Frontiers of Video

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INTERNATIONAL SYMPOSIUM ON THE DIGITAL SWITCHOVER

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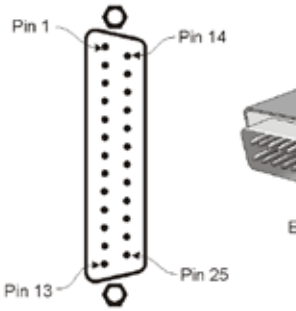
Frontiers of video

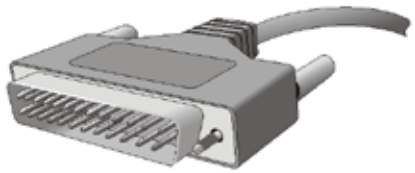
- The evolution of digital video over more than 30 (!) years
- Image issues
- UHDTV and beyond - what comes next after HDTV?

The origins of digital video

CCIR-601 signal format introduced in 1982

- 525 / 625 lines
- Full bandwidth digital component video
- 27 Msamples per second ‘common data rate’
- Connector with multicore cable required



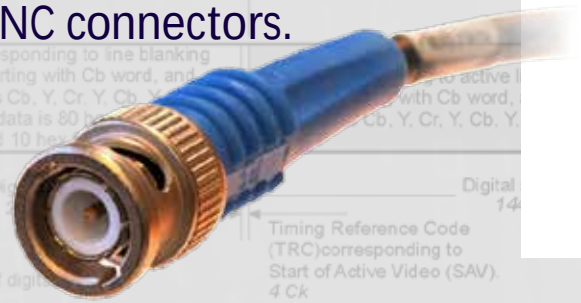


Example of connector

Pin number	Function	Pin number	Function
1	Clock +	14	Clock -
2	System ground	15	System ground
3	Data bit 7 +	16	Data bit 7 -
4	Data bit 6 +	17	Data bit 6 -
5	Data bit 5 +	18	Data bit 5 -
6	Data bit 4 +	19	Data bit 4 -
7	Data bit 3 +	20	Data bit 3 -
8	Data bit 2 +	21	Data bit 2 -
9	Data bit 1 +	22	Data bit 1 -
10	Data bit 0 +	23	Data bit 0 -
11	Spare bit A +	24	Spare bit A -
12	Spare bit B +	25	Spare bit B -
13	Chassis ground (shield)		

CCIR-656 interface introduced in 1986

- Serial digital interface at 270Mbps.
- Single coaxial cable and BNC connectors.



CCIR : Comité Consultatif International pour la Radio

Key ITU-R Recommendations on image formats

1982: BT. 601 Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios

1993: BT.709 Parameter values for the HDTV standards for production and international programme exchange

1995: BT.1201 Extremely high resolution imagery

2008: BT.1543 1280 x 720, 16:9 progressively-captured image format for production and international programme exchange in the 60 Hz environment

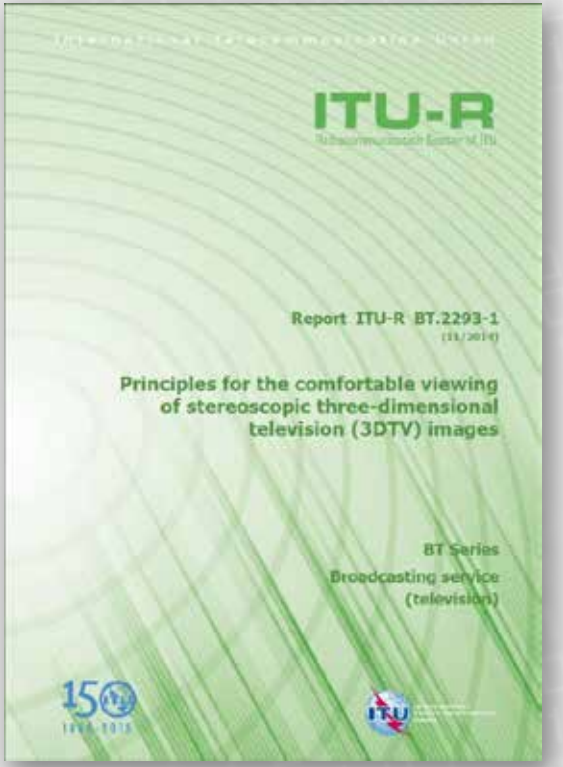
2009: BT.1847 1280 × 720, 16:9 progressively-captured image format for production and international programme exchange in the 50 Hz environment

2012: BT.2020 Parameter values for ultra-high definition television systems for production and international programme exchange

2014: BT.2050 Use of UHDTV image systems for capturing, editing, finishing and archiving high-quality HDTV programmes

Let’s not completely forget 3DTV!

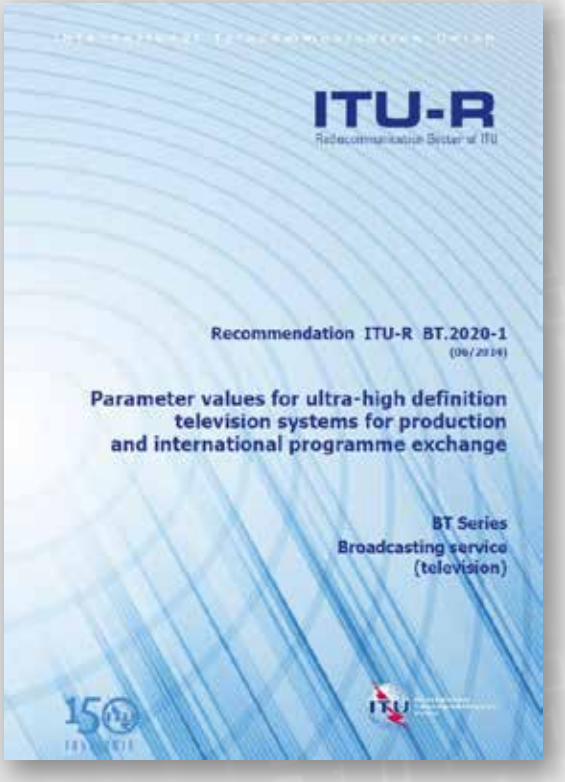
BT.2293-1 (2014) Principles for the comfortable viewing of stereoscopic three-dimensional television (3DTV) images



UHDTV - production and international programme exchange

Rec. ITU-R BT.2020

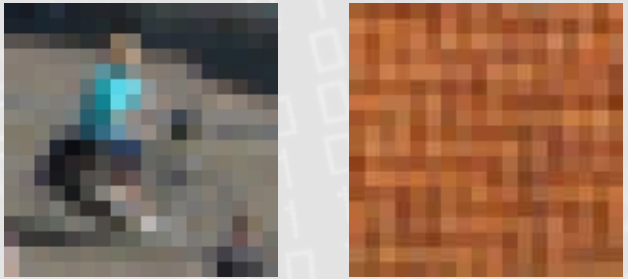
- Higher spatial resolution - multiples of 1920 x 1080
  - 3840 x 2160
  - 7680 x 4320
- Aspect ratio 16:9
- No interlace!
- Frame rates up to 120 Hz
- Wide colour gamut
- 10 or 12 bits per sample



The trend towards higher spatial resolution

Comparing resolution of SD and HDTV

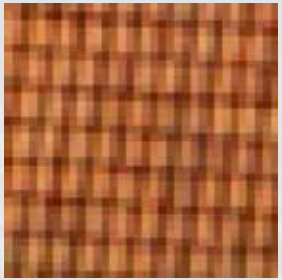
SD (720x540 & 720x576) 4:3 aspect ratio



16:9 aspect ratio HD (1920x1080)

Comparing resolution of HDTV and UHDTV

HDTV 1920x1080



UHDTV 3840x2160

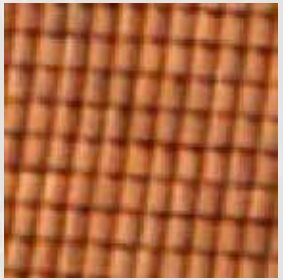
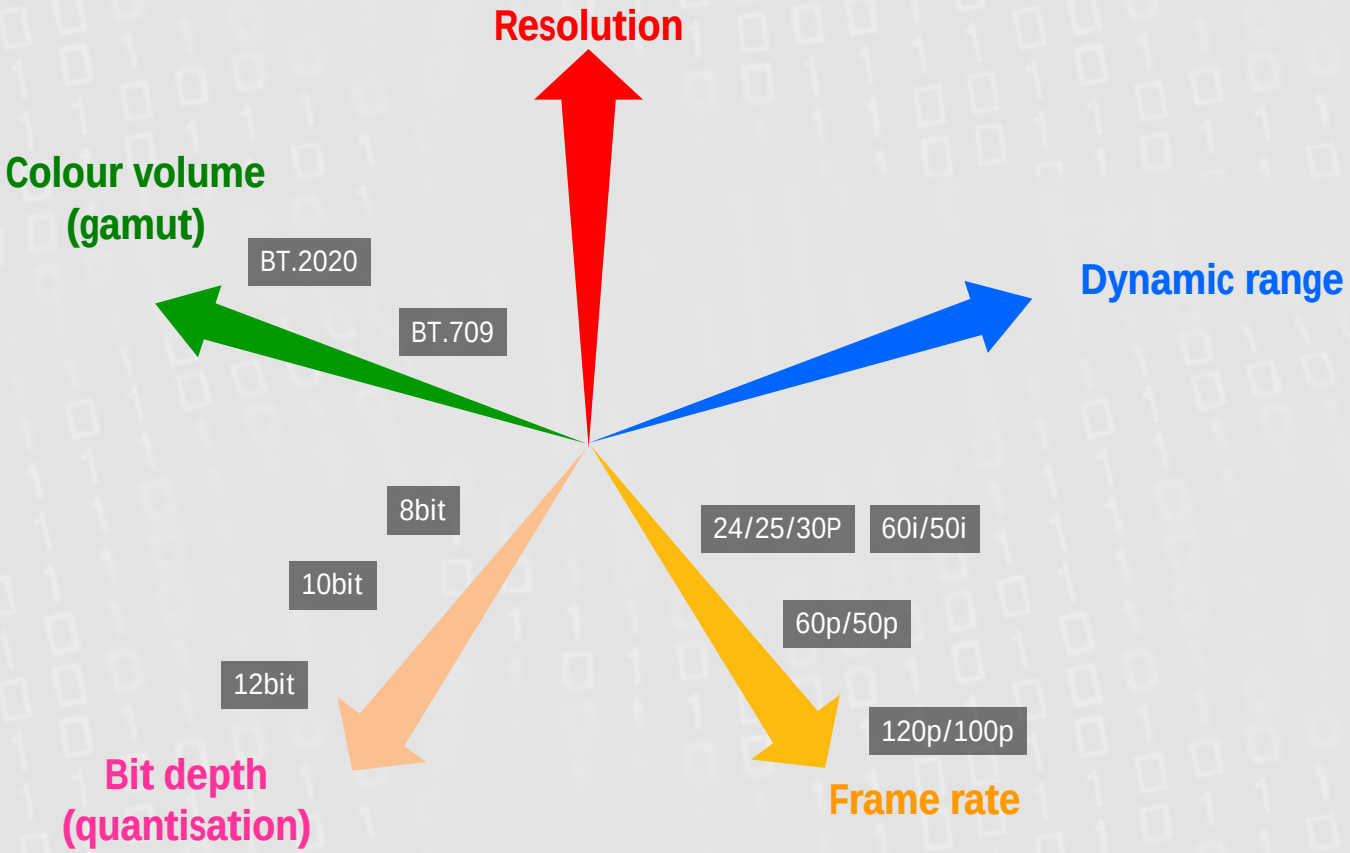


Image quality

More than just resolution



Wider colour gamut

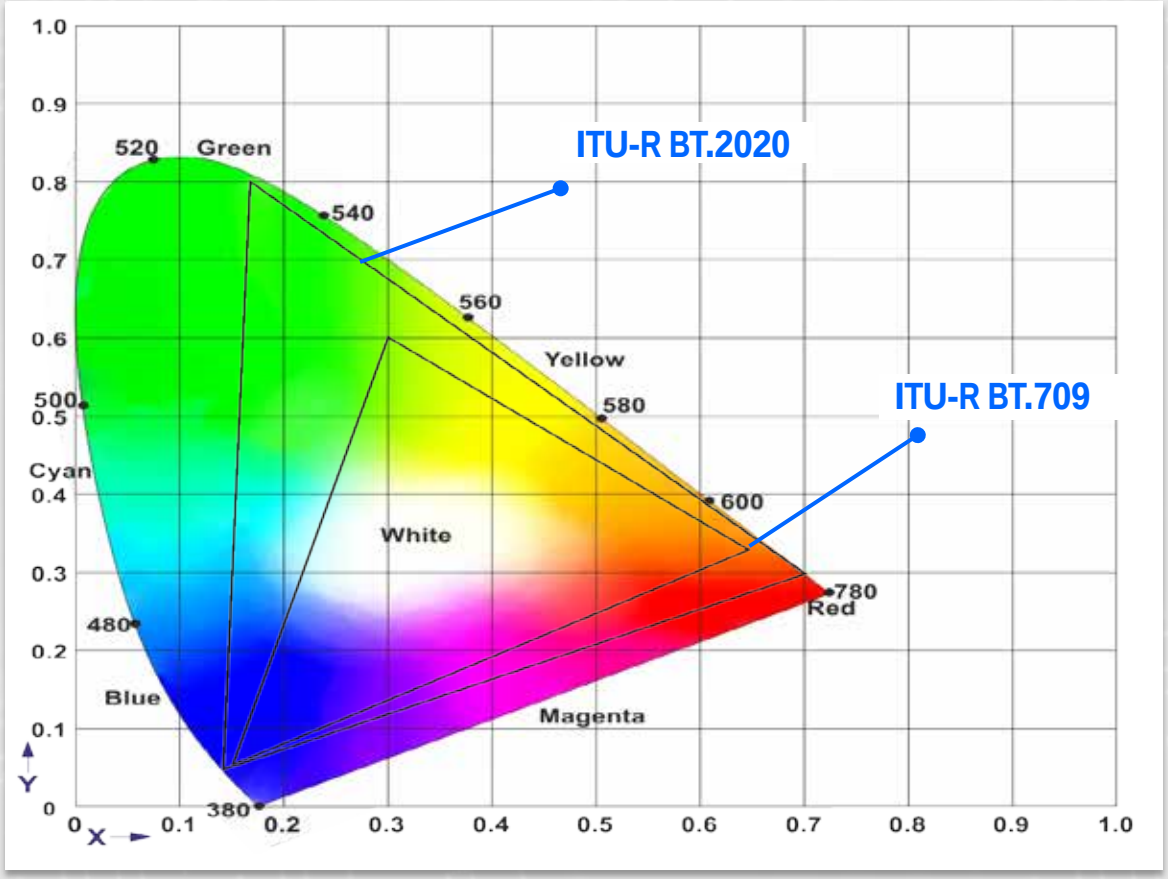
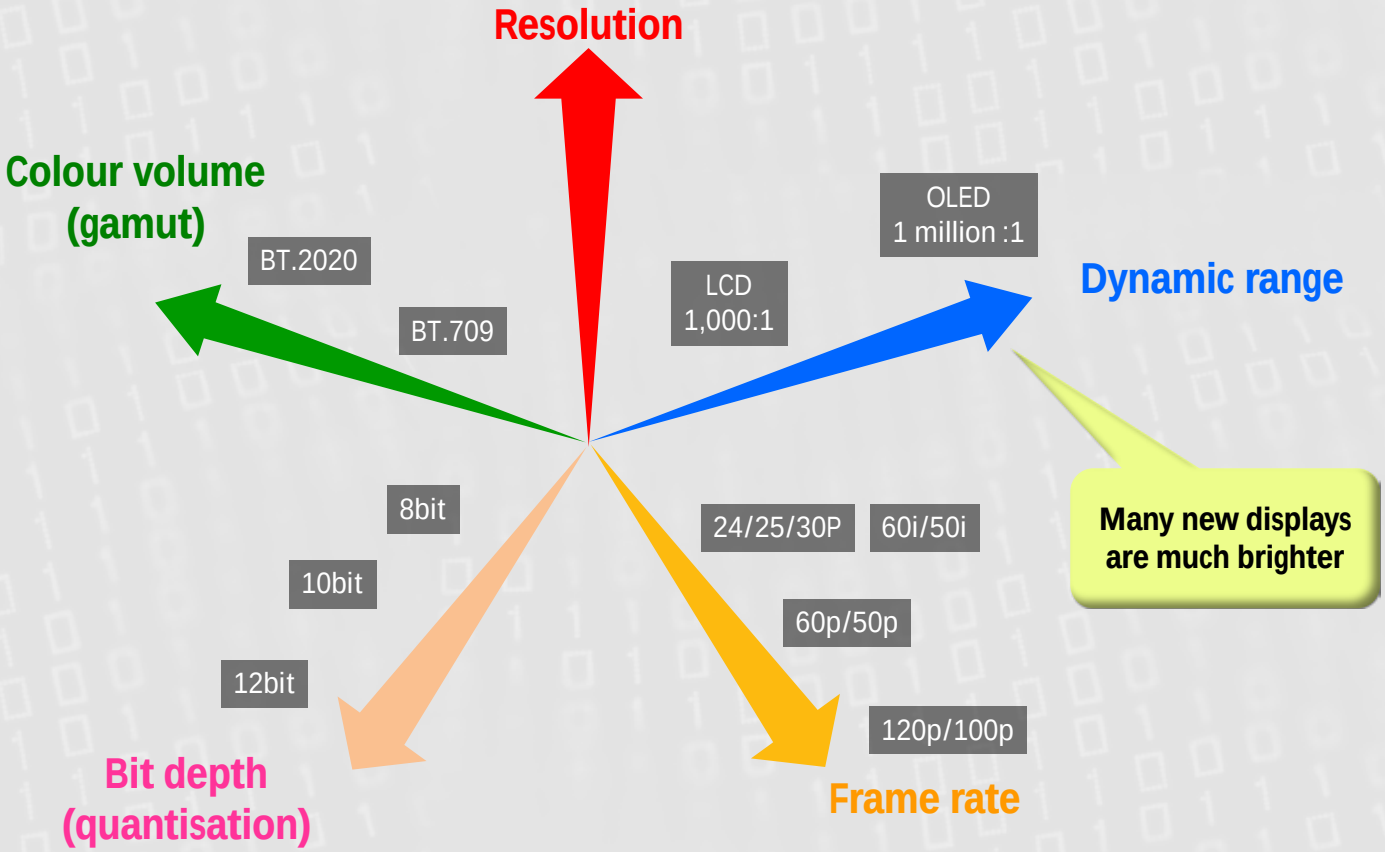


Image quality

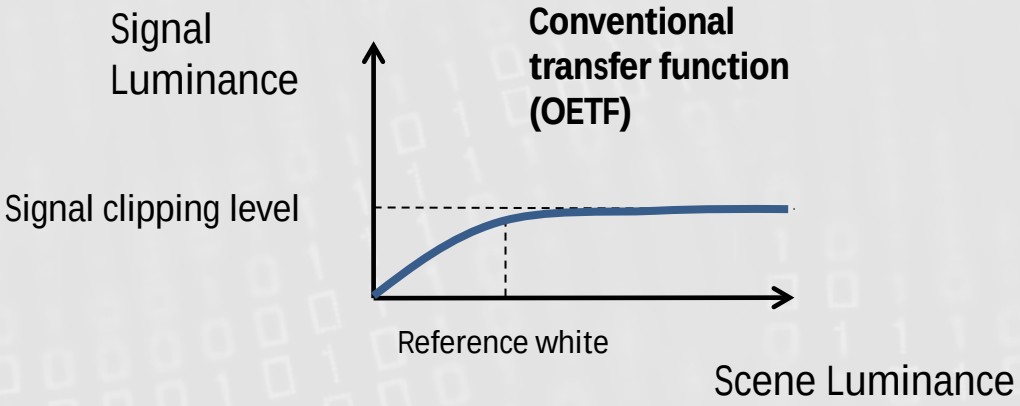
More than just resolution



Opto-Electrical Transfer Function (OETF)

UHDTV OETF has same characteristics as for HDTV (BT.709)

- Designed for a reference viewing environment using displays with peak brightness of 100 cd m^{-2}



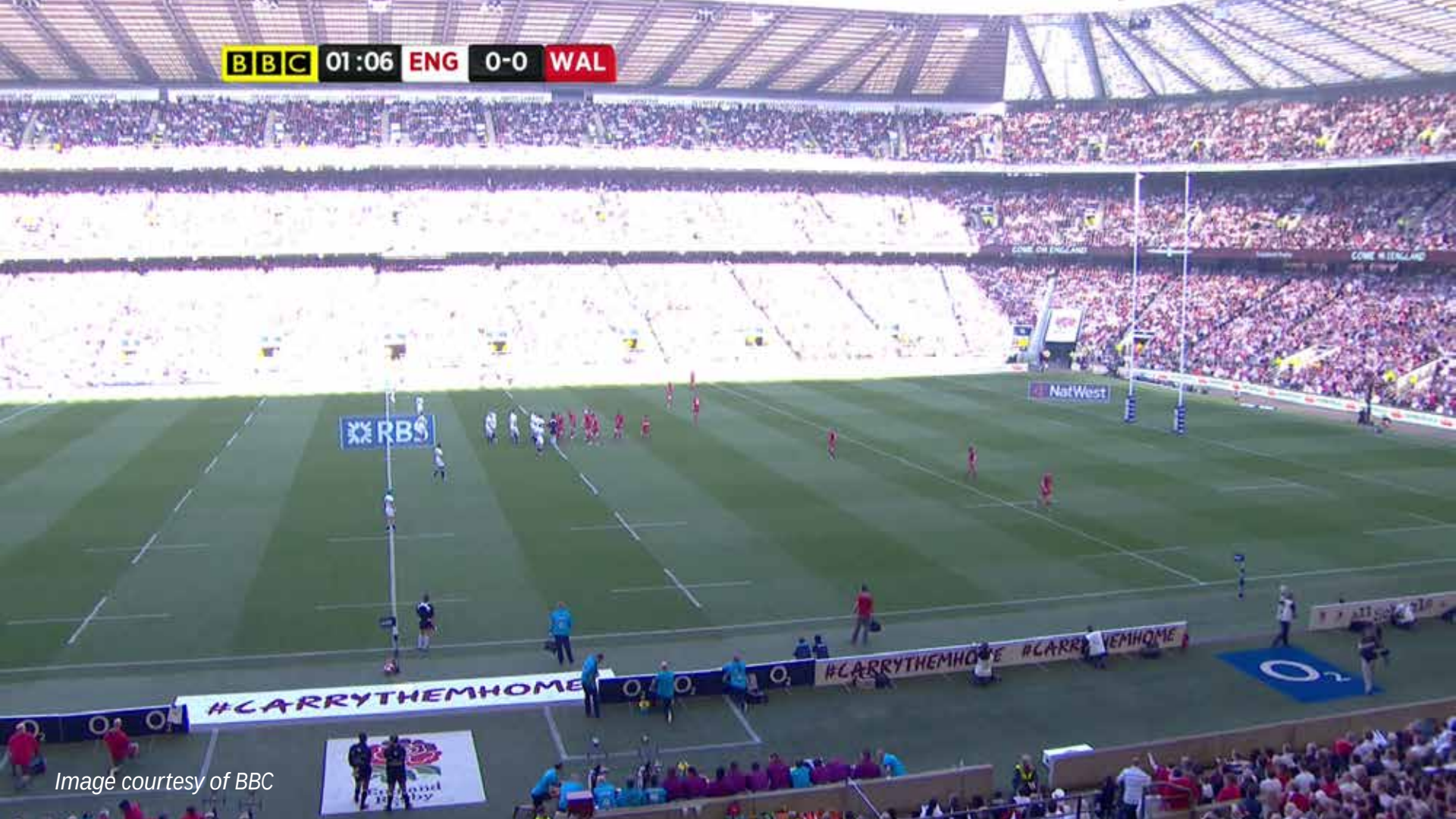
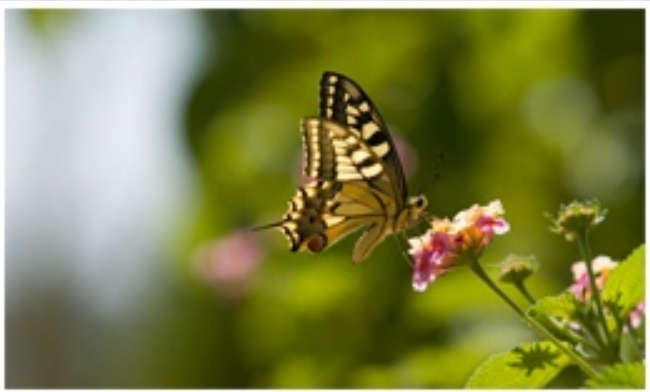
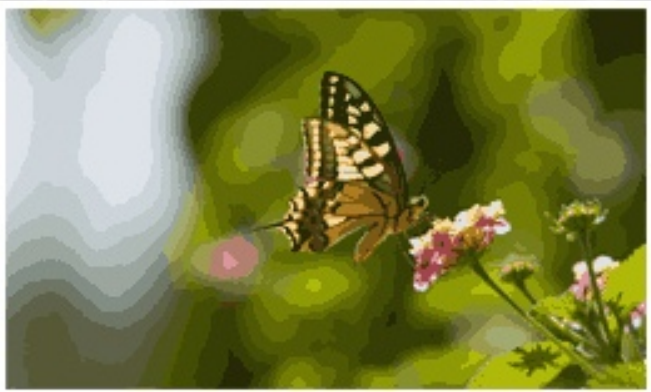


Image courtesy of BBC

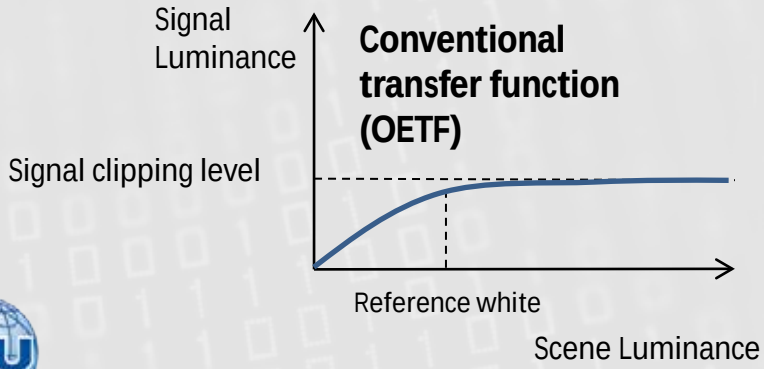
High dynamic range and high brightness display



Conventional display



High brightness HDR display with conventional OETF: banding (simulated)



Using the conventional transfer function (OETF) representing high scene brightness on high peak brightness displays would show visible contouring - unless more bits per sample are used to represent the signal.

A new OETF is required!

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UHDTV is coming!

HDR / Extended Image Dynamic Range Television (EIDRTV) is also coming!

- Compatibility with existing broadcast operational practice must be taken into account
  - conversion between colour gamuts of BT.709 and BT.2020
  - conversion/coexistence between standard dynamic range and high dynamic range
  - any impact on bit-rate for delivery to the home must be understood
- Brighter highlights – adds ‘sparkle’ and even more realism
  - NB: consider display brightness vs. power consumption vs. viewing comfort

Work towards [preliminary] draft new Recommendation ITU-R BT.[EIDRTV]

- Working Party 6C and Rapporteur Group RG-24

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Don’t forget the subjective impact of audio on perceived image quality!

Thank you!

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