

# INTRODUCING JPEG 2000

JPEG 2000 is an increasingly popular Discrete Wavelet Transform (DWT) based compression method. Current Ericsson solutions use Discrete Cosine Transform (DCT) based compression; DCT is not 'better' or 'worse' than DWT but there are fundamental differences. These differences create operational and commercial implications, discussed throughout this paper.

# STUDIO QUALITY CONTENT OVER IP NETWORKS

Live news, sports and entertainment is a key aspect of broadcast profitability, driving valuable advertising and sponsorship revenue. Now Ericsson is adding JPEG 2000 technology to our DSNG and Contribution products, offering broadcasters high quality and low latency, over increasingly available low-cost fibre connections.

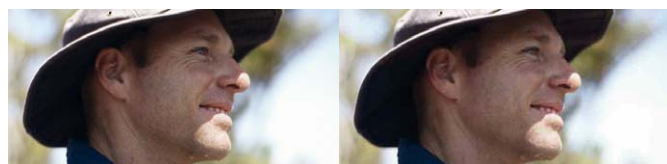
## How does JPEG 2000 work?

DCT compression is based on spatially dividing pictures into blocks. As compression increases, the blocks eventually become visible. However, it's important to note that DCT compression schemes like JPEG or MPEG-2, suffer much more from blocking than newer DCT schemes like AVC-Intra and H.264 /MPEG-4 AVC.

JPEG 2000 does not use blocking. In JPEG 2000, which uses wavelet compression, the whole image is analyzed and then compressed, decomposing picture information by resolution, rather than by blocks. The lower frequencies then have additional decompositions applied in several iterations. This process results in a multi resolution representation of the original image, which has profound operational differences from DCT based systems – as compression levels increase, JPEG 2000 compressed images gradually lose resolution bands, rather than show blocks. So, while DCT compression increasingly shows blocks, JPEG 2000 increasingly softens.

## When does JPEG 2000 look better than DCT based compression?

There is no simple answer to this question and from Ericsson's point of view, it does not make commercial sense to 'take sides'. It seems to be a matter of individual preference, operational context, the kind of DCT compression being used and the kind of content. Here's an example comparing DWT and DCT based compression.



At very low bitrates, most observers will typically prefer JPEG 2000 softening on the left versus conventional JPEG's tendency towards DCT blocking on the right. As the bitrate increases, differences become more subtle.

Blocking is not the only quality difference. JPEG 2000 is 10 bit, describing the image in steps from 0 to 1023. MPEG-2 is only 8 bit, describing the image in steps from 0 to 255. This means JPEG 2000 has greater precision, so less problems with image 'banding' on skies, cycloramas and gradients.



10 bit gradient (left) versus 8 bit gradient (right). Note the 'steps' on the right introduced by the lower quantization.

Furthermore, JPEG 2000 uses 4:2:2 sampling, whereas many MPEG-2 implementations use 4:2:0 sampling. The higher 4:2:2 colour sampling precision of JPEG 2000 can be important to customers, especially when images need subsequent manipulations, such as keying, where a clean edge is required. It also gives JPEG 2000 advantages in complex production signal chains involving multiple encodes and decodes. If 4:2:0 MPEG-2 signals pass through 4:2:2 devices (most production and post production technology is 4:2:2) then the re-sampling process involved causes progressive colour inaccuracies which result in colours looking blurred. By contrast, JPEG 2000 4:2:2 sampling maintains better colour sharpness.

In summary, on image quality alone, compared to MPEG-2, JPEG 2000 is less prone to blocking and more accurately describes the original image.

## Choosing the right compression technology

As we have seen before, each compression technology has its optimal operating point: MPEG-2 is still being used in a vast of legacy deployments, MPEG-4 AVC delivers superb picture quality with high compression efficiency, while JPEG 2000 is suitable for low-latency applications where higher bandwidth is available.

## Why is JPEG 2000 used for backhaul and contribution?

One area which JPEG 2000 deployment is increasing is HD backhaul and contribution over Ethernet. Many Broadcasters and content providers have access to Ethernet networks or other data paths which have reasonable capacity but which cannot handle uncompressed HD-SDI at 1.5 Gbps.

What is needed is a way to keep picture quality high but reduce the data payload to a level that the Ethernet networks can comfortably handle. JPEG 2000 is well suited to this task: well encoded HD programming can be sent at 200 Mbps or less using JPEG 2000. The resulting pictures are almost indistinguishable from the uncompressed originals and multi generation performance is good. Transmission can take advantage of widely available telecommunication links providing a very low cost solution, compared to uncompressed HD-SDI transport.

Since JPEG 2000 has no GOP structure, latency is low and editing is uncomplicated.

## Ericsson JPEG 2000 Solution

We are offering JPEG 2000 compression technology as an option to our widely deployed contribution product portfolio: the Contribution Encoder, the RX8200 Advanced Modular Receiver, and in the future to our market-leading multi-format integrated digital satellite news gathering solution, the Voyager II.



Ericsson's Contribution Encoder will be able to host up to six hot-swappable JPEG 2000 encoding modules, providing maximum flexibility and scalability for broadcasters and service providers with different density needs.

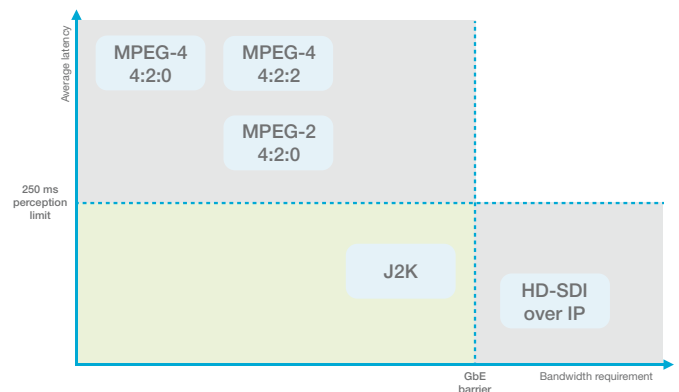


The RX8200 Advanced Modular Receiver will be orderable with JPEG 2000 decoding option for either SD or HD resolution, adding light compression capabilities to its already impressive feature set.



The JPEG 2000 option will be available in our multi-format integrated DSN solution, enabling Voyager II customers to deliver MPEG-2/ MPEG-4/JPEG2000 SD/HD/3G/3D content over satellite or fibre. With the ease of repurposing, broadcasters will be able to maximize their return on investment.

Ericsson technology and thought leadership ensures you get just the right solution for the given problem. Our flexible platforms can be easily customized to your exact needs.



Typical latencies and bandwidth requirements of different technologies, defining the ideal operating point for JPEG 2000: high-quality, low-delay live content over fibre.



Ericsson has the breadth of portfolio and competence to deliver and operate customized end-to-end solutions



Differentiate yourself and increase your revenues by delivering live content



Intuitive user interface design and management system integration helps you bring the most out of your staff



Operate your services confidently, enjoy worldwide Ericsson Support



Minimize total cost of ownership with flexible configuration and ease of repurposing

**Americas**

Ericsson Television Inc.  
4500 River Green Parkway  
Duluth, GA 30096  
USA  
Telephone: +1 678 812 6300  
Fascimile: +1 678 812 6400  
Email:  
tvsalesamericas@ericsson.com  
tvsupportamericas@ericsson.com

**Asia Pacific**

Ericsson Television Limited  
12/F Devon House  
Taikoo Place  
Quarry Bay  
Hong Kong  
Telephone: +852 2590 2388  
Fascimile: +852 2590 9550  
Email:  
tvsalesapac@ericsson.com  
tvsupportapac@ericsson.com

**Australasia**

Ericsson Television Pty Limited  
Building C, 11 Talavera Road  
North Ryde NSW 2113  
Sydney  
Australia  
Telephone: +61 2 9111 4999  
Fascimile: +61 2 9111 4949  
Email:  
tvsalesanz@ericsson.com  
tvsupportanz@ericsson.com

**Europe, Middle East,  
India and Africa**

Ericsson Television Limited  
Strategic Park  
Comines Way  
Hedge End  
Southampton  
Hampshire  
SO30 4DA  
United Kingdom  
Telephone: +44 (0)23 8048 4666  
Fascimile: +44 (0)23 8048 4667  
Email:  
tvsalesemea@ericsson.com  
tvsupportemea@ericsson.com

The content of this document is subject to revision without notice due to continued progress in methodology, design and manufacturing. Ericsson shall have no liability for any error or damage of any kind resulting from the use of this document.