DES5-1
Invited

Recent Standardization Activities for Electronic Displays in IEC TC 110 - Following Technology Development -

Kei Hyodo[1], Yoshi Shibahara[2], Shin Uehara[3]

Kei.Hyodo@yuasa-system.jp
[1]Yuasa System Co. Ltd., 2292-1 Kibitsu, Kita-ku, Okayama-shi, Okayama, Japan
[2]FUJIFILM Holdings Corporation, 210, Nakanuma, Minamiashigara-shi, Kanagawa, Japan
[3]AGC Inc., 1-5-1 Marunouchi Chiyoda-ku, Tokyo, 100-8405, Japan
Keywords: Standardization, New Display Technologies, New Display Applications.

ABSTRACT

Thanks to the lots of technical development in electronic display field. There are lots of new technologies are available in that field. In addition to those new technologies, thanks to those new technologies, electronic displays are applied for new applications that was impossible unless there are those new technologies. For example, HMD (Head Mounted Displays) were impossible to be realized without having very small displays with very high pixel resolution. While technology development is important, at same time, how to clearly expose benefits by using those new technologies are important, too. Without having proper way(s) of measurement and evaluation, it is hard for us to properly value those new technologies. From that sense, the importance of having standard measurement and evaluation methods is getting bigger and bigger while display technologies are evolving faster and faster.

1 Introduction

IEC, International Electrotechnical Commissions, is the international organization to develop technical standards for electronic technologies. It has many Technical Committees (TCs). Among those TCs, one TC, which is TC 110, Electronic Displays, is working in the field of electronic displays to develop proper standards, which is called International Standards (ISes), to set proper measurement and evaluation of electronic displays. Since speed of technology development of electronic displays is very high, we, IEC TC 110 are working hard to catch up that. In addition to that, since applications of electronic displays are expanding widely and rapidly, we are following that trend, too. Through this paper, we, IEC TC 110, would like to explore our activities of standardization efforts for electronic displays' measurement and evaluation to guide said evolutions of electronic displays.

2 Our Approaches

2.1 Wider Applications for Electronic Displays

Recent developments of electronic displays expand the applications of electronic displays very rapidly and widely, such as a wristwatch, big wall displays, and HMD (Head Mounted Displays). Also, electrification of automobiles and autonomous driving explore new possibilities of utilizations of electronic displays. Not only those, but thanks to hard work of display engineers, new form factors of electronic displays allow new applications utilizing new characteristics, such as flexibility of mechanical shape change, such as 'foldable', 'rollable', and arbitrary shape displays. And, thanks to further development of display technologies, such as 'micro' LED and 'large' LED panel, those allow us to apply LED displays from very small, micro displays, to very large wall size displays.

2.2 Requirement of New Measuring and Evaluation Methods

Along those new developments, to realize those new technologies, it is important to have proper ways of measuring and evaluating those new technologies. If there is no proper way of measuring and evaluating those technologies, it is hard for us to properly compare those technologies against the conventional displays. Often, development starts without having proper way of evaluations. That may introduce difficulties of realizing a unique characteristic of a new technology. Especially a standard way of evaluating a new technology is very import to have common understanding of importance of that new technology. We, IEC TC 110, realize that importance and work closely with industrial leads to have proper International Standards to realize new technology properly.

2.3 Common Measurement and Evaluation Methods

As stated in section 2.2, we realized importance of having 'standard' measurement and evaluation method, while technologies are evolving rapidly. There, we came up with having 'common' measurement and evaluation methods among display technologies. Before having those methods, we had standards based upon technologies, such as for LCD and OLED. Because the complexity of display technologies increased rapidly, if we continue having technology-based standards, it is

obvious that we could not handle increasing numbers of standards. Therefore, we started our effort to make 'common' standards that could apply for several technologies. Since the main objective of display is going to show images, it is important to have 'common' optical measurements and evaluation methods. Table 1 shows our structure of our working groups (WGs) reflecting the said consideration. Table 2 shows examples of common optical measurement methods. Those are applicable for varieties of displays, depending upon the scopes (the scope mentions what area that standard covers) of those standards. For example, IEC TR 62977-1-31 covers the technical information about light measuring devices that is used to measure optical characteristics of displays. When we measure and evaluate a display, if we don't use a proper measuring device in the proper way, we could not obtain proper measured result. If we don't have proper measured result, it is hard for us to evaluate that display properly. From that sense, this kind of fundamental information about measurement and evaluation is the one of the biggest key factors of measuring and evaluating a display. Therefore, we, IEC TC 110, put lots of effort to have proper fundamental standards to have proper fundamentals.

2.4 New Applications

As stated in section 2.1, we are using displays for many applications that were impossible until recently. To cover that trend, we, IEC TC 110, newly established PT 63340 (SPA) in Table 1 started studying how IEC TC 110 develops standards for those new applications. Table 3 shows examples of what SPA is developing. Since new application may or may not need to have new measuring and/or evaluation method, we are studying that, and developing technical report (TR) first for those new applications. Once we set a proper direction to have a proper standard to cover a new application, we will start our development of having a new standard to cover that new application.

2.5 New Form Factors

As stated in section 2.1, thanks to huge efforts by display engineers, we could have displays in new form factors, such as foldable and rollable displays. Those displays are not only mechanically flexible to change their mechanical form, but also those displays show images in 'non-planer' form. As shown in Table 1, WG 8 works developing standards to cover flexible displays. Table 4 shows published standards from WG 8 to cover flexible displays, and Table 5 shows currently developing standards. As shown in those tables, WG 8 covers many flexible characteristics that is needed to cover evolving flexible displays to have new form factor, such as a foldable cell phone. In addition to that, from optical measuring standing point of view, since there were no such displays until recently, there is no need to have any standards to cover 'non-planer' displays. The images on 'non-planer' displays have unique characteristics that the planer display does not have. Table 6 shows newly developing standards to address that uniqueness. Fig 1 shows an example of significance between planer and non-planer displays from optical measuring standing point.[1]

3 Results

As a result, we, IEC TC 110, are managing those WGs and the way of developing standards differently from our activities in past years to make sure that we could cover new display applications and new display technologies.

4 Discussion

For us, IEC TC 110, how to keep up our development with the speed of technology evolution while keeping our quality of standards is the one of biggest challenge. To realize that we, IEC TC 110, work very closely with SID's display methodology activities and other standardization body such as CIE and ISO. At same time, we are open to having any questions or comments from display related entities, such as academies, industries, and governments.

5 Conclusions

We, IEC TC 110, are working very closely with display academia and industries to develop proper international standards for new technologies and applications.

References

[1] K Kalantar, Metrology of Non-Planar Light Sources Using Near-Field Goniometric Measurement Method, IDW 2020 64.2

Table. 1 - IEC TC 110 WGs (as of 2021-10-2)

Label	Description
WG 6	3D Display Devices (3DDD)
WG 8	Flexible display devices (FDD)
WG 9	Touch and interactive displays
WG 10	Laser displays
WG 12	Eyewear display
WG 13	Optical measurements of electronic displays (OPT)
WG 14	Durability test methods for electronic displays (DTM)
WG 12	Eyewear display
WG 18 (former WG 5)	Organic light emitting diode displays (OLED)
MT 61747	Liquid crystal display devices (LCD)
PT 62595	Display lighting unit
PT 63340	Electronic displays for special applications (SPA)

AG 11	Advisory Group on Strategy (AGS)
AG 15	Advisory Group for Project allocation (AGP)

Table. 2 - Examples of 'Common' optical measurement standards (as of 2021-10-2)

Project Reference	Title
IEC TR 62977-1-31:2021	Electronic displays - Part 1-31: Generic - Practical information on the use of light measuring devices
IEC 62977-2-1:2021	Electronic displays - Part 2-1: Measurements of optical characteristics - Fundamental measurements
IEC 62977-2-2:2020	Electronic displays - Part 2-2: Measurements of optical characteristics - Ambient performance
IEC TR 62977-2-3:2017	Electronic display devices - Part 2-3: Measurements of optical properties - Multi-colour test patterns
IEC TR 62977-2-4:2018	Electronic displays - Part 2-4: Transparent displays - Overview of application scenarios
IEC TR 62977-2-5:2018	Electronic displays devices - Part 2-5: Transparent displays - Measurements of optical characteristics

Table. 3 - Examples of Technical Reports for new Display Applications (as of 2021-10-2)

Project Reference	Title
IEC TR 63340-1 ED1	Electronic displays for special applications - Part 1: General introduction
IEC TR 63340-2 ED1	Electronic displays for special applications - Part 2: Elevator and escalator
IEC TR 63340-3 ED1	Electronic displays for special applications - Part 3: Gaming and e-sports

Table. 4 - Examples of Published Standards for flexible displays (as of 2021-10-2)

Project Reference	Title
IEC 62715-1-1:2013 ED1	Flexible display devices - Part 1-1: Terminology and letter symbols
IEC 62715-5-1:2017 ED1	Flexible display devices - Part 5-1: Measuring methods of optical performance
IEC TS 62715-5-2:2016 ED1	Flexible display devices - Part 5-2: Measuring methods of optical characteristics from the vantage point for curved displays
IEC 62715-5-3:2017 ED1	Flexible display devices - Part 5-3: Visual assessment of image quality and defects
IEC TS 62715-5-4:2019 ED1	Flexible display devices - Part 5-4: Measuring method of blur in flexible transparent displays
IEC 62715-6-1:2018 ED2	Flexible display devices - Part 6-1: Mechanical test methods - Deformation tests
IEC 62715-6-2:2017 ED1	Flexible display devices - Part 6-2: Environmental testing methods
IEC 62715-6-3:2020 ED1	Flexible display devices - Part 6-3: Mechanical test methods - Impact and hardness tests

Table. 5 - Examples of currently developing Standards for Flexible Displays (as of 2021-10-2)

Project Reference	Title
PWI 110-45 ED1	Measuring methods of crimp force
IEC 62715-2 ED1	Flexible display devices – Part 2: Essential ratings and characteristics
IEC 62715-6-5 ED1	Flexible display devices – Part 6-5: Mechanical misaligned folding test method
IEC 62715-6-7 ED1	Flexible display devices – Part 6-7: Crease and waviness measurement methods
IEC TR 62715-6-21 ED1	Flexible display devices - Part 6-21: Foldable durability test for foldable display set

NOTE: PWI stands for 'preliminary working item'.

Table. 6 - Examples of Standards addressing 'non-planer' displays (as of 2021-10-2)

Project Reference	Title
IEC TR 62595-1-3:2019 ED1	Display lighting unit - Part 1-3: Lighting units with arbitrary shapes
IEC 62595-2-5:2021 ED1	Display lighting unit - Part 2-5: Measurement method for optical quantities of non-planar light sources

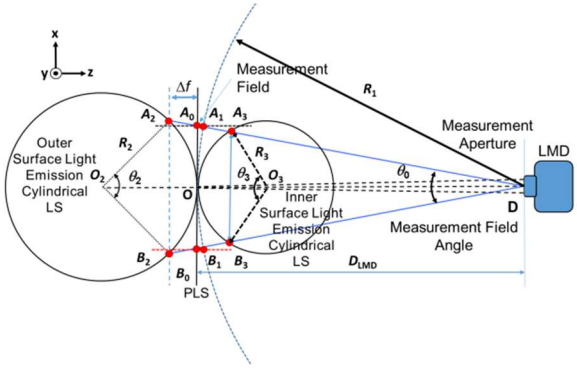

Fig.1 – an example of Schematic diagram of optical characteristic measurement of a planar, a convex and a concave cylindrical light sources [1]