DVB-S2 and the Radyne ComStream DM240

White Paper

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Background

DVB-S standard has paved the way for effective distribution of digital video broadcasts and interactive services since it was adopted in 1994. The broadcast industry has firmly adapted to the format because it established a universal framework for MPEG-2 based digital television services to be broadcast over satellite using Viterbi concatenated with Reed-Solomon FEC and QPSK modulation. In 1999, the DVB-S standard was extended and became the DVB-DSNG standard. This newer standard allowed for more efficient modes of modulation (such as 8PSK and 16QAM) to be utilized. Introducing the higher order modulation resulted in overall savings in bandwidth but also required an increase of power to achieve similar Eb/No results.

DVB-S2

DVB-S2 standard (EN 302 307) is the next generation DVB standard and is currently implemented and available in Radyne ComStream's DM240-S2 Modulator. Note: The DM240-S2 modulator can operate in either DVB-S or DVB-S2 modes without adding additional software or hardware. At the core of this standard is a powerful Low-Density Parity Check (LDPC) concatenated with Bose-Chaudhuri-Hocquenghem (BCH) coding. The DVB-S2 standard utilizing LDPC and BCH block codes, will replace the DVB-S standard that utilizes Viterbi and Reed-Solomon coding. This will result in performance that is considerably closer to the Shannon Limit [1]. Figure 1 is a block diagram that shows the Radyne ComStream DM240-S2 processing in the modulator.

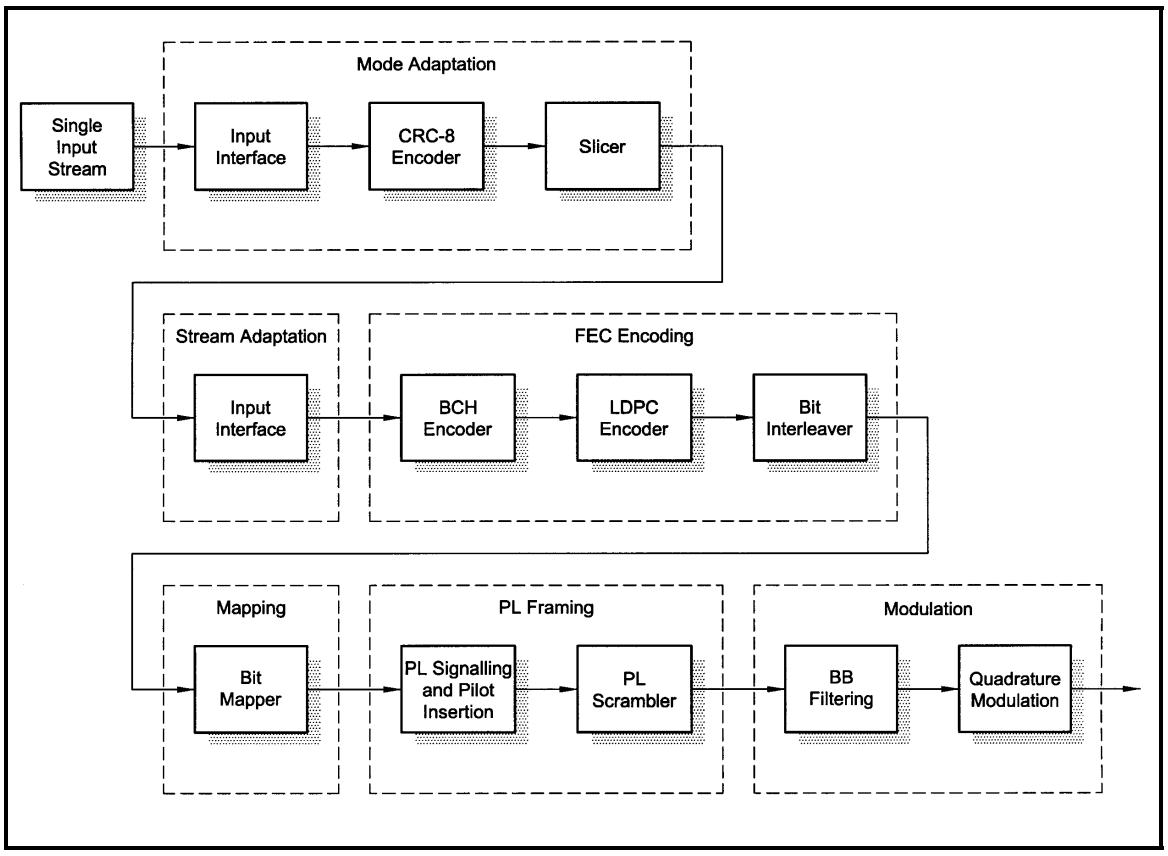

Figure 1. DM240-S2 Modulator Block Diagram

Four main application areas make up the DVB-S2 specification. These include Broadcast Services, Interactive Services, DSNG, and Professional Services. Since DVB-S2 is an open standard, there is no need to rely on proprietary coding solutions to get superior performance. Figure 2 shows a comparison of Spectral Efficiency between the DVB-S and DVB-S2 standards. For the same C/N and symbol rate, there is a 25 - 35% increase in throughput. DVB-S2 also provides additional baseband roll-off options of 0.20, 0.25, as well as the 0.35 used for DVB-S.

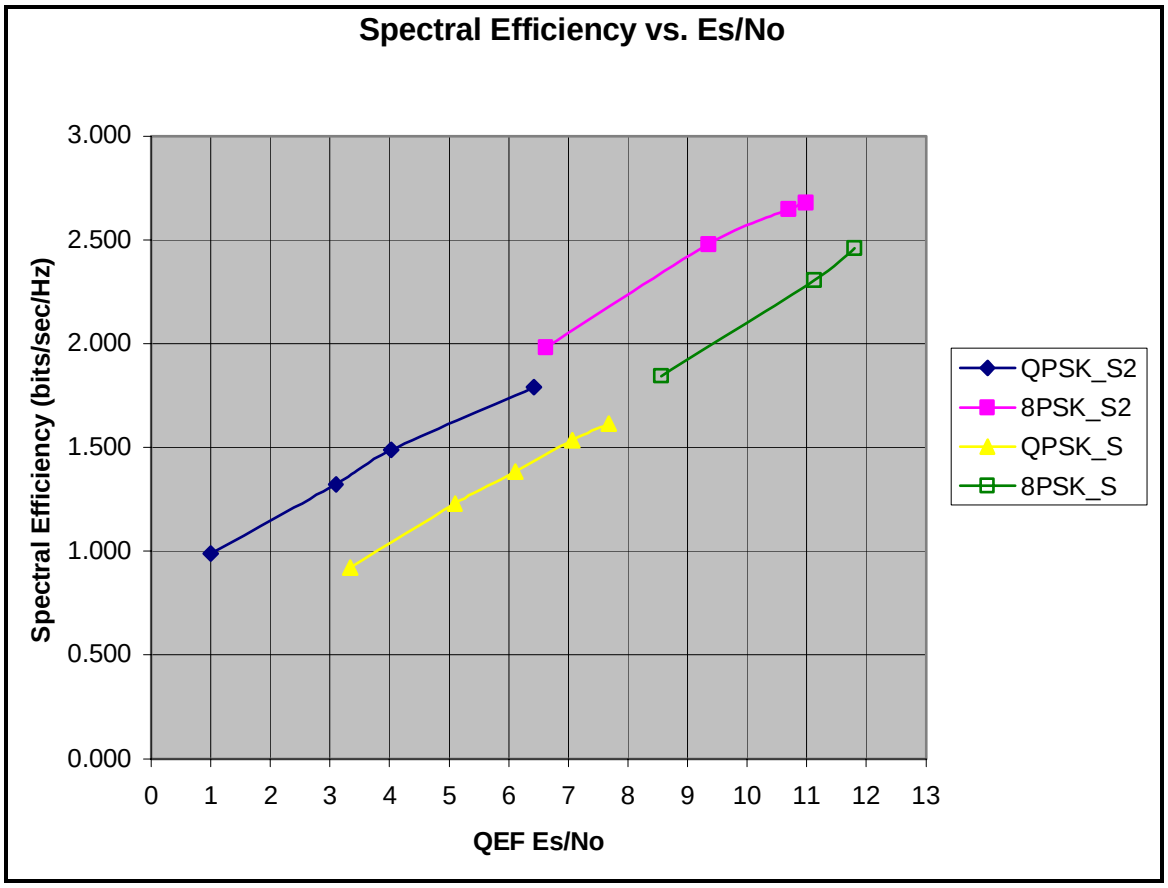

Figure 2. DVB-S2 Spectral Efficiency

The Broadcast Services mode of operation uses a Constant Coding and Modulation (CCM) transmission system. The normative implementation of Broadcast Services mode supported by the DM240-S2 uses a single transport stream input. Operating in this mode allows a variety of FEC rates to be used with the QPSK and 8PSK modulation schemes.

Additionally, the DVB-S2 specification provides features for advanced applications. Features such as multiple inputs modulated into one carrier, Variable Coding and Modulation (VCM) that allows for the modulation type and FEC to be stream dependent, and Adaptive Coding and Modulation (ACM) that will allow for the ability to select appropriate levels of error correction as required for each individual frame. Both of these advanced modes of operation allow the coding and modulation to change on a frame-by-frame basis. As these advanced solutions begin to be utilized, Radyne ComStream's DM240 DVB-S2 Modulator platform will be field upgradeable to implement these modes of operation.

DVB-S2 offers several performance advantages over the preceding DVB-S standard. Figure 3 compares DVB-S and DVB-S2 performance for QPSK and 8PSK modulations with a variety of FEC Rates.

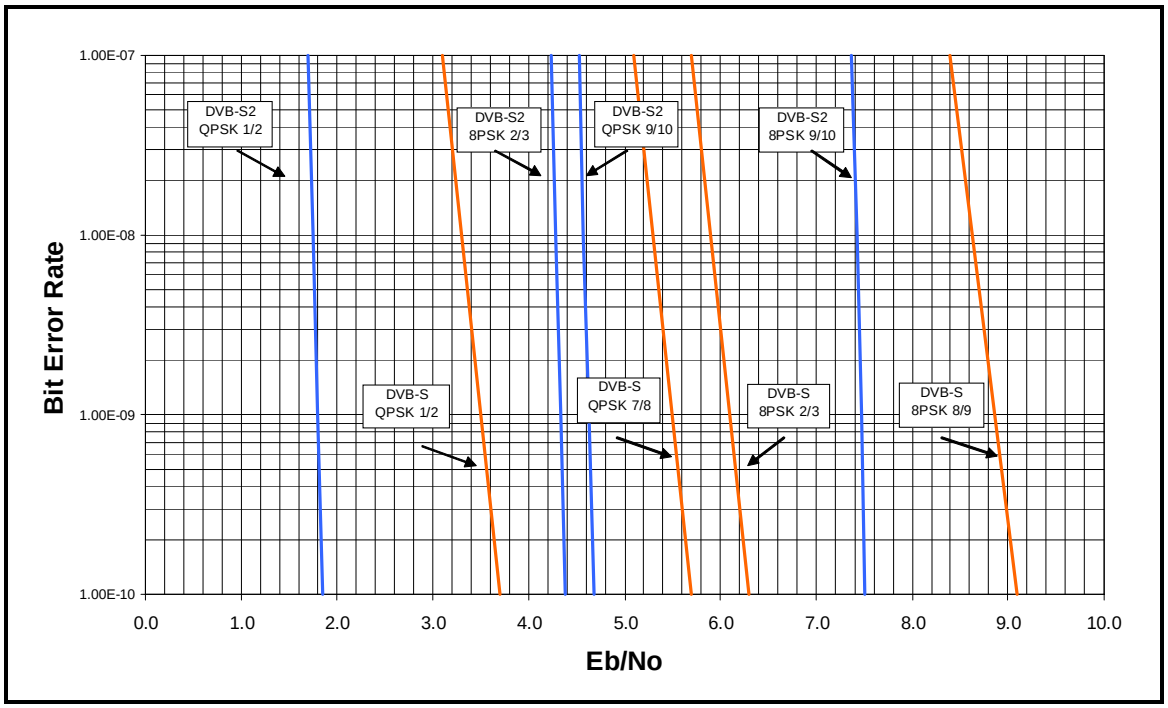

Figure 3. DVB-S vs. DVB-S2 Performance

If we compare 8PSK 2/3 FEC Rate for a 1 x 10^{-9} bit error rate, the required Eb/No level for DVB-S is 6.10 dB vs. 4.35 dB for DVB-S2, equating to a 1.75 dB reduction in required power for the same Eb/No reducing the required spectral power by 28.7%.

For a data rate of 6 Mbps using 8PSK 2/3 FEC Rate, the DVB-S would have a symbol rate of 3.26 Msps, assuming a carrier spacing factor of 1.3, would require 4.23 MHz of bandwidth on the satellite. In comparison, the DVB-S2 would have a symbol rate of 3.03 Msps requiring 3.94 MHz of bandwidth on the satellite resulting in a bandwidth savings of approximately 6.9%.

Conclusion

The DM240-S2 Modulator is available today supporting normative functionality in the Broadcast Services mode. Overall, the increase in performance that DVB-S2 delivers will allow for bandwidth and power savings over the current DVB-S/DSNG standard, resulting in reduced operating costs over the Satellite. The unique architecture of the base DM240 allows for DM240's currently deployed in the field to be upgraded to the newer DVB-S2 mode of operation by installing the DM240-S2 firmware and hardware upgrade kit. As the DVB-S2 standard continues to evolve, and additional advanced systems such as VCM and ACM are required, the DM240-S2 will adapt and allow for these modes to be implemented with firmware and hardware upgrade kits.

Further Information

The DM240-S2 specification can be obtained at www.radn.com

The DVB-S2 standard can be obtained at the DVB website www.dvb.org

References

1. Sklar, Bernard, "Digital Communications", Englewood Cliffs, NJ: Prentice-Hall, Inc., 1988, pp. 387-389.


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