## **UHD Masterclass Agenda**



### Welcome, Thierry Fautier, Ultra HD Forum President, Harmonic

### **Guidelines & standards in the field**

Madeleine Noland, UHDF Guidelines Chair, LG, Skip Pizzi, NAB

### **3 TECH PANEL:** learnings from the FIFA World Cup & other sports in 2018

Madeleine Noland *(Chair)* Stephan Heimbecher, SKY Dolf Schinkel, KPN Joerg Sander, HBS Mickaël Raulet, Ateme, Ian Nock, UHDF Interop Chair, FWC

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2

### MARKET PANEL: Getting HDR to market in 2018

María Rua Aguete, IHS Markit *(Chair)* Yoeri Geutskens, @UHD4K Thierry Fautier Mike Zink, Warner Bros Adina Gorita, Insight TV Michel Chabrol, Eutelsat

## **IBC 2018** Activities





2018

**Operators' yearly survey\*** 

**IBC Masterclass** 

**Future zone booth** 

**Phase A refinements** 

FIFA 2018 debrief

<u>\* https://www.surveymonkey.com/r/UHDFSurvey2018</u>

## Demo @ IBC\* \* Future Zone



The Consumer Experience	HFR	CAE	Dynamic HDR	Scalable
• KPN TV • NASA TV	• Interop • BC	<ul> <li>VOD</li> <li>Live</li> <li>Comparison w/BBC Live</li> </ul>	<ul> <li>Phase A</li> <li>Phase B</li> </ul>	• UHD/HD
🂩 kpn	Cateme Transforming Video Delivery	trightcove:	technicolor	
harmonic	🔁 LG	<b>D</b> BEAMR	⊂≘ateme	
SONY	SONY	harmonic		
		BBC		
		SONY		

SairmileWest

## **Importance of Technologies**\*

\*Source : UHD Forum internal members



## **FIFA'18 Outcome for the Forum's members**



### Large Success of UHD Forum members



## Why did you join the Ultra HD Forum?





Other	4
Comments:	Contribute on content security requirements and constraints
	Charter member company of the Forum
	Alignment with other International standards.

#### \*Source : UHD Forum internal members

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## Korean UHD with ATSC 3.0 PyeongChang Winter Olympics

## Madeleine Noland, LG Electronics Chair, Ultra HD Forum Guidelines Work Group

## **ATSC 3.0**



**Digital Terrestrial Television system** 

**Robust physical layer similar to DVB-T2** 

All IP-based transport

Hybrid broadcast/broadband

### Includes all UHDF Phase A and B technologies for broadcast

4K resolution HFR (100/120 fps with temporal scalability) HDR/WCG (PQ and HLG with static and dynamic metadata) Next Gen Audio (AC-4 and MPEG-H, one per region)

## ATSC 3.0 Video



### Resolutions up to 3840 × 2160

### Spatial scalability (SHVC)

### **High Frame Rate**

Up to 100, 120, 120/1.001 (plus lower framerates) Temporal sub-layering enables backward compatibility Plus temporal filtering for optimizing both the SFR and HFR pictures

### **High Dynamic Range**

PQ & HLG transfer functions (plus SDR) Metadata for PQ

### Wide Color Gamut

Wide Color Gamut BT.2100 (plus BT.709 for SDR) Y'CBCR non-constant luminance ICTCP constant luminance (for PQ) Full Range coding (for PQ) SL-HDR1 for delivering SDR/709 stream that SL-HDR1-capable decoders can render as HDR/2020

## ATSC 3.0 Audio



## MPEG-H AUDIO ALLIANCE

The Next-Generation System for Interactive and Immersive Sound Immersive 3D sound Works for various speaker positions and headphones Enhanced dialog, alternate languages, consumer choices

1 technology per country or region

Dolby AC-4

NEXT GENERATION AUDIO



MPEG-H in South K // \_\_\_\_\_

## Korean ATSC 3.0 Deployment



LG and Samsung commercially launched ATSC 3.0 TVs in advance of the Pyeongchang Winter Games

Since fall of 2017, all new LG 4K UHD TVs and most new LG smart TVs sold in Korea have dual ATSC 3.0-ATSC 1.0 capability

KBS, MBC and SBS prepared 4K workflows and mobile units for the Olympics





## **Korean 2018 Winter Olympics**











## **Example Korean Olympic Workflow**



Studio



## **Mobile TV**





## Korea's Aggressive UHD Plan



Already more than 10 percent of broadcast programming is produced in 4K.

This includes dramas documentaries, entertainment, sports, news, etc.

Year	UHD Goal
2018	10%
2019	15%
2020	25%
2023	50%
2027	100%



## **NBC's UHD Presentation of PyeongChang Winter Olympics in U.S.**

# **Skip Pizzi**, NAB (with thanks to NBC Sports And Olympics Engineering)

## PyeongChang 4K UHD and 5.1 + 4 NGA Dolby Atmos



Opening and closing ceremonies on a 1-day delay along with select events from the following competition venues, time delayed, over the duration of the Games:

Figure Skating, Short Track Speed Skating, Ski Jumping and Hockey

#### UHD Picture Specifics:

- NHK 8K downconverted to 3840 X 2160, 59.94P. Native HLG was convert to PQ for distribution.
- Transport stream bit rates set from as high as 80 mb/s down to 18 mb/s based on point in the signal path

#### NGA Dolby Atmos Audio Specifics:

- Derived from NHK 22.2.
  - The 22.2 downmixed 5.1 was provided from NHK. Discrete effects and crowd sources were added to the 5.1 mix for the +4 overheads, composed of venue live microphones, captured in sync to add immersive effects to the mix
  - Discrete channels were sent from Korea to NBC Sports HQ in Stamford CT. where the immersive 10-channel mix was created in a 4K-UHD Mobile Unit
  - The completed mix with picture was sent to NBCU's Network Operation Center in Englewood Cliffs NJ where the PCM audio was encoded to Dolby Digital Plus with JOC, creating a Dolby Atmos 5.1+4 soundtrack for the UHD pictures for distribution to DBS and VOD

DBS provider DIRECTV carried a UHD 4k and Dolby Atmos 5.1+4 Linear Channel DISH Network carried a UHD 4k and Dolby Digital 5.1 Linear channel Comcast carried UHD 4k and Dolby Atmos 5.1+4 VOD

#### Lessons learned:

- UHD: use of 4K lenses was important. HLG to PQ translation at 1 knit normalized, was transparent using static LUTs
- NGA: ability to add dowminx attenuation metadata to the overhead channels protected the 5.1 and stereo versions derived form the 10 channel mix. This allowed higher overhead channel amplitude for greater effect. Fine tuning was required to find the right settings for coder bandwidth, overhead amplitude and downmix attenuation while listening to both the immersive and derived 2 and 5.1 channel versions

## **Selected Content**



Opening and closing ceremonies on a 1-day delay, along with select events from the following competition venues, time delayed, over the duration of the Games:

Figure Skating, Short Track Speed Skating, Ski Jumping and Hockey

## **Delivery Channels**



DBS provider DIRECTV carried a UHD 4K/HDR and Dolby Atmos 5.1+4 Linear Channel

DBS provider DISH Network carried a UHD 4K/HDR and Dolby Digital 5.1 Linear channel

Cable provider Comcast carried UHD 4K/HDR and Dolby Atmos 5.1+4 VOD

WRAL experimental ATSC 3.0 transmission carried UHD 4K/HDR and Dolby Digital 5.1 Linear channel





NHK 8K video was down-converted to 3840x2160, 59.94p

Native HLG was converted to PQ for distribution

Transport stream bit rates ranged from 18 Mb/s to 80 Mb/s at various points along the signal path

## **UHD** Audio



### **Derived from NHK 22.2 channel original mix**

A 5.1-channel downmix was provided by NHK. Discrete effects and crowd sources from the 22.2 channel original were added to the 5.1 mix for the +4 overheads From live venue microphones, captured in sync to add immersive effects to the mix

Discrete channels were sent from Korea to NBC Sports HQ in Stamford, CT where the immersive 10-channel (5.1+4) mix was created in a 4K-UHD Mobile Unit

The completed mix with picture was sent to NBCU's Network Operation Center in Englewood Cliffs, NJ where the PCM audio was encoded to Dolby Digital Plus with Joint Object Coding (JOC), creating a Dolby Atmos 5.1+4 soundtrack for the UHD distribution to DBS and VOD



#### Stamford 4K 2018 Olympics



## **UHD Stamford Technical Operation Center**





## **Audio Control, Stamford OB Unit**





## **Lessons** Learned



### **UHD Video**

Use of 4K lenses was important HLG to PQ translation normalized to 1 nit was transparent using static LUTs

### NGA

Ability to add downmix-attenuation metadata to the overhead channels protected the 5.1 and stereo versions derived from the immersive (10 channel) mix. This allowed higher overhead-channel amplitude for greater effect.

Fine tuning was required to find the right settings for coder bandwidth, overhead amplitude and downmix attenuation while listening to both the immersive and derived 2 and 5.1 channel versions

## **Acknowledgements @ NBCU**



Karl Malone, Sound designer, NBC Sports and Olympics

Chris Seeger, Director of Advanced Content Production Technology

Jim Starzynski, Director and Principal Audio Engineer

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## UHD Take-up in the Field: FIFA and Roland Garros



Madeleine Noland, LG Electronics, Chair UHDF Guidelines WG (Moderator)

Jorg Sander, Chief Technical officer, HBS

Stephan Heimbecher, Director Innovations & Standards, Technology, Sky

Ian Nock, Founder, Fairmile West, Chair UHDF Interoperability WG

**Dolf Schinkel,** TV Architect, KPN Media Services

Mickaël Raulet, Director, Research & Innovations, Ateme

## Introduction



Ultra HD Forum promotes adoption of UHD services with a focus on end-toend workflows

The Forum produces Guidelines and conducts Interops to inform and improve the UHD ecosystem

# The Forum is pleased to announce publication of the 5<sup>th</sup> version of the Phase A Guidelines

The Forum's UHD Phase A Guidelines v1.5 is available for download at www.ultrahdforum.org

Among the updates is the addition of 4 UHD productions of marquee television events

### In today's panel we will explore two such events:

FIFA World Cup (Stephan, Jorg, Ian, Dolf) Roland Garros (Mickaël)

## **FIFA'18**



### 24 broadcatsers subscribed to UHD HDR offer





### FIFA WORLD CUP RUSSIA 2018

## **Camera Plan**



#### Standard 37 + 1 + 2 Camera Plan

- 2x Ultra Motion
- 8x Super Slow Motion
- 2x RF Steadicams
- 1x Cable Cam
- 2x In Goals
- 2x Box Cams (GLT)
- 2x Cranes
- 1x Tactical Camera
- Up to 5x Handhelds for pre/post match activities
- 2x RF Handhelds for fan colour from inside and outside stadium



## **UHD/HDR Operations**

### **UHD/HDR** Production

2 Layers, but single camera plan / no side-by-side production Core layer 1080p/50 SDR REC.709 with HD Graphics Enhanced Layer UHD 2160p/50 HDR BT.2020 without Graphics

### **Vision Mixer**

8 Cameras Dual output UHD/HDR and 1080p/SDR 11 Cameras Dual output 1080p/HDR and 1080p/SDR 21 Cameras Single output 1080p/SDR All Replays 1080p/SDR

### Shading of all cameras is done on the 1080p/SDR layer



## **Dual Layer Workflow**





## **UHD HDR vs HD SDR**







### **Color crunched**

**Color properly represented** 

Wide angle

Narrow angle

## HDR Workflows used for FIFA'18





## **Feedback on UHD/HDR QoE**



UHD gives a wider pan and brings less fatigue to users than HD

- HDR was not consistent between venues / cams
- HDR was noticed in high shade/high brightness matches
- **TV** processing (as noticed in Interop) not always good.

Some broadcasters had to do last-minute adjustments, causing troubles to consumers

"Can be better to have a good & stable SDR than a poor HDR"

SDR (UHD & HD) looked pale vs HDR

HDR wasn't always "wow", but SDR looked worse than HDR at all times

For operators & broadcasters who have deployed UHD, UHD was a success, even better with HDR





FIFA'18 was the most challenging event ever produced in HDR, it worked! Only prepared Broadcasters/Operators have succeeded to make HDR work When working, HDR was showing a noticeable improvement vs SDR All networks exercised: DTH, IPTV, IP Cable ABR (managed), OTT to TVs HLG not supported on all STB, TV color mapping not always consistent Ultra HD Forum Phase A was deployed during FIFA'18 Broadcasters & operators members of the Ultra HD Forum were all successful

Time to join the Ultra HD Forum?



On DTH: Compatible TV with CI+ smartcard



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# **UHD TV Market Update**

Maria Rua Aguete, Research Director

17<sup>th</sup> September 2018 Maria\_aguete

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## **The Night Watch**

BY REMBRANDT VAN RIJN FROM 1642 (RIJKSMUSEUM)





## 4K shipment share by region, Q2 2018



In China, North America and Western Europe 4K represents over 50% of shipments. Japan lags, due to a preference for smaller (non-4K) screen sizes.



## Screen size growth continues



Ongoing LCD display capacity investments and price erosion drive size growth.

Long-term trend of 1-inch per year size growth (over 10 years).

Chinese consumers buy largest TVs.

Small sizes preferred in Japan. Latin America decline 2014-15 caused by subsidised sets in Mexico for digital switch-over.

### Average TV screen size (shipments): 4 quarter rolling



## **Channels...growing steadily**



### Unique channel brands per region.

**Count does not duplicate channels** eg. TravelXP or Insight TV on multiple platforms and countries per region

Count excludes 'pop up' channels, e.g. FIFA World Cup coverage.

### **Unique linear UHD channels**



## **Content choice: limited, but growing:** UK (February-18)





## **Content choice: limited, but growing:** UK (February-18)









# Sony Pictures invested early in 4K and now has over 180 4K titles



## **56** Titles available in **4K** *with* HDR

## **Operator perspective:**



# **DIRECTV** has **3** fully dedicated 4k channels



#### What are the main selling points for HDR content versus non HDR?

**HDR** (High Dynamic Range) gives you better contrast – "You'll see greater detail in the clouds on a sunny day, the foam on the ocean waves, and the sand in a sand trap."



# Thank you! Questions?

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# HDR ecosystem tracker September 2018





### Ultra HD Forum – IBC 2018

### Ultra HD in the World and in Europe - Amsterdam

### 17th September 2018 Michel CHABROL – Senior VP New TV Formats Eutelsat S.A. (mchabrol@eutelsat.com)





## **Ultra HD situation in the WORLD**





# ULTRA HD/4K Channels Or feeds in the World

LYNGSAT, UHD Forum & Eutelsat Research – September 2018

## World Ultra HD Channels/Services As Of August 2018





## **Ultra HD situation in europe**





# ULTRA HD/4K Channels Or feeds in Europe

LYNGSAT, UHD Forum & Eutelsat Research – September 2018

## Europe Ultra HD Channels/Services As Of August 2018



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