IMMERSIVE VIEWING WITH HIGH DYNAMIC RANGE

4K RESOLUTION ULTRA HIGH DEFINITION

4k Resolution Ultra High Definition has launched and is available to view now with the promise that it will revolutionise our enjoyment of broadcast events. But how much will the reality live up to the marketing claims? And are there other developments that might aid our viewing enjoyment?

IT'S NOT ALL ABOUT RESOLUTION

Whilst it is true that 4k resolution can look very impressive, the clarity effect is not always noticeable. Much of the visual improvement can only be perceived if you are close enough to the display. Analysis of how much detail the human eye can resolve suggests that you might have to sit closer than you think - or invest in a very big TV screen.

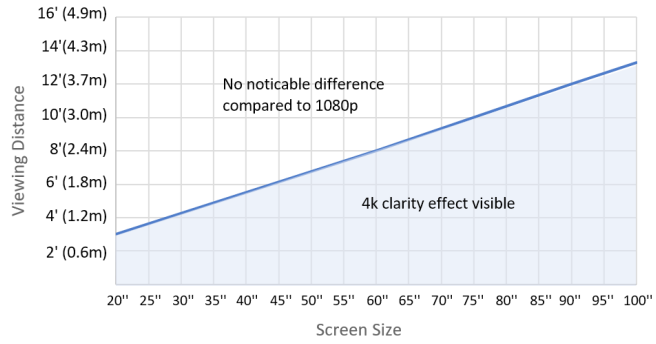

Figure 1 How close do you need to be to see the 4k effect?

HIGH DYNAMIC RANGE TO THE RESCUE

In addition to raw resolution, the human eye perceives high contrast as increased clarity.

Figure 2 With greater contrast comes more perceived sharpness

High Dynamic Range describes a much broader range of luminance - allowing more levels of grey to be displayed. More levels of grey can better define edge transitions, show detail in areas of extreme darkness or extreme lightness and lead to a much greater perception of clarity & realism.

Importantly, unlike raw resolution, the human eye can detect these luminance differences from much greater distances.

Figure 3 More levels of luminance with HDR

Whilst screen sizes have increased enormously since the demise of the CRT there will likely be some push-back from the consumer to install very large displays in the average domestic home. Broadcasts technologist need to find a solution to offer greater realism beyond pure resolution.

WHICH HDR FORMAT?

Multiple HDR formats have been developed offering different advantages, each adopted by different industry players.

DOLBY VISION

Dolby Vision has gained many industry backers for many consumer content delivery systems - such as Blue-ray and on-demand platforms. With its dynamic meta-data system, it claims to give optimal results for high production value, non-live content such as movies and drama. However, for live Events, management of the dynamic meta-data channel through the multi-stage, multi-operator production chain makes it an impractical choice.

HDR10

HDR10 is a system that implements a fixed, non-linear transfer and mapping function from the wide dynamic range of the real world onto the 10-bit luminance quantization of digital video. This fixed opto-electric transfer function in the camera and inverse mapping in the display device means that HDR video can pass through the broadcast chain with little change to today's workflows.

HLG

HLG is in many ways similar to HDR10. It implements a static non-linear opto-electric and electro-optic transfer function making it attractive for the live production broadcast chain. Having been developed by the BBC and supported by other broadcasters (with a back-catalogue of legacy content) such as NHK, it has an added benefit of providing backwards compatibility so that HDR content can be shown on non-HDR screens – and vice versa.

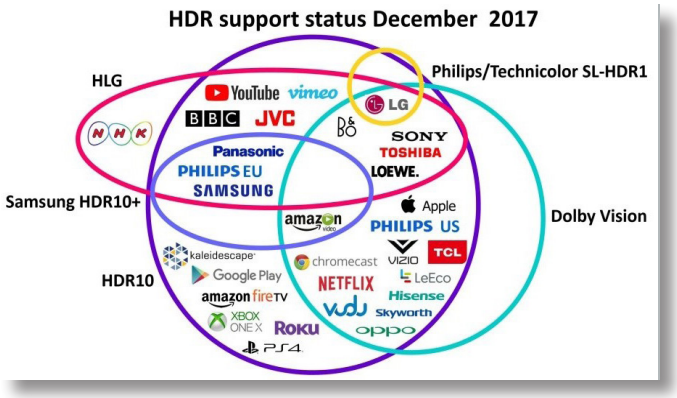

Figure 4 HDR support status, December 2017

Both HDR10 and HLG pass through the live broadcast chain in the same way – with the required non-linear luminance transfer function implemented in the camera and display device. The HDR format being used is simply signalled through the chain. Indeed, in the near term, ad-hoc events operators may find themselves switching between HDR formats from event to event as they serve different end broadcast platforms.

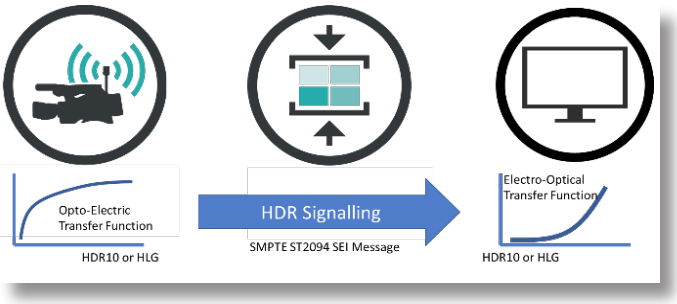

Figure 5 Implementing HDR content capture

SDR/HDR COMPATIBILITY

As the proponents of HLG have noted, there is a large back-catalogue of older non-HDR content that can attract strong viewing figures. Similarly, there will be a large proportion of viewers that will not, immediately upgrade to new HDR capable display devices. As HDR services launch, broadcast platforms may show a mix of HDR content and non-HDR content within an event. Will all commercials be produced in HDR for example?

Figure 6 How good will a mix of HDR and non-HDR content look?

The conversion and mapping SDR content into HDR luminance space is not trivial. Fixed conversion is not optimal for all content – think skiing, think a fireworks display. Dynamic mapping can also have issues with transition response times – think skiing followed by fireworks. Good SDR to HDR conversion is also never going to be perfect either – You cannot perfectly re-create what has been lost. Such issues will face the broadcast industry as HDR channels are launched and attempt to manage with a mix of HDR and SDR content.

VISLINK HDR SUPPORT

As Events operators look to fulfilling requests for HDR trials and future system rollout they need to be assured that equipment purchases have an economically attractive lifespan. Vislink's wireless camera system is designed to be future proof. As HDR systems evolve, Vislink's wireless camera solutions are shipping now as HDR Ready devices.

Product	HDR Support
HCAM	✓ HDR Ready
UltraReceiver	✓ HDR Ready

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