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Reducing Transmission Costs with DVB-S2

White Paper

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For broadcasters and network operators worldwide, bandwidth costs represent a burdensome business expense. DVB-S2, with its high spectral-efficiency, significantly reduces the amount of spectrum needed to transmit content and can potentially save broadcasters and network operators millions of dollars on spectrum leasing costs. Return on investment (ROI) on DVB-S2 solutions often exceeds the initial capital expenditure in a matter of months.

DVB-S2 is a new transmission standard that replaces both DVB-S and DVB-DSNG. Its second-generation framing structure, channel coding and modulation systems provide spectral efficiency so close to the theoretical Shannon limit that it is unlikely to be superseded in the near future.

DVB-S2's higher spectral efficiency enables bandwidth savings of up to 30% and margin gain of up to 2.5 dB. A number of factors and capabilities contribute to these exceptional efficiency gains:

- QPSK, 8PSK, 16APSK and 32APSK modulation schemes, ranging in spectrum efficiency up to 5 bit/s/Hz and optimized for operation over non-linear transponders
- Code rates ranging from 1/4 up to 9/10
- A choice of 0.2%, 0.25% and 0.35% spectrum shaping factors
- A powerful, low-overhead FEC system that allows quasi-error-free operation at about 0.7dB to 1dB from the Shannon limit.
- Variable Coding and Modulation (VCM) provides differential error protection and modulation for selected service components or transport streams.
- DVB-S2 enables more than one transport stream to be transmitted in the same carrier, with each stream using the most suitable modulation scheme.

Upgrading to DVB-S2 requires an investment in equipment. Modulators must be replaced with DVB-S2 compatible equipment on the transmission end. In order to receive DVB-S2 content, compatible professional receivers are necessary. DBS subscribers must have DVB-S2 set-top boxes to receive DVB-S2 broadcasts.

In most cases, however, broadcasters save so much on spectrum expense – and save it so quickly - that the expense is soon recouped. For contribution, distribution, DSNG or complete network solutions, return on investment in DVB-S2 solutions is surprisingly fast.

Whether an operator uses DVB-S for DSNG or fixed-point contribution, or for distribution to cable, terrestrial or DBS systems, switching to DVB-S2 can substantially reduce the amount of spectrum needed—and the bandwidth expense.

Below are a few examples that illustrate just how great the savings can be and how quickly investment in a DVB-S2 can be returned.

EXAMPLE 1: DSNG

For a studio or network that transmits content from remote locations on an occasional basis, switching from DVB-S to DVB-S2 means

significant savings on bandwidth cost—or the ability to substantially increase the amount of content transmitted at no additional expense.

For example, a broadcaster leases 18 MHz of spectrum on an as-needed basis, with three DSNG units each transmitting on 6 MHz. Each DSNG unit transmits a single channel at a bit-rate of 6.8 Mbps, using DVB-S QPSK modulation, 7/8 FEC and 35% roll-off. Total bandwidth for each channel is 6.0 MHz (5.7 MHz video and 0.3 MHz for audio communication with the studio). The (Eb/N0) required by the standard is 6.4 dB, but to be conservative, we will use 6.1 dB. Expressed in terms of carrier to noise ratio (C/N), it is 8.176 dB.

By upgrading to DVB-S2, the broadcaster can reduce the bandwidth cost of transmitting the three channels--or transmit an additional channel at the same cost. Using 8PSK modulation, 2/3 FEC and 20% roll-off, with pilots on, the bandwidth required to transmit one channel with DVB-S2 is 4.5 MHz (4.2 MHz for video and 0.3 MHz for audio communication with the studio). This represents a 25% bandwidth savings versus the 6 MHz required to transmit the same content under DVB-S. The link budget (C/N) under this scenario is 7.92 dB, below the 8.176 dB for DVB-S.

Thus, simply by switching from DVB-S, the broadcaster can transmit content from four DSNG units on same 18 MHz bandwidth—at the same cost--on which only three units could previously transmit. Alternatively, the broadcaster might choose to continue broadcasting only three channels and reduce bandwidth costs by 25%.

Let's assume that each DSNG unit transmits for three hours about 60 times each year, for a total of 540 hours of transmission time each year. At a cost of $300 per Mhz per hour, reducing required bandwidth by 4.5 MHz translates to annual savings of $729,000. Savings over the expected five year life cycle will reach almost $3.65 million.

EXAMPLE 2: SATELLITE DISTRIBUTION TO DVB-T TRANSMITTERS

Because of the discrepancy between the 36 MHz bandwidth of satellite transponders and the required bandwidth for one 24 Mbps DVB-T transport stream, it is extremely difficult to utilize satellite bandwidth efficiently for distribution to DVB-T systems using DVB-S. DVB-S2 addresses this problem, resulting in savings on spectrum of 50%.

Using DVB-S, a 36 MHz transponder transmitting with QPSK and 2/3 FEC has a useable bit-rate of 32.77 Mbps and a carrier to noise ratio (C/N) of 6 dB. However, because a typical DVB-T transport stream is 24 Mbps, over 36% of useable bandwidth is wasted.

DVB-S2's VCM dual-transport capabilities effectively provide double the useable bandwidth vis a vis DVB-S, enabling two 24 Mbps transport streams to be transmitted over the same 36 MHz transponder, for a total of 48 Mbps.

Using QPSK, 5/6 FEC and 25% roll-off and variable content modulation, DVB-S2 can simultaneously transmit two 24 Mbps transport streams on a single 36 MHz transponder, for a total of 48 Mbps. The C/N is 5.98 dB, below the 6 dB level for DVB-S transmission.

While the usable bit-rate increases by 45%, from 32.77 Mbps to 48 Mbps, the effective bit-rate doubles, from 24 Mbps to 48 Mbps. Thus the broadcaster only needs to lease one transponder rather than the two needed with DVB-S.At a satellite transponder rental cost of $9000 per MHz per month, the broadcaster saves $3.89 million each year by reducing the number of transponders needed.

Whether installing a new DVB-T system or upgrading existing infrastructure, smart money goes with DVB-S2. While DVB-S2 modulators and receivers are somewhat more costly than DVB-S equipment, a new DVB-S2 solution will cost less than a DVB-S solution since, with both transport streams transmitting over a single transponder, only one IRD is needed for each receiving site.

In our example, ROI for upgrading from DVB-S to DVB-S2 is less than one year for a system with 200 receiving sites. With savings over the projected five-year lifecycle of almost $20 million, upgrading to DVB-S2 is clearly the right choice.

EXAMPLE 3: SATELLITE DISTRIBUTION TO SMALL CABLE OPERATORS

Broadcasters that distribute content to very small cable operators have developed "headends-in-the-sky" (HITS) that provide complete ready-to-transport bouquets that the operators only need to transmodulate to QAM.

In order to provide this service in the most cost-effective—and profitable—manner possible, costly satellite bandwidth must be fully exploited. Local cable infrastructure is generally 256 QAM, with a transmission rate of 55.616 Mbps and a useable bit-rate of 50.981 Mbps. Using DVB-S, with QPSK and 3/4 FEC, 38 Mbps can be transmitted over a 36MHz transponder. 50 MHz is needed to transmit the complete 50.981 Mbps transport stream, at an annual cost of $5.4 million.

With DVB-S2, the 36 MHz transponder can achieve a total bit-rate of 52.995 Mbps by using QPSK with 8/9 FEC, a 20% roll-off factor and C/N of 6.4 dB. Thus using DVB-S2 increases transponder bit-rate by almost 40% and enables all necessary content to be transmitted over a single transponder. The complete HITS transport stream can thus be transmitted over a single transponder at an annual cost of $3.888 million, for annual savings of $1.512 million. Because the bandwidth savings are so substantial, the higher investment for DVB-S2 versus DVB-S equipment is returned almost immediately:

DVB-S2 enables network operators and broadcasters increase the bandwidth efficiency of costly spectrum. For both contribution and distribution applications, the savings from switching from DVB-S to DVB-S2 are often so substantial that ROI on upgrading encoders, decoders and modulators to DVB-S2 is often achieved in a matter of months.