Ultra HD Breakfast, London May 2017
Connected TV Summit
Agenda

• Thierry Fautier
  – State of the UHD union including update on the Forum
  – Update on phase B and exciting things coming soon ...

• Ian Nock
  – Mini HDR primer
  – Lessons learnt from our NAB demos
  – Update on our Interoperability work

• Arian Koster
  – Real world HDR issues from an operator perspective

• Q/A
Global Advocacy for Next-Gen A/V Delivery

CHARTER (17)

CONTRIBUTOR (18)

ASSOCIATE (25)

60 members
Ultra HD Forum Progress

Members

Guideline (Phase A)

Interop

Liaison

Communication

By NAB’17

60

V1.3 incl Watermarking

Public Interop Fest with 11+3 demos

Engagement with DVB/ATSC/SMPTE/CTA

Master Class on HDR
What is coming Next?

- Interop
- Guideline
- ATSC 3.0
- China
- Liaison
- Communication

- June’17 plug fest DTG/German TV platform
- Phase B
- Meeting in Korea (Winter Olympic’18)
- Meeting in Q4’17 (Huawei Invitation)
- Work closer with UHD Alliance on Broadcast
- Considering booth at IBC

Considering booth at IBC
## Phase B

<table>
<thead>
<tr>
<th>Topic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGA</td>
<td>Object based</td>
</tr>
<tr>
<td>HDR Dynamic Metadata</td>
<td>Dolby, Technicolor, HDR10+</td>
</tr>
<tr>
<td>HDR Dual Layer Technology</td>
<td>Backward compatibility</td>
</tr>
<tr>
<td>HFR</td>
<td>P100 &amp; 120</td>
</tr>
<tr>
<td>HDR Conversion Tools</td>
<td>PQ10 &lt;&gt; HLG</td>
</tr>
<tr>
<td>HDR “Brightness” Control</td>
<td>Could become a regulated topic</td>
</tr>
<tr>
<td>Applications : OTT</td>
<td>Live</td>
</tr>
<tr>
<td>Applications : OTA</td>
<td>ATSC 3.0 / DVB-T2 / ISDB-T</td>
</tr>
<tr>
<td>Applications : MVPD</td>
<td>Broadcast / IP Unicast &amp; Multicast</td>
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Ultra HD is ...

4K

HDR

WCG

HFR

NGA
SDR reproducing the view
HDR with WCG a more realistic view
High Dynamic Range

Range of light in the real world in nits

Current TV

HDR

.004

10

100

3,000

18,000

1 MILLION

1 BILLION

Starlight

Moonlight

Indoor Light

Campfire

Lightbulb

Indirect Sun

Direct Sun
Wide Color Gamut
HDR & WCG - Color Volume Combination of Color and Luminance
HDR Phase A Formats

As defined in ITU BT.2100

• PQ - Perceptual Quantization - EOTF
  – Screen Referenced Reproduction
  – With or Without Metadata
  – HDR10 is a media profile of PQ
  – No backwards compatibility

• HLG – Hybrid Log Gamma - OETF
  – Scene Referenced Reproduction
  – No Metadata
  – Has a very specific form of backwards compatibility

NOT A FORMAT WAR – EACH HAS PROs and CONs with specific use cases
HDR Phase A Formats

• **PQ10 (+ optional metadata)**

  - Single layer HEVC Main10 Bitstream
  - Bitstream is not backwards compatible to DVB-UHD phase 1 receivers

• **HLG10**

  - Single layer HEVC Main10 Bitstream
  - Bitstream decodable by DVB-UHD phase 1 receivers as Standard Dynamic Range
HDR Phase A Formats
Primary Formats of HDR Phase B
DMCVT - Dynamic Metadata

Dynamic Metadata for Color Volume Transforms – with four vendor specific application approaches

- ST.2094-10 - Dolby – Parametric Tone Mapping
- ST.2094-20 – Philips – Parameter-based Color Volume Reconstruction
- ST.2094-30 – Technicolor – Reference-based Color Volume Remapping
- ST.2094-40 – Samsung HDR10+ - Scene-based Color Volume Mapping
The Display Future is Clear
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Facilitating interoperability work and plug-fests to test the usability and comprehensiveness of Ultra HD and related media standards including the Forum’s Guidelines. Describe and promote the use of Ultra HD and related media services that meet the scope of the Ultra HD Forum.
Interop Events to Date

• Plugfest 1 - March 2016
  – Base HDR Interoperability inc. PQ
• Plugfest 2 - September 2016
  – Operator Demonstration – SDR, PQ & HLG
• Plugfest 3 - October 2016
  – HDR Interoperability inc SDR, PQ, HLG & SL-HDR1
• Plugfest 4 – December 2016
  – Comparative performance SDR, PQ & HLG at DTG/DTVP 5th Plugfest
• Phase A (HDR/SDR) and Future Technologies Demonstration – April 2017
  – HLG/SDR, PQ<>HLG<>SDR Conversions, Dynamic Metadata and High Frame Rate
NAB17 Demonstrations

Pod 1 - Broadcaster HDR

Pod 2 Ext.
Pod 2 - Mixing HDR & SDR formats, & Quality of UHD HDR

Pod 3 - Dynamic Metadata

Pod 4 - High Frame Rate

Pod 5 - HDR and SDR Improvements
The Lessons of Interop

- Identification of Video Streams with correct signalling and metadata
- Firmware update and support for HDR formats
- Content suitability for end to end and platform validation
- Issues of reproducability and quantitative measurement
- User Interface and Display Configuration Issues
- Color Reproduction & Enhanced Display Processing problems
Next Steps in Interop – Subject Areas

• Conversions (SDR, HLG, PQ)
• Content Switching SDR/HDR
• Next Generation Audio - NGA
• HDR Brightness / Loudness
• Testing and Measurement Methods and Test Patterns
• High Frame Rate
• Signalling and Metadata in Delivery
• Mobile Displays

• Next Interop at DTG, DTVP .... Late June 2017
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Arian Koster

OPERATOR PERSPECTIVE OF HIGH DYNAMIC RANGE IN IPTV AND IT’S LIMITATIONS
KPN IPTV operator

• KPN is a Telco and TV operator with 2 million TV subs
  – 200+ channels linear TV
  – Radio and PPV channels.
  – NPVR, Start over TV, replay TV, TV Apps

• Small scale 4K TV service launched to 1k subs in 2016
  – 2 channels, VoD Netflix 4K
There are 6 types of UHDTV panels on the market

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
<th>Notes</th>
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<tbody>
<tr>
<td>2014</td>
<td>HDMI 1.4, AVC, 8 bit panel, Rec 709</td>
<td>Only suitable for OTT UHDTV service, not via STB due to lack of HDCP 2.2</td>
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<tr>
<td>2014/2015</td>
<td><strong>HDMI 2.0, HDCP 2.2, AVC</strong></td>
<td>Can support KPN “4K-only” service</td>
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<tr>
<td>2016</td>
<td><strong>HDMI 2.0a, HDCP 2.2, HEVC, HDR10</strong></td>
<td>First HDR devices on the market. Will render HLG signals as SDR image</td>
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<tr>
<td>2016</td>
<td>HDMI 2.0a, HDCP 2.2, HEVC, 10 bit panel, Rec 2020 HDR10, “HLG”</td>
<td>Supports HLG, but needs upgrade to HDMI 2.0b. to support HLG signalling</td>
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<tr>
<td>2016</td>
<td>HDMI 2.0a/b(?), HDCP 2.2, HEVC, 10 bit panel, Rec 2020 HDR10, HLG, Dolby Vision</td>
<td></td>
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<tr>
<td>Future</td>
<td>HDMI 2.1 High Frame Rate, 8K, Dynamic Metadata (ST.2094) + all of the above</td>
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Experiment: Start HDR service

Who will be able to see this service?

- 3 out of 6 UHD types
- Covering 2/3 of the TV sets in the market

4K HDR
PQ Rec.2020
50 Hz

H.265 HEVC

STB
HDMI2.0a

Ultra HD
HDR TV
Mapping of 4K PQ and HLG services on UHD TV’s. Without and with HD Simulcast

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<thead>
<tr>
<th>Year</th>
<th>PQ</th>
<th>HLG</th>
<th>PQ</th>
<th>HLG</th>
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<td><img src="red" alt="Red" /></td>
<td><img src="red" alt="Red" /></td>
<td><img src="yellow" alt="HD" /></td>
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<td>2015/2016</td>
<td><img src="red" alt="Red" /></td>
<td><img src="green" alt="HDR" /></td>
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<td>2016</td>
<td><img src="blue" alt="HDR" /></td>
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<td>2016</td>
<td><img src="blue" alt="HDR" /></td>
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HDR HFR

4K HDR HFR Rec.2020 100 Hz

H.265 HEVC

Frame rate 100 or 120 Hz

Ultra HD HDR HFR TV

HDMI 2.1

Ultra HD 4K TV (SDR)

Ultra HD HDR TV

HD TV
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