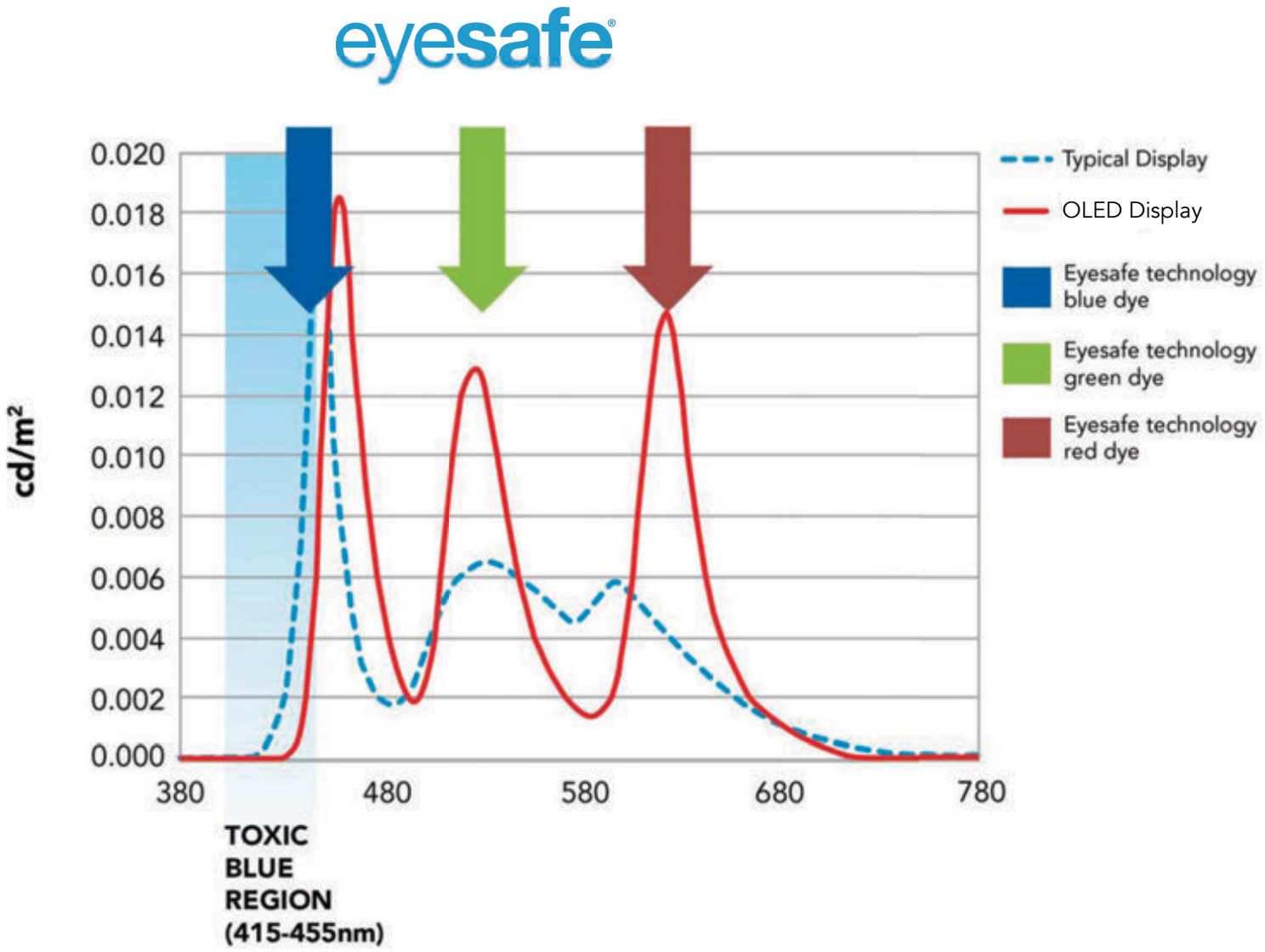
EYESAFE® DISPLAY



Eyesafe® Display redesigns light emission and the color filter for beautiful color with less blue light

Eyesafe Surgically Manages Blue Light While Maintaining Color Performance

- Eyesafe dyes provide best-in-class blue light management while maintaining color performance
- Targeted filtration focused in the most toxic blue light range
- Achieves Eyesafe® Standard requirements



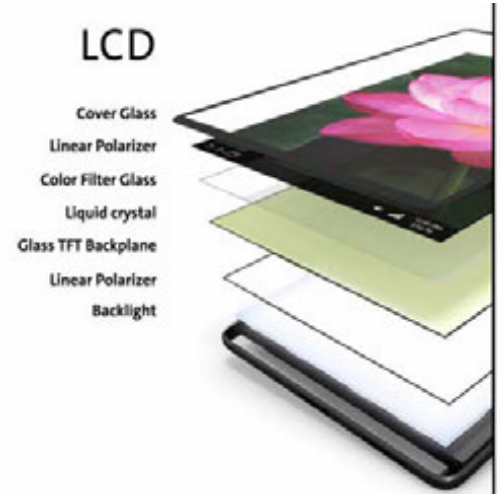
Eyesafe Display OLED and LCD Solutions

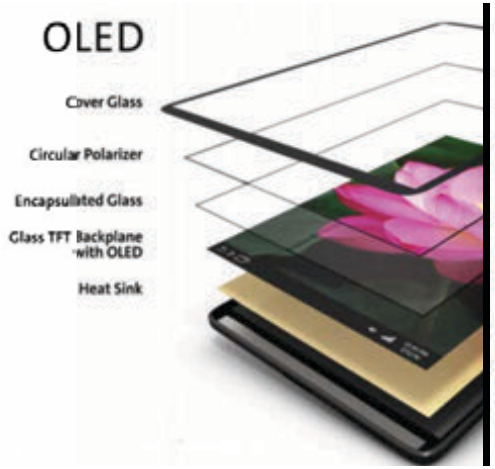
Eyesafe materials science, formulation capabilities and display expertise are applied to develop high value solutions across the consumer electronics market -

Eyesafe materials provide flexibility in design applications:

- Coated films for screen protection
- Optically clear adhesives for screen protection
- Coated films and OCA for display
- LED packaging materials

eyesafe





Screen Protection

eyesafe®

Programs and Next Steps

Paul Herro

COO

Email questions to: thefuture@eyesafe.com

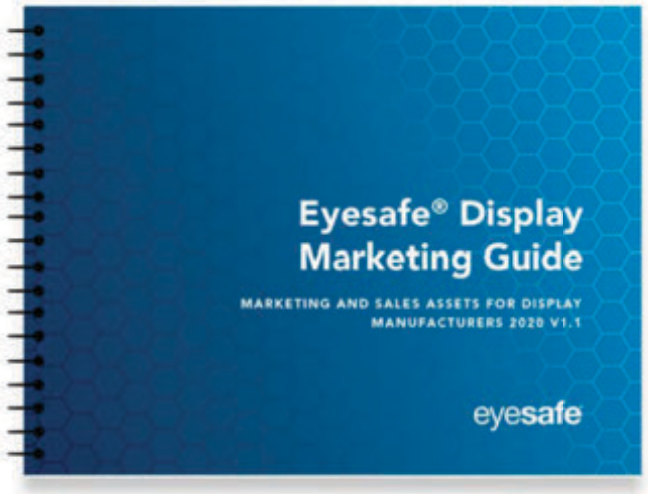
New Industry Leading Eyesafe Display Certification

- Announcing new industry mark representing health and safety for manufacturers
- Representing efficacy in protection from blue light and color quality and achievement of Eyesafe health requirements
- TUV Rheinland is certifying brands Eyesafe Display requirements beginning June 1, 2020

Eyesafe Promotion Tools for Panel Makers and Brands

Certification Mark

- Use of The TÜV Rheinland Eyesafe Certification Mark in marketing and packaging
- Premium industry mark for low blue light management



Marketing, PR & Sales Tools

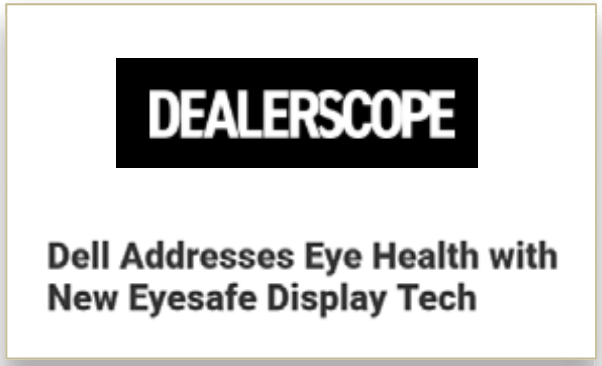
- Access to Eyesafe Low Blue Light Marketing Guide
- Involvement with 2020 Blue Light Industry Handbook
- Involvement with major press and public relations announcements

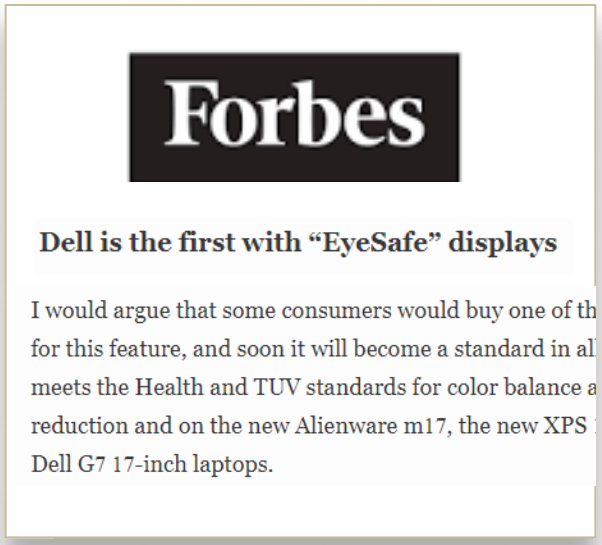
Display Branding

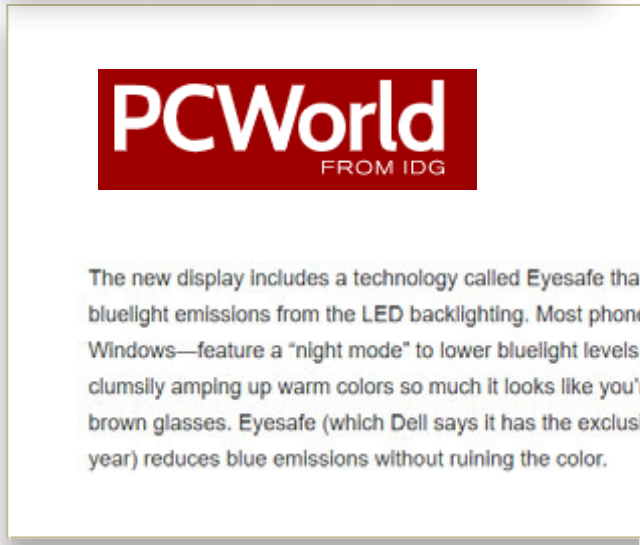
- Ability to identify as Eyesafe-certified to the industry
- Ability to brand panels as Eyesafe and sell to Eyesafe brand customers
- Example: “Dell Eyesafe® Display”

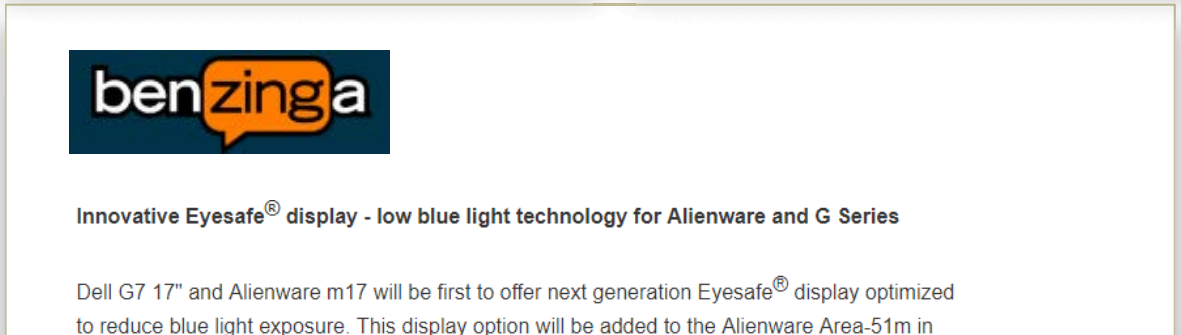
Example Dell Eyesafe Media Coverage Computex 2019

- *64+ earned media placements reaching over 1 Billion media impressions*
- *148 newswire syndication placements reaching over 57 Million impressions*









“I would argue that some consumers would buy one of these Dell laptops just for Eyesafe, and soon it will become a standard in all laptops.”

- Patrick Moorhead, Forbes, June 6, 2019

Eyesafe Programs – Enabling “Health-first” Products

	A	B	C
	Eyesafe Certification + Business & Technology Program	**Eyesafe Certification + Business Program**	**Eyesafe Certification**
Eyesafe Certification	✓	✓	✓
Eyesafe Brand License	✓	✓	✓
Access to Eyesafe Accessory Products	✓	✓	✓
Eyesafe Marketing Program Inclusion	✓	✓	
Custom Strategic Marketing and Business Development Fund	✓	✓	
Eyesafe Display Technology	✓		

The Future of Low Blue Light Displays is Now

Next Steps

1. New Eyesafe innovative panels are ready for commercialization
2. TÜV Rheinland Eyesafe Display certification
3. Eyesafe program implementation

Contact

Paul Herro, Eyesafe: paul@eyesafe.com
Stanley Liu, TUV: stanley.liu@tuv.com

Email questions to: thefuture@eyesafe.com

Thank You!

Gene Munster
Kalyan Varma
Stanley Liu
Dr. David Friess
Herve Gindre
Paul Herro
Amir Soleimanpour
Derek Harris
Arick Wierson
Donnie Oliphant
Tom C. C. Shen

Yanbing Wu
Jeffrey Li
Mingjong Jou
P.H. Wu
June Qiu
Tony LT Chen
Wu Yanbing
Jeff Lin
Li Dongsheng
Frank Azor
Derek W. W. Hsu

Tao Yuan
James Yang
Sally Chang
Eunice Wu
Jing Liao
Roy Chen
Jarree Jiang
Kari Finkler
Roland LeBreton
Sam Wu
Jacky C.W. Chen

Cindy Chen
Christine Huang
Jupiter Huang
Ron Huang
SoHoon Han
JeeWoong Moon
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