Product Bulletin
January 23, 2017

Release 1.5 for CDM-570A/L-IP Satellite Modems

Overview

Comtech EF Data has been a thought leader in the high-end satellite ground equipment market for decades, providing enterprise, maritime and energy users, service providers, MNOs and systems integrators with the most cost-effective backhaul and satellite networking suite for the most demanding fixed and mobile networks. This trend continues with the release of VersaFEC®-2 High Performance LDPC option board for the CDM-570A/L-IP Satellite Modems. The CDM-570A entry-level point-to-point and point-to-multipoint solution provides the efficiency, intelligence and horsepower required to support the ever-increasing demands of enterprise, energy and maritime users.

In addition to VersaFEC-2, Release 1.5 also includes CarrierID based on our MetaCarrier® spread spectrum technology.

VersaFEC-2

A highly evolved version of our industry-leading VersaFEC waveform, the high-performance VersaFEC-2 waveform has been designed from the ground up to provide optimal performance for latency sensitive applications that require the highest coding performance at the lowest latency, providing bandwidth savings from 20-30% over its predecessor. VersaFEC-2 introduces a number of new modulation and coding combinations and a new family of constellations that allows better operation on non-linear satellite channels, outperforming the DVB-S2 standard. This new innovation offers both large block and small block options, providing as much as 80-90% decrease in end-to-end latency compared to DVB-S2/S2X. End-to-end latency significantly affects connection-oriented and interactive applications, either severely reducing the speed and quality of the application or, worse, causing the application not to operate at all. The VersaFEC-2 modulation and coding method was purpose-built to support these applications at the low-to-medium data rates typical with mobile backhaul.

The VersaFEC-2 waveform is comprised of 74 new ModCods with a new family of constellations. Similar to the DVB-S2 and DVB-S2x industry standards, VersaFEC-2 provides two operational modes, Long-Block and Short-Block. Long-Block provides 38 ModCods with coding gain and spectral efficiencies better than DVB-S2 Normal Frame (DVB refers to their long block as “Normal Frame”) and on par with DVB-S2x Normal Frame at approximately 80-90% lower latency. VersaFEC-2 Short-Block provides 36 ModCods. All higher order constellations within VersaFEC-2 are quasi-circular for optimal peak-to-average performance, which makes them less prone to performance degradation in non-linear satellite channels. In addition, new 32-ary modulation has been added to support spectral efficiencies approaching 4.2 bps/Hz (at 5% rolloff). ACM operation is supported in point-to-point mode when using IP/Ethernet interface.

VersaFEC-2 High Performance LDPC vs. DVB-S2

The VersaFEC-2 high-performance waveform provides a significant performance advantage over the industry standard DVB-S2, as well as its predecessor, VersaFEC. Figure 1 compares the Long Block version of VersaFEC-2 with DVB-S2 Normal Frame.

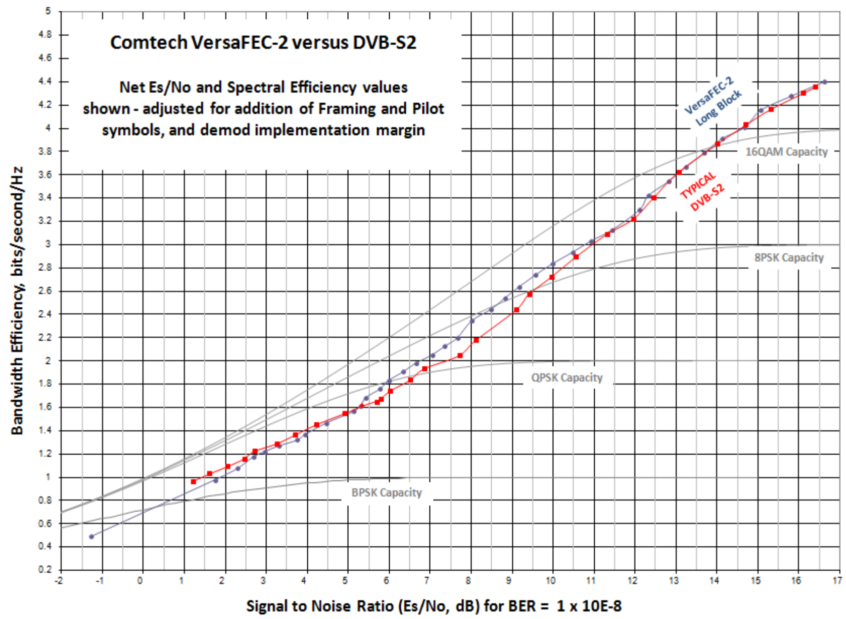

Figure 1: VersaFEC-2 vs. DVB-S2

As depicted in Figure 1, VersaFEC-2's spectral efficiency is higher than the DVB-S2 standard in the scenarios most common (5 dB to 11 dB terminal C/N) with low to medium range data rates applications, and is on par with the DVB-S2 standard at higher terminal C/N conditions. The increased performance levels of VersaFEC-2 directly affect the bottom line due to the fact that either:

- Additional throughput (Mbps) can be transmitted through a given satellite resource (MHz), resulting in an increase in revenue stream with a given OPEX cost structure, or

- Less satellite resource (MHz) would be required for a given throughput (Mbps), resulting in a decrease in OPEX cost structure for a given revenue stream.

In both cases, the mobile network operator or service provider sees significant benefits. For existing services, an increase in performance for the most common modes of operation directly correlates to an increase in margins, assuming end user pricing remains the same. Conversely, the modified economic model that results from a decreased cost basis opens the mobile network operator or service provider up to penetrate new markets. Or, combining the two, an enhanced level of services can be provided to end users. In all three cases, the use of Versa-FEC2 provides a mobile network operator or service provider the opportunity to grow their business through a differentiated level of service.

VersaFEC-2 vs. VersaFEC

Figure 2 provides a comparison of VersaFEC-2 with its predecessor, VersaFEC. As depicted in the figure, Versa-FEC-2 provides up to 1.7 dB improvement over VersaFEC.

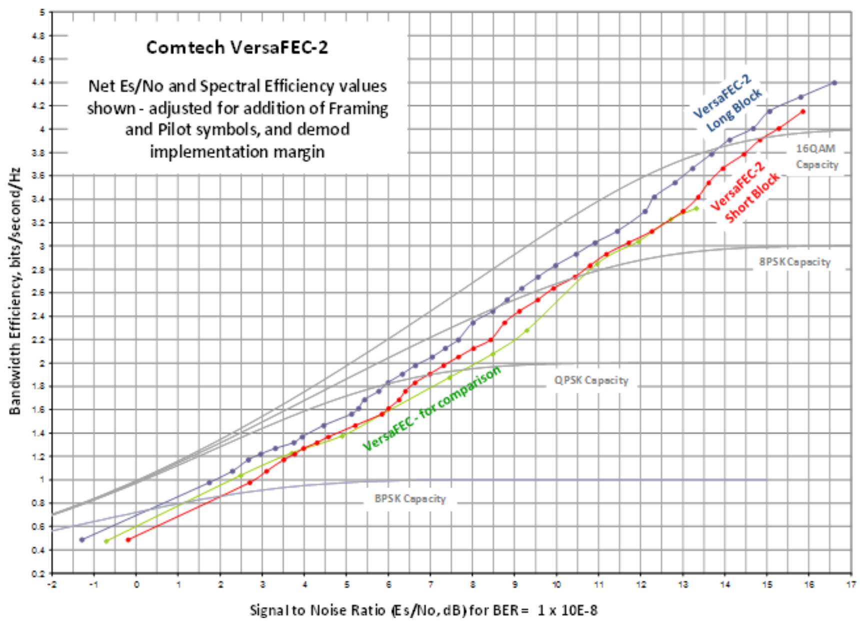

Figure 2: VersaFEC-2 vs. VersaFEC

Focus on Latency

VersaFEC-2, utilizing a constant symbol per block architecture, significantly outperforms DVB-S2 and DVB-S2x in latency performance. To highlight this difference, Table 1 provides a comparison of VersaFEC-2 performance against DVB-S2 or DVB-S2x in terms of channel latency for a 512kbps link.

Waveform	ModCod	Data Rate	End-to-end latency (no Satellite)	VersaFEC-2 Advantage
DVB-S2 or DVB-S2x	QPSK Rate 0.5 Normal Frame	512 kbps	275 milliseconds	85% lower latency compared to equivalent DVB-S2
VersaFEC-2	QPSK Rate 0.489 Long Block	512 kbps	41 milliseconds	
DVB-S2 or DVB-S2x	QPSK Rate 0.5 Short Frame	512 kbps	72 milliseconds	91% lower latency compared to equivalent DVB-S2
VersaFEC-2	QPSK Rate 0.489 Short Block	512 kbps	7 milliseconds	

Table 1: End-to-End Processing Latency of VersaFEC-2 vs. DVB-S2/DVB-S2x

As can be seen from Table 1, whether the Long Block or Short Block option is utilized, the end-to-end latency of VersaFEC-2 is a small fraction of those associated with the DVB-S2/S2X. Higher latency of DVB-S2/S2X negatively impacts all connection-oriented or interactive applications, either severely reducing the speed and quality of the application or, worse, causing the application not to operate at all.

VersaFEC-2 Adaptive Coding & Modulation (ACM) for Point-to-Point IP/Ethernet Links

An ACM method varies the modulation and code rate (MODCOD) of a link based upon real-time link conditions. This is in contrast to a Constant Coding and Modulation (CCM) method, which uses a fixed MODCOD for a link at all times. The disadvantage of the CCM approach is that a link must be designed to the worst-case operating condition to achieve desired Service Level Agreement (SLA). As worst-case conditions typically occur less than 1% of the time, the link is severely underutilized during clear sky conditions, resulting in significant inefficiencies and unattractive economics, thereby limiting the addressable market. The CDM-570A leverages ACM in both directions of the link, enabling aggressive modulation and coding in times of clear weather conditions (high Mbps/MHz ratios) while backing down to more robust modulation and coding during adverse conditions.

CarrierID

Satellite operators and service providers spend a considerable amount of time on their attempts to reduce interference. There are both capital and operational expenses incurred for this effort. Capital expense includes investment in high value geolocation tools. Operational expenses can include subscription-based plans for geolocation tolls. In addition, there are personnel dedicated to identifying and reducing sources of interference. There is also the lost opportunity cost; partial or whole transponders not available for use by the satellite operator.

There are long- and short-term causes of interference. Long-term may be from adjacent satellites, which would be due to either lack of coordination between users, outdated or poorly designed equipment, or small mobile antennas. In addition to these reasons, there may be deliberate interference for political reasons, or terrestrial sources, such as microwave links or radar. Short-term causes may be from users, such as cross polarization, or transmitting on the wrong frequency or satellite. It may also be caused by equipment malfunctions or incorrect back-up configurations.

The types of interference are predominantly designated by satellite operators as unauthorized carriers or from incorrect cross/co-polarization; approximately 80% of interference events are between these two types as reported by the operators.

Interference has a financial impact as well to satellite operators and users. When there is interference on a transponder, there is revenue lost due to the reduction of available bandwidth and power capacity. Expenses are increased, ranging from the purchase of interference monitoring or geolocation equipment, or dedicating personnel to interference mitigation. Geolocation systems may be purchased, with costs upwards of $500,000 per system, and a monthly recurring fee of $15,000. There are per use arrangements for geolocation. These are priced in the range of $20 to $30,000 per year per satellite; they are not available in all frequency bands in all regions. Ultimately, this is a quality of service issue that is unique to wireless services.

Satellite interference had become such an acute problem that a satellite industry-wide group was created to address it. The Satellite Interference Reduction Group (sIRG) members include satellite operators, service providers, broadcasters, and equipment manufacturers. Three working groups were formed within the sIRG to address different segments of the satellite industry. The Broadcast, VSAT, and Data groups are pursuing approaches to mitigate interference that are unique to their segments of the market.

As a result of these industry initiatives, Comtech EF Data developed a technology called MetaCarrier® that is used to embed and detect Carrier ID on video and data satellite carriers. The Meta prefix is used in its meaning of a carrier used to describe another carrier. In this case, MetaCarrier means that we have a separate carrier that contains information, which is used to describe another single carrier, a group of carriers, or a relay, such as a satellite transponder, or terrestrial wireless relay. What is unique is that the MetaCarrier is embedded
Carrier ID Using MetaCarrier Technology.

CDM-570A now incorporates carrier identification (CID) technique that uses Comtech EF Data’s MetaCarrier spread spectrum technology to embed a unique carrier identification sequence for the transmitted carrier to help identify interfering carriers. CDM-570A with MetaCarrier is used in tandem with the Comtech EF Data’s MCDD-100 MetaCarrier Detection Device to provide a complete MetaCarrier embedding and decoding solution.

Ordering

VersaFEC-2 is available as an optional plug-in board for CDM-570A. Presence of VersaFEC-2 board enables VersaFEC-2 operation up to the modem’s purchased data rate and symbol rate.

CarrierID is a software option that can be ordered with the modem or enabled in the field using a FAST code.

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