Product Bulletin
March 24, 2009

VersaFEC® Forward Error Correction

Comtech EF Data is pleased to announce the release of VersaFEC®, the next generation Forward Error Correction (FEC). VersaFEC provides maximum coding gain with the lowest possible latency to support cellular backhaul and other latency-sensitive voice, video and data applications.

The release of VersaFEC demonstrates Comtech EF Data's continued leadership in introducing cutting edge technologies to optimize satellite communications.

VersaFEC Forward Error Correction

VersaFEC is a system of short-block, low latency Low Density Parity Check (LDPC) codes designed to support latency-sensitive applications, such as cellular backhaul over satellite. Designed to provide maximum coding gain while minimizing the end-to-end latency, VersaFEC provides an excellent alternative to existing LDPC and DVB-S2 codes.

VersaFEC is designed to:

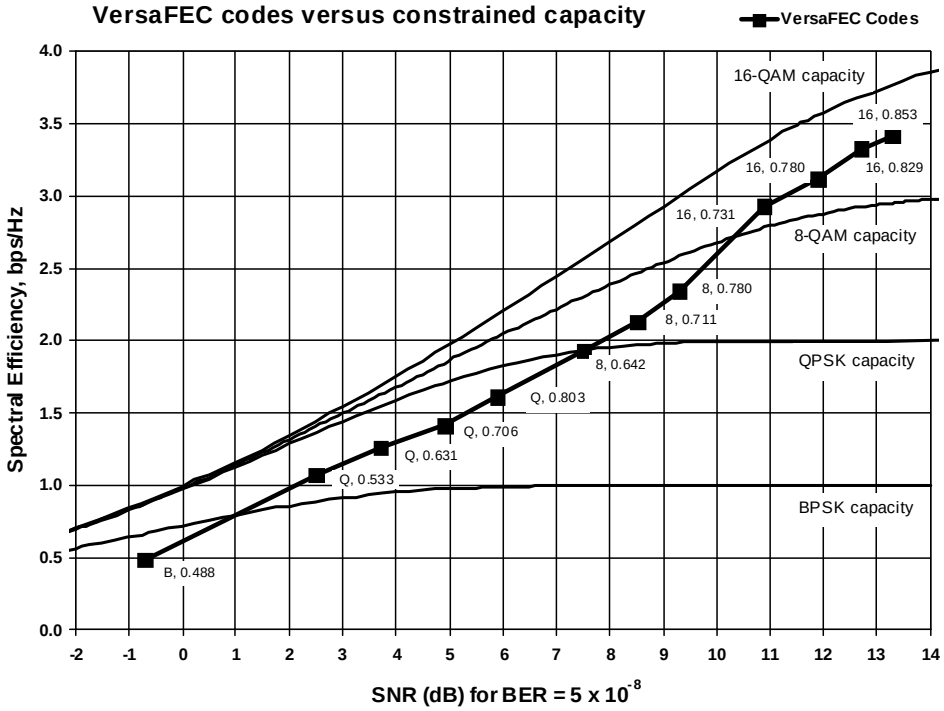
(a) Provide an expanded choice of modulation and code combinations (ModCods). These new combinations provide equivalent coding gains to our existing LDPC offering, and also significantly reduce latency. The existing LDPC codes (as as well as DVB-S2 short-block codes) use 16 kbit blocks, whereas VersaFEC uses blocks ranging from 2 kbits to 8.2 kbits.
(b) Support a patent-pending Adaptive Modulation and Coding (ACM) system. The ModCods have been chosen to provide a continuous progression in terms of Eb/No and spectral efficiency, while reducing latency to near-theoretical minimums.

VersaFEC Coding Performance

VersaFEC includes 12 Modulation and Code sets (ModCods):

Modulation	Code Rate	Spectral efficiency, bps/Hz	Block size, bits	Typical Eb/No, for BER = 5 x 10^{-8}	Latency at 64 kbps, in milliseconds	Min. Data Rate, CCM mode	Max. Data Rate, CCM mode
BPSK	0.488	0.49	2k	2.4 dB	26	18 kbps	5.7 Mbps
QPSK	0.533	1.07	4.1k	2.2 dB	53	20 kbps	10 Mbps
QPSK	0.631	1.26	4.1k	2.7 dB	59	23 kbps	10 Mbps
QPSK	0.706	1.41	4.1k	3.4 dB	62	26 kbps	10 Mbps
QPSK	0.803	1.61	4.1k	3.8 dB	66	28 kbps	12 Mbps
8-QAM	0.642	1.93	6.1k	4.6 dB	89	35 kbps	12 Mbps
8-QAM	0.711	2.13	6.1k	5.2 dB	93	39 kbps	12 Mbps
8-QAM	0.780	2.34	6.1k	5.6 dB	97	43 kbps	12 Mbps
16-QAM	0.731	2.93	8.2k	6.3 dB	125	53 kbps	12 Mbps
16-QAM	0.780	3.12	8.2k	7.0 dB	129	57 kbps	14 Mbps
16-QAM	0.829	3.32	8.2k	7.5 dB	131	60 kbps	14 Mbps
16-QAM	0.853	3.41	8.2k	8.0 dB	132	62 kbps	16 Mbps

The performance of the VersaFEC codes compared with the Shannon Bound is shown in the below Figure. VersaFEC is at or near the DVB-S2 performance with 16 kbit blocks.



Compared to Turbo Product Codes, VersaFEC generally provides 1.0 dB or more reduction in Eb/No. This translates into leased bandwidth savings and reduced BUC/HPA sizes.

Low Latency

VersaFEC is specifically designed for low latency applications. As a comparison, Comtech EF Data's current LDPC Rate 2/3 8-QAM and VersaFEC Rate 0.642 8-QAM provide essentially identical spectral efficiency and Eb/No performance. However, at 64 kbps, the latency has been reduced from 350 milliseconds to 89 milliseconds – a reduction by a factor of 4.

Compared to DVB-S2 short block, the VersaFEC provides a latency reduction of anywhere from a factor of 4 to as much as a factor of 10. E.g. DVB-S2 QPSK Rate 2/3 and VersaFEC QPSK 0.631 have near identical spectral efficiency and Eb/No performance. However, at 64 kbps, the VersaFEC latency is 59 ms compared to over 500 ms for DVB-S2 – a reduction by a factor of over 8.

In addition to using smaller block sizes, to further reduce latency, VersaFEC uses non-interleaved systematic LDPC codes. Compared to DVB-S2's interleaved codes, this achieves a significant reduction in latency. The total end-to-end latency for a high code rate systematic code (such as VersaFEC) asymptotically approaches half the latency of an interleaved code (such as DVB-S2).

Compared to the DVB-S2 short block ACM, VersaFEC ACM could reduce the system latency by as much as one order of magnitude.

Availability

VersaFEC is available as a plug-in module for Comtech EF Data's CDM-625 Advanced Satellite Modem. It can be shipped factory installed or can be field upgraded.

VersaFEC Constant Coding and Modulation (CCM) is available for immediate shipment. VersaFEC ACM mode is planned for release within the next 60 days. Customers with the VersaFEC module will be able to upgrade to ACM without requiring additional hardware.

To learn more about the VersaFEC Forward Error Correction, please refer to the datasheet and user documentation available on our web site, www.comtechefdata.com. To place your order, please contact your Comtech EF Data sales associate.

sales@comtechefdata.com **+1.480.333.2200** **+1.480.333.2540**