



From the number of '4K' TVs to be found in stores these days you could be forgiven for thinking the era of ultra high definition TV is already upon us. But, from the perspective of broadcasters it is certainly not the case. BILL FOSTER, from Digital Decoded, says that consumers who think they are future-proofing by buying a '4K' TV today could be in for a nasty shock.

Unlike the relatively straightforward launch of HDTV, there are multiple layers of complexity in Ultra High Definition (UHD) TV which will not only confuse consumers, but many in the broadcast and CE industries as well. What is not generally understood is that the UHDTVs available to buy today are unlikely to support the features which will be added over the next few years.

Firstly, though, a word on the terminology. UHD TV is not 4K. While the latter is widely used by the TV industry, 4K actually refers to the cinema format of 4096 x 2160 pixels. For television the pixel count has been adjusted to be a multiple of HDTV's 1920 x 1080. The Digital Video Broadcasting (DVB) Project, European Broadcasting Union (EBU) and Consumer Electronics Association (CES) all use slightly different descriptions, but each defines two different pixel counts: UHD-1 – which is what this article is about – has 3840 x 2160 pixels, exactly four times the resolution of HDTV, whilst Japan's Super HiVision with its 7680 x 4320 pixels has been designated UHD-2.

Phased introduction

In its first iteration – defined by the DVB Project as UHD-1 Phase 1 – the only real enhancement over HD from a consumer's perspective is a quadrupling of the pixel count. Those within the broadcast industry who have conducted UHD-1 trials are in general agreement that this is not enough to create a compelling viewing experience. Almost the same effect can be achieved

with a decent upscaling engine. To deliver a totally new viewing experience – which is what the pay TV broadcasters will need if they are to persuade viewers to part with additional cash – will require several other features to be added.

The first of these is a higher frame rate. Whilst UHD-1 Phase 1 supports an increase in the number of frames per second (fps) to 50p or 60p from HDTV's more common 50i or 60i, trials conducted by several broadcasters indicate 100fps or more will be needed for sports and other fast motion programming. This will not only require considerable additional broadcast bandwidth, it will also demand more complex and therefore expensive electronics within TVs, not to mention another generation of HDMI interface. Put another way, most of today's '4K' TVs could become nothing more than over-priced upscaling HDTVs.

And it doesn't stop at just a higher frame rate. A new set of specifications defined under ITU-R BT.2020, in addition to supporting frame rates up to 120p, increases dynamic range up to 12 bits and supports a wider colour gamut (WCG) – or in layman's terms a way to represent far more graduations of colour than is currently possible. The WCG defined in BT.2020 is similar to a part of the cinema's industry's DCI specification known as P3, something that today is only supported by laser projection systems (of which there are only a handful in use), but over time will become more important. Currently, there is no TV display available that can achieve all the

features of BT.2020, and this is likely to be the case for some time yet.

BT.2020 is actually a 'family' of specifications, for which the DVB Project has created the more user-friendly definition UHD-1 Phase 2. The plan is to move to this enhanced feature set sometime between 2016 and 2018. The devil, though, is in the detail because a 'family' in this instance means there are several options, always a dangerous scenario where propositions involving consumers are concerned. Unless a clearly defined specification is published and set in stone, when given a choice CE manufacturers will almost always pick the lowest (read cheapest) specification they can get away with. Most early HDTVs were less than 'Full HD' (1080p) until costs fell low enough for them to be offered as standard.

DigitalEurope, whose predecessor EICTA created the 'HD/HD Ready' logos adopted by the CE industry in Europe, recently unveiled an 'Ultra HD' logo along with a minimum specification CE manufacturers will need to meet in order to use the logo. Unlike the initial HD Ready specification – where 'HD' was defined as a minimum of 1280 x 720 pixels and there was no obligation to support 1920 x 1080 – the only way to qualify for the 'Ultra HD' logo is by providing the full 3840 x 2160 resolution. However, support for frame rates in excess of 60p, the higher dynamic range offered by increasing the number of bits per pixel, and a colour gamut wider than the ITU's previous BT.709 specification used by HDTV today, are all optional. >>

ULTRA HD

Will broadcasters wait for Phase 2?

>> Whatever flavour of Phase 2 is ultimately chosen by the broadcasters, it will require a higher overall data rate. Fortunately the new HEVC (High Efficiency Video Coding) compression standard is able to reduce the amount of data needed to broadcast UHD-1 to the home over satellite, cable or terrestrial TV to a more manageable rate.

Broadcasters are less fortunate because ideally they need to handle video in its uncompressed state. At the studio level, today's uncompressed HDTV requires around 1.5 gigabits per second (Gbps); by raising the frame rate to 120fps and increasing the number of bits per pixel to achieve HDR and WGC, something approaching 30 Gbps could be needed. Significant investment to upgrade existing facilities will therefore be required – for many in secondary markets who are still managing the transition from SD to HDTV this will be some way off.

Even broadcasters in primary markets such as the US and Western Europe are not rushing headlong into this next generation of TV. Sky Deutschland's Head of Innovations & Standards, Technology, Stephan Heimbecher, speaking at the 2014 PEVE conference in London, gave the clearest indication yet that his company would be unlikely to launch an Ultra High Definition TV service based on the DVB's Phase 1 specification. The extensive trials they have conducted indicate clearly that simply upping the pixel count is not enough to create the compelling user experience they need to attract more than just early adopters. The strong impression given by Heimbecher was that his company would wait for Phase 2 to be ratified. A recent BBC R&D presentation to a Royal Television Society meeting in London delivered a similar message.

The fact that all the broadcast equipment needed to deliver Phase 2's higher quality pictures is not yet available is of course another good reason for not rushing into a UHD service. It's also an opportunity for broadcasters and their equipment suppliers to try out new infrastructure options such as high-speed IP networks to replace the now long-in-the-tooth SDI-based interconnectivity used today.

Some additional breathing space will also provide broadcasters with much needed time to build a library of material ahead of a launch, as was the case with HD. And it's not just the equipment that must be upgraded: scenery has to be more detailed, another lesson learned during the migration from SD to HD.

4K Blu-ray

Streaming is being touted as a way to deliver 4K material to consumers, at least until broadcasters are ready to begin offering services. Another option, already adopted by Sony, is to provide a selection of material pre-loaded onto a media player and top that up with additional paid-for downloads. The latter is entirely practical, but streaming will depend heavily on local network constraints, particularly if HDR and WDG are to be offered alongside higher resolution.

The BBC conducted a successful streaming experiment of UHD-1 Phase 1 during the Commonwealth Games this summer, but it required a broadband connection of 15 Mbps. Bandwidth limitations outside a few markets therefore puts physical media firmly back on the agenda and is undoubtedly why the Blu-ray Disc Association is pushing ahead with plans to launch 4K Blu-ray, probably during the latter part of 2015. Video will be encoded using HEVC and, as I predicted in last year's *DVD and Beyond*, the format is



Sony 4K Media Player FMP-X1

being extended to include a 66GB 2-layer version, as well as a new 100 GB disc.

4K Blu-ray is being future-proofed to a certain extent with the addition of higher dynamic range (up to 10-bits from 8-bits) and frame rates up to 60fps, as well as support for the extended colour gamut offered by the BT.2020 specification – although as mentioned earlier, the latter is not capable of being displayed on any consumer TV on the market today.

Do we actually need more pixels?

The various investigations into the visual impact of HDR and WDR have thrown up an interesting fact: when the same parameters are applied to HD 1080p the effect of these enhancements on perceived quality is not only significant, but potentially has more impact than just raising the pixel count.

However, whilst this option could provide a potentially sizeable cost saving for broadcasters, it would be a stake through the heart of those in the Consumer Electronics industry who see UHD as their salvation when it comes to reinvigorating an otherwise stagnant market. Marketing 'enhanced HD' as a value-add worthy of additional cost would be a much harder task.

UHD-2 waiting in the wings

Potentially the biggest threat to UHD-1 comes

from UHD-2. While the European Broadcasting Union and its members, and their opposite numbers in the US, deliberate over the optimum timescale for the introduction of UHD-1 Phase 2, the Japanese are pushing ahead with the development of the '8K' UHD-2 / Super HiVision format. This is already at a fairly advanced stage, and in fact nine matches were produced in SHV at the World Cup earlier this year (compared with only three shot in UHD-1).

Originally slated to launch in 2025, the target is now the 2020 Tokyo Olympic Games. The current plan is to have a pilot service running in Japan by 2018, ahead of a full launch in time for the start of the Games.

Super HiVision introduces a number of new production and technical challenges, many of which are still being worked through. The viewing experience for the consumer is also somewhat different from that provided by UHD-1, being more immersive than that delivered by even a large screen 4K TV display. An analogy might be IMAX compared with a regular cinema screen. Replaying the accompanying 22.2 channel audio track will also present a challenge for those with limited space in their living rooms!

But, if UHD-1 Phase 2 isn't ready for launch in Europe and the US until 2018, and UHD-2 is ready to go by then, will manufacturers still want to sell UHD-1's lower resolution, or will they move on to the potentially more lucrative market offered by UHD-2? From the broadcasters' perspective, should they simply skip UHD-1 altogether and put their investment into UHD-2, which can always be downscaled to deliver '4K' or HD pictures to legacy TVs?

Pity the poor consumer

So, where does all this leave those consumers who are splashing out large amounts of cash on new 4K TVs today?

Given that no decisions have been made as to which elements of UHD-1 Phase 2 might be offered by broadcasters, compatibility with Phase 1 TVs is by no means assured. The degree of obsolescence will depend largely on when the TV was purchased and the level of future-proofing included by the manufacturer.

Sony, for example, stated at IFA 2103 that the displays it introduced at that show would be firmware upgradable to HDMI 2.0, and it's likely the other A-brands have a similar strategy, but whether any of those Chinese manufactured sub-\$1,000 sets offer that facility is debatable. If broadcasters decide to adopt frame rates higher than 60fps yet another generation of HDMI will be needed and the goal posts move again.

And, of course, none of the above takes into account the possibility that broadcasters may jump directly to UHD-2. ■



BILL FOSTER provides a technology radar service to those seeking a clear vision through today's era of rapid technological change in the media and entertainment industries. Contact: bill@digital-decoded.com