Measurement Method of Energy Consumption for HDR products

1. HDR Technology
2. EPA 8.0 revision (U.S. Energy Star)
3. Power Measurement for HDR Displays
4. Proposal

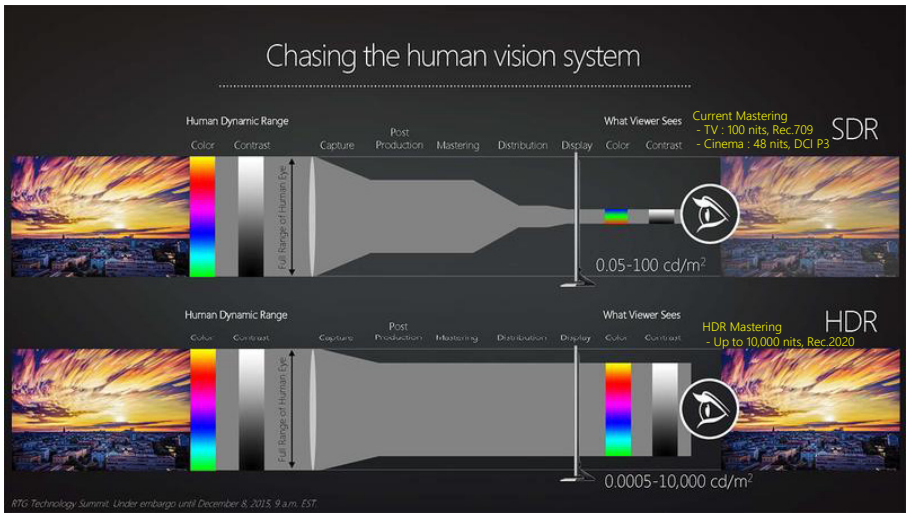
IEC TC100 AGS / Korea NC

2017. 05. 17

LG Life's Good

1. HDR Technology

✓ HDR technology makes image much brighter and deeper color significantly.



1. HDR Technology

There are 3 kinds of HDR technology with different in EOTF, mastering luminance, and color space.

HDR	Mastering Luminance	EOTF	Color Space (BT.2020)
HDR10	1000nits ~ 4000nits	PQ EOTF	YCbCr
Dolby	1000nits ~ 4000nits Dynamic Metadata(scene by scene)	PQ EOTF	ICtCp (UCS)
HLG (Hybrid Log Gamma)	1000nits	HLG	YCbCr

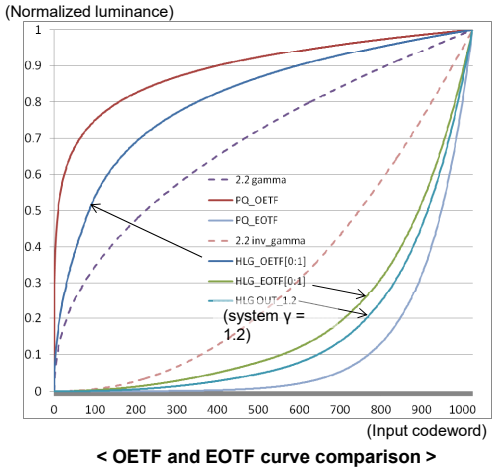
✓ SMPTE

ST.2084 – PQ EOTF (June, 2014)
ST.2086 – Static Metadata(July, 2014) , BDA HDR(Nov., 2014)
ST.2094 – Dynamic Metadata(Feb., 2016)

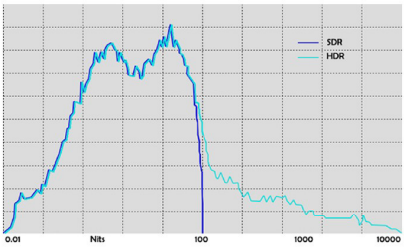
✓ ATSC 3.0 : Next generation broadcasting system(CS by end of 2015)

1. HDR Technology

HDR shows discriminating black and unsaturated peak white up to 10,000 cd/㎡ just like the real world.



< OETF and EOTF curve comparison >



< Histogram data for SDR and HDR contents >

2. Power Measurement for HDR Displays

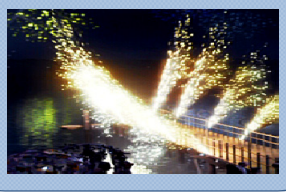
For playback of HDR contents or HDR-like mode, the power consumption of TV set would considerably vary due to the luminance boosting, dimming and HDR image processing.

✓ SDR input

- ✓ SDR modes
- ✓ SDR signal processing
- ✓ Relatively **low luminance**
- ✓ Relatively **low power**

✓ HDR input

- ✓ HDR modes
- ✓ HDR signal processing
- ✓ Relatively **high luminance** (Boosting)
- ✓ Relatively **high power**
- ✓ Wide APL (Average Picture Level) range



3. EPA 8.0 revision (U.S. Energy Star)

✓ U.S. EPA announced EPA TV Energy Star 8.0 revision for recent display products.

- `16.8 : EPA[1] 8.0 Revision Plan announcement
- `16.11 : EPA Data
- **`17. 3 : *EPA 8.0 Draft 1 announcement*** ✓
- `17. 4 : Draft 2 announcement
- `17. 5 : Final Draft announcement(expected)
- `17. 6 : ***Final Specification Release(expected)*** ✓
- `18. 3 : Effect (expected)

✓ EPA proposes to measure the power use with HDR enabled as a separate test.

✓ EPA also encourages the development of an industry standard native HDR test clip.

* 1) EPA : Environmental Protection Agency

4. Power Measurement Standard for HDR displays

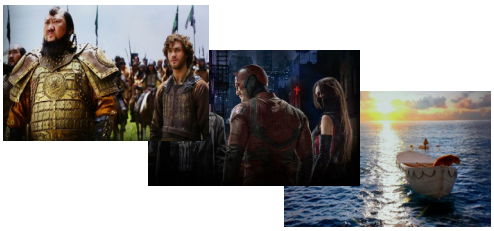
✓ Current IEC-62087 test clip is for SDR contents NOT HDR.

✓ IEC-62087 (Current)

- SDR Contents(HD)
- BT.709 color
- Normal Broadcasting contents in US and AUS

✓ IEC-62087 (Next)

- HDR Contents(UHD Movie)
- BT.2020 color
- Mainly HDR movie contents



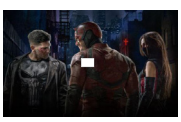
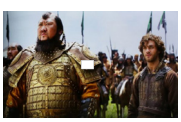
4. Power Measurement Standard for HDR displays

◆ Structure of Video Clip

Video clip consists of HDR cinema contents(UHD) with BT.2020 color container.

◆ Considerations

- Need to sample video clip from many popular HDR video contents
  - Typical APL range of various HDR contents
- Prevents possible cheating on measurement of power consumption
  - Random access video clip
  - Check minimum luminance by dimming
  - Check correlation between power consumption and instantaneous power

	Low APL	Medium APL	High APL	Lower limit of luminance
Luminance				

5. Proposal

- ✓ **HDR version of IEC-62087 should be started in this year.**
- ✓ **Take over the PT 100-15 project as IS(International Standard).**
- ✓ **NP document (PT 100-15, Measurement Method of Energy Consumption for HDR products) can be submitted in this year.**

TA 12 Subcommittee(s) and/or Working Group(s)

Label	Title
Project Teams	
PT 100-11	Market, policy and technical trends for Energy Saving System
PT 100-15	Measurement Method of Energy Consumption for HDR products
PT 62087-7	Audio, video and related equipment - Methods of measurement for power consumption - Part 7: Computer Monitors
PT 62654	Energy Saving System (ESS): Network - Based Energy Consumption Measurement of AV Multimedia Equipment and Systems
Maintenance Teams	
MT 62087	Methods of measurement for the power consumption of audio, video and related equipment
ad-Hoc Groups	
AHG 1	Ad hoc group on possible extensions to IEC 62087

HDR power consumption draft