TV TechCheck
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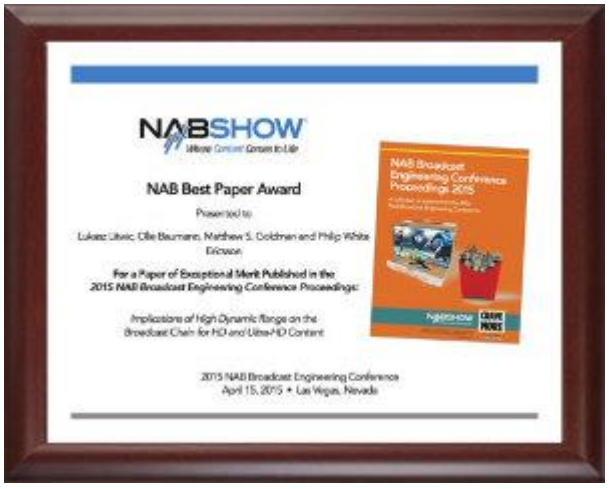
# NAB's Best Paper Award Presented to Ericsson for Research on High Dynamic Range (HDR) Technology




High Dynamic Range (HDR) is one of the important tools for defining next generation television systems. In short, HDR technology allows the simultaneous presence on a display of both lowlights (e.g., details in deep shadows) and highlights (e.g., clouds in a bright sunny day). In current systems, one or both of these ends of the dynamic range "spectrum" may be lost. A session entitled " *Next Generation Television*" at this year's NAB Broadcast Engineering Conference (BEC, April 11-16, 2015, Las Vegas, NV) on Sunday April 12 included a paper, excerpted here, describing an overview of techniques used to provide an immersive viewing experience and offering some insight into the question of what bitrates will be required to provide HDR services using existing video compression technology. The paper is entitled " *Implications of High Dynamic Range on the Broadcast Chain for HD and Ultra-HD Content ,"* and is authored by Lukasz Litwic, Olie Baumann, Matthew S. Goldman and Philip White, all from Ericsson.

This paper exemplifies all the target metrics for excellence desired for publication in the NAB BEC Proceedings. At the NAB Technology Luncheon on April 15 in Las Vegas, the authors of the paper were honored with the NAB Best Paper Award.

BEC Conference Committee Chairman Larry Oaks (VP of Technology at Meredith LMG) presents the NAB Best Paper Award to Ericsson co-authors Lukasz Litwic and Matthew S. Goldman.

Below is an excerpt from the paper:

*"High Dynamic Range: The Ultimate Experience?*
*The human visual system is much more sensitive to luminance (brightness) than it is to chrominance (color),with an extremely wide dynamic range of approximately one million to one (a contrast ratio of the luminance of the brightest object to that of the darkest) [6]. The HVS dynamic range can discern from 105 cd/m 2 (candelas per square meter or "nits" of luminance) bright sunlight to 10 -4 cd/m 2 dim starlight. It is highly complex, adaptive and not fully understood in terms of television viewing. Unlike increased resolution, which works best on a very large screen, increasing the dynamic range that a viewer can see is equally applicable to any screen size, as well as with resolutions less than UHD.*

*The production standard for consumer video, however, has not been changed since the physics of cathode ray tubes (CRTs) were first documented in the 1930s, including setting the peak white level to 100 nits. Although modern video cameras can capture a very wide dynamic range and the very latest HDTVs claim maximum peak output in the range 400-1,200 nits, TV production standards have not been updated as of yet. Reduced dynamic range translates to the inability to see both lowlights (e.g., details in deep shadows) and highlights (e.g., clouds in a bright sunny day) simultaneously; one or the other will be "lost". The impact of reduced dynamic range particularly is noticeable for specular reflections, such as sunlight reflecting off of the surface of water or metal; with HDR, such light usually causes a physiological response in the viewer ("feeling" the light, including squinting of the eyes, for example).*

FIGURE 4A. EXAMPLE OF LOWLIGHT STANDARD DYNAMIC RANGE. [7]

*The impact of HDR is difficult to represent without a high output active light source such as a studio reference monitor designed for this purpose. However, the concept can be expressed by simulating HDR through the combination of multiple exposures of the same image (albeit without the dramatic impact of specular reflections). Figure 4a shows a scene of the Gateway Arch with lowlight exposure. Note that the central building is crushed.*

*In Figure 4b, the exposure is adjusted for proper highlights, so that the building is reproduced properly, but now the detail on the buildings and in the sky are no longer visible.*

FIGURE 4B. EXAMPLE OF HIGHLIGHT STANDARD DYNAMIC RANGE. [7]

FIGURE 4C. EXAMPLE OF HIGH DYNAMIC RANGE, SIMULATED BY TONE. [7]

*In each of these cases, the standard dynamic range (SDR) is not capable of reproducing both dark and light areas simultaneously. Figure 4c simulates how an HDR image would be represented, which more closely resembles the realism that the human visual system provides.*

*Demonstrations of the benefit of HDR over the past two years have convinced standards development organizations to study how to specify this new dimension of immersion into the TV viewing experience. Significant benefits have been shown for not only UHD but also HD resolutions, resulting in many believing that HDR is arguably* ***the*** *most important new development for TV."*

A complete copy of the Ericsson paper on HDR is included in the 2015 NAB BEC Proceedings, available for purchase online as a USB drive (printed book and CD-ROM formats are no longer available) at the NAB Store. The BEC Proceedings is over 500 pages with 61 papers included that were presented at the 2015 BEC.