4K & DVB-S2X – HOW OPERATORS CAN BE COST-EFFECTIVE

Introduction

Beyond four times (4K) the resolution of High Definition (HD) video, true Ultra HD (UHD) delivers a more immersive viewing experience, **boosting picture detail and sharpness**, as well as providing more **realistic and richer colors**.

Until recently, the UHD market has mainly been driven by TV manufacturers. Now it is set to expand, providing opportunities for the whole value chain from content suppliers through to service providers and equipment manufacturers.

But with capacity already at a premium due to trends like HD video generating high bitrate streams, is the satellite industry ready to cope with a UHD world?

DIALOG

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4K UHD

Broadcasting HD requires more bandwidth than broadcasting in Standard Definition (SD), even if more efficient coding (H.264/AVC) is used.

In order to launch 4K channels, again more bandwidth is required, as the efficiencies introduced by even more efficient coding (H.265/HEVC) are outweighed by the significantly higher resolution. Where an HD channel may require an average of up to 5 Mbps, the same channel in UHD may require up to 20 Mbps.

This is a challenge which broadcasters, satellite operators and satellite service providers need to address as the uptake of 4K UHD begins to gather pace.

DVB-S2X

The transmission standard, DVB-S2X, and High Efficiency Video Coding (HEVC) are just two examples of technologies which the satellite industry needs to consider investing in.

In comparison with DVB-S2, DVB-S2X results in an efficiency gain of between 15% and 30% in a typical distribution network (including DTH), increasing to up to 51% in selected contribution networks; see **Figure 1**. This exceeds the results from proprietary systems available today.

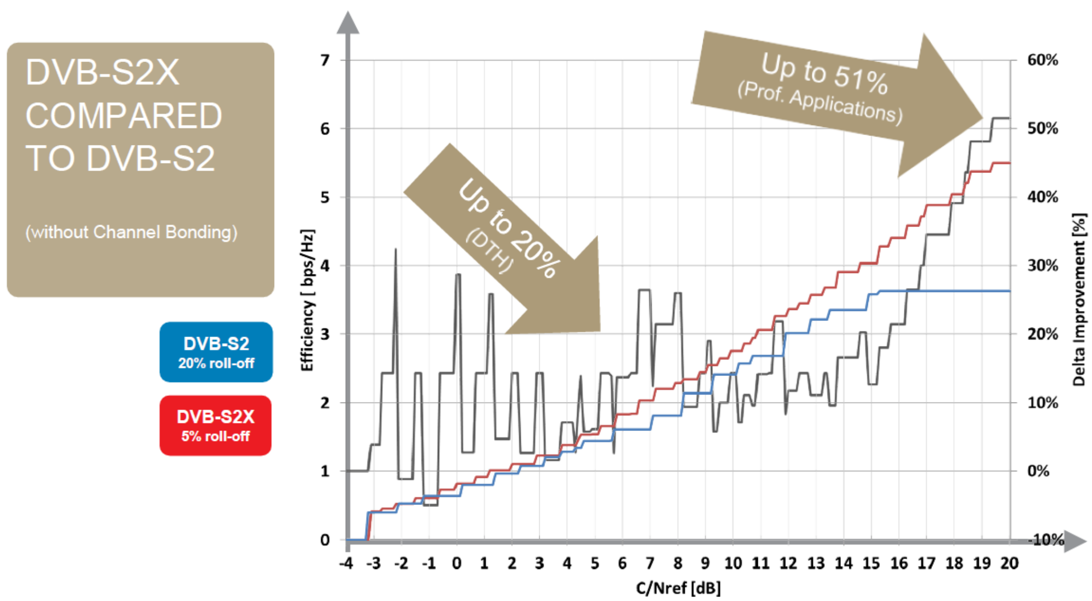
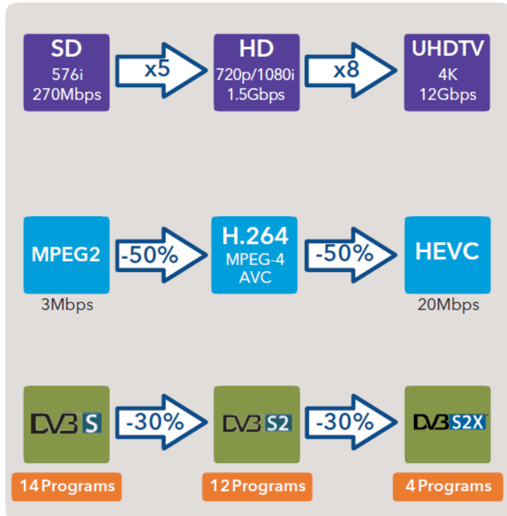


Figure 1: DVB-S2X achieves efficiency gains of between 15% and 30% in a typical distribution network (including DTH), increasing to up to 51% in selected contribution networks



4K UHD Requirements

Improvements include smaller roll-offs, advanced filtering of satellite carriers and increased granularity in MODulation and CODing schemes (MODCODs). It also features higher order modulation (64/128/256APSK) support, linear and non-linear MODCODs, better implementation of MODCODs and wideband support, as well as very low Signal-to-Noise Ratio (SNR) support for mobile applications, channel bonding and additional standard scrambling sequences to mitigate co-channel-interference.

As shown in **Figure 2**, the advantages of efficiency technologies can be stacked, which leads to more bandwidth, better picture quality, additional channels, a higher link margin or an increased satellite footprint.

For content contribution and primary distribution to remote headends or DTT towers, where both transmission and reception equipment is of professional grade, upgrading the equipment to the DVB-S2X standard already makes sense today, as the reduction of satellite Operational Expenditure (OPEX) significantly outweighs any Capital Expenditure (CAPEX) of swapping modems. By making use of DVB-S2X/DVB-S2 (or DVB-S2X/DVB-S) transmodulation, the installed base of existing IRDs may be preserved, effectively allowing operators to decouple the modulation migration to DVB-S2X from the coding migration, for example, from AVC to HEVC; see **Figure 3**.

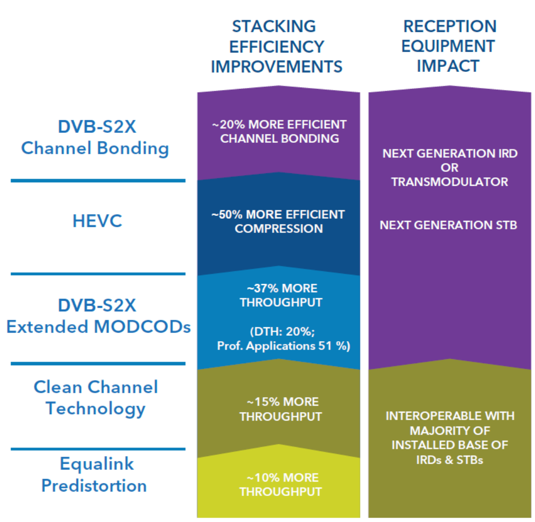


Figure 2: Stacking Efficiency Improvements & Reception Equipment Impact

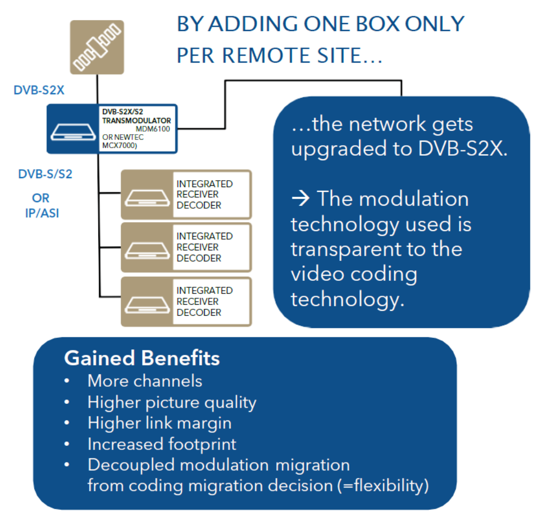


Figure 3: Adding a DVB-S2X/S2 Transmodulation Device

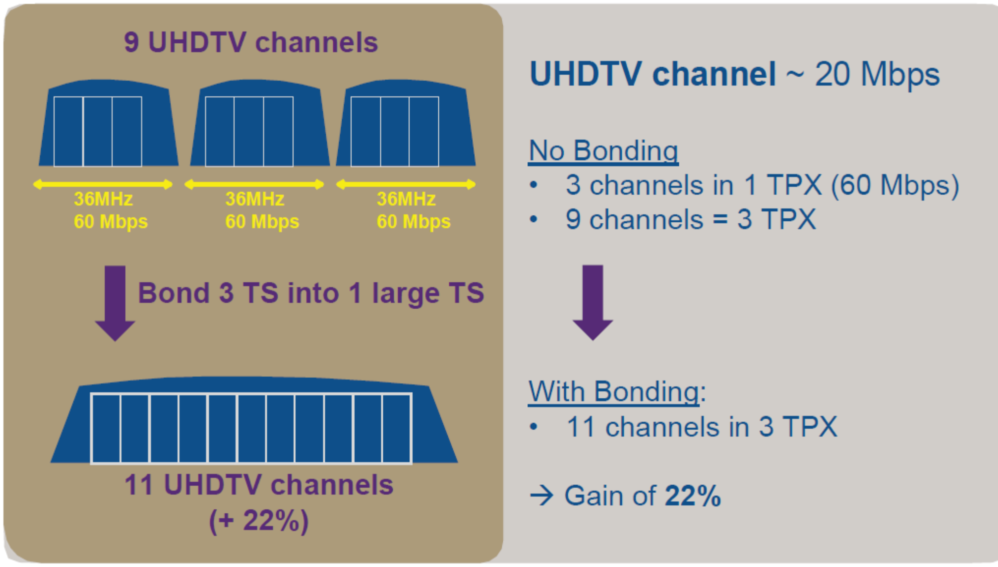


Figure 4: Channel Bonding Example Calculation

In the case of DTH, as new set-top boxes are required to receive 4K and benefit from HEVC anyway, it is only logical to go for one which is also DVB-S2X compatible as soon as possible. This is reinforced by the fact that chipsets supporting DVB-S2X are becoming available.

Channel Bonding and Wideband

Within the improvements DVB-S2X delivers, channel bonding is particularly important.

A single high bitrate transport stream is created, whereby channels are statistically multiplexed. Channel bonding allows this single stream to be distributed over up to three transponders, treating them as if it was a single one. This operation dramatically increases the efficiency of a broadcaster's operations.

Under the assumption a UHD channel requires about 20 Mbps (see **Figure 4**), in a traditional 36 MHz transponder it is possible to transmit about three UHD channels, totalling about 60 Mbps. The statistical multiplexing gain obtained by multiplexing three channels is fairly low. When spanning three transponders, a total of nine channels can be hosted.

With DVB-S2X channel bonding, the accumulated gain provided by statistical multiplexing will allow broadcasters to host up to 11 channels on three transponders.

Another important improvement of the DVB-S2X standard is that it supports technology for typical wideband transponders, which are available today to host high-speed data links. The wideband implementation in DVB-S2X typically addresses satellite transponders with bandwidths up to several hundred MHz ranging from C- to Ka-band and High Throughput Satellites (HTS).

DVB-S2X with 256APSK Is a Reality

Perhaps the most exciting part of DVB-S2X is that the benefits it brings are already being demonstrated by and delivered to a number of broadcasters.

The world's first DVB-S2X 256APSK satellite transmission, for example, was successfully completed by Japan-based Nippon Television Network Corporation (Nippon TV) with ST Engineering iDirect technology see **Figure 5** '256APSK Constellation Diagram'.

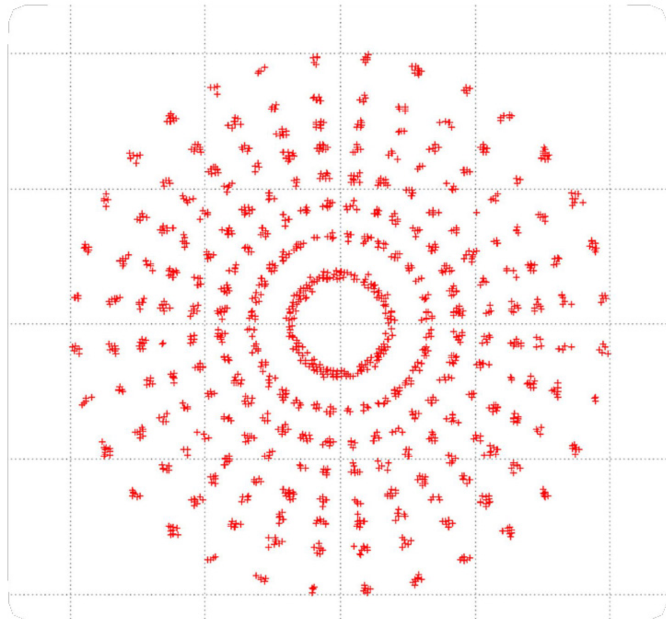


Figure 5: 256APSK Constellation Diagram

The test followed Nippon TV's interest in the DVB-S2X modulation standard for its next-generation video network over Japan. Considering the benefit of the 5% roll-off technology that saves satellite bandwidth, Nippon TV wanted to establish the feasibility of using this higher modulation and see if the associated challenges could be overcome.

Nippon TV transmitted a 256APSK carrier in a 5 MHz slot from an SNG truck to JSAT's Superbird-B2 satellite. The transmission was successfully received at Nippon TV's headquarters in Minato, Tokyo.

The MDM6100 Broadcast Satellite Modems transmitted 25 Mbps from the SNG truck using a 1.4m antenna, which was received on a 5m dish at the TV station.

Improving Performance on Top of DVB-S2X

Equalink 3®, a technique used on the MDM6100 Broadcast Satellite Modem for linear and non-linear predistortion, can also bring efficiency gains on top of DVB- S2X by improving the performance on set-top boxes, both with and without receiver equalizers. The gain – QPSK 5/6 DVB-S2 MODCOD is 0.4 dB with receiver equalizer and 0.6 dB without receiver equalizer – can be applied to increase the link availability or increase symbol rate, while reducing the modulator roll-off. In the latter case, the additional link margin is used to compensate for the decrease of the power spectral density of the carrier, driven by the increase of the symbol rate under fixed uplink power.

Typical results show increased bandwidth efficiency of 7% (in the case of a receive equalizer) and 10% (in the case of a receiver without equalizer). The gain is larger for higher MODCODs, for example, 15% in the case of 8PSK 5/6 MODOCD with equalizer. The performance depends on the non-linear characteristics of the transponder, its IMUX and OMUX filters characteristics and the MODCOD used.

The additional throughput Equalink provides equates to up to 15% more TV channels in a DTH carrier.

CONCLUSION

By choosing the right technologies, operators can accommodate increased profitability, interoperability and growth in the satellite communications market – all of which is particularly relevant when talking about delivering UHDTV.

The combination of the technologies implemented on DVB-S2X result in an efficiency optimization of up to 51% in a professional satellite link. For DTH networks, the average gain will be around 20%, even when the gains from channel bonding are excluded.

Indeed, if UHD is to become as popular as HD, DVB-S2X will be essential in guaranteeing the best performance with barrier-breaking throughputs at optimal service availability.

For many years, ST Engineering iDirect has supported the DVB-S2X standard across its portfolio of professional modulators, demodulators, modems (6000 & 7000 series) and hubs (HUB6000). DVB-S2X is also supported by the Newtec Dialog® Multiservice Broadcast (MSBC) solution.

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