

EVOLUTION DVB-S2X TECH BRIEF

The DVB-S2X Solution on Evolution

ST Engineering iDirect has developed a DVB-S2X solution that not only meets minimal requirements, but will sustain exceptional performance for the launch of High Throughput Satellites (HTS) and growing end-user expectations. This technical brief highlights the characteristics that make our DVB-S2X implementation on Evolution a powerful feature.

Optimized MODCODs

ST Engineering iDirect has implemented 24 MODCODs from QPSK to 256APSK, making selections for each level of signal strength to produce optimal Adaptive Coding and Modulation (ACM) efficiency spread across the full DVB-S2X range (see right):

The orderly spacing between the MODCODs eliminates unnecessary duplication of those having similar efficiencies and enables the system to lock onto one MODCOD rather than switching back and forth between two closely adjacent MODCODs without any benefit.

Our selection incorporates seven Linear MODCODs (as indicated by “-L” at right), which are designed for linear channel operation but also demonstrate strong general performance along the efficiency curve. All MODCOD physical layer frames are Normal Frames coded with block length of 64,800 bits and pilots on.

MOD	COD
QPSK	9/20
	11/20
	3/5
	2/3
	3/4

MOD	COD
8APSK	-L 5/9
QPSK	-L 1/2
	-L 5/9
	26/45
	23/36
	25/36
	3/4
	7/9

MOD	COD
32APSK	-L 2/3
	23/45
	7/9
64APSK	-L 32/45
	11/15
	4/5
128APSK	3/4
256APSK	-L 29/45
	-L 31/45
	32/45
	3/4

EVOLUTION

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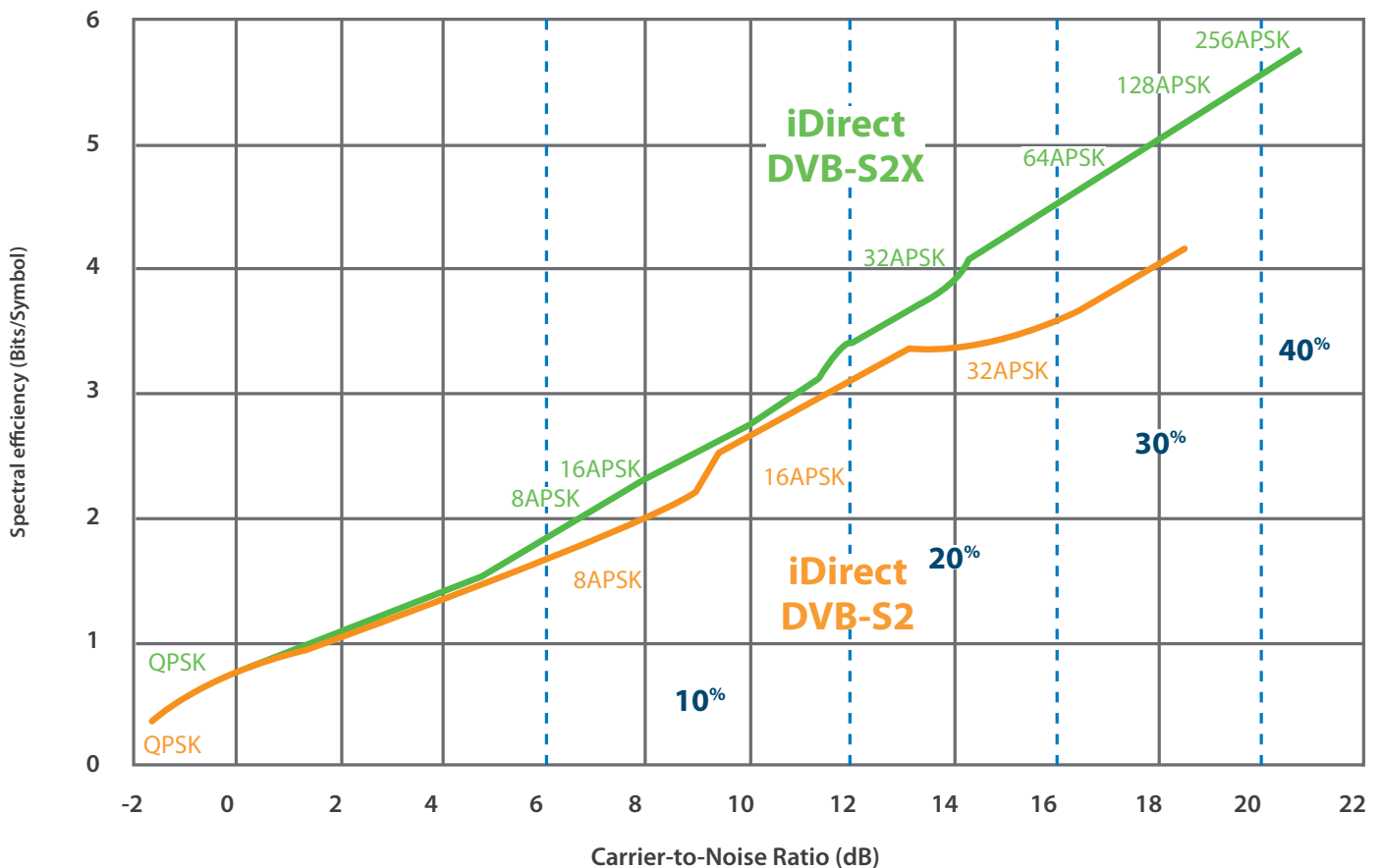
Highly Efficient

Evolution's DVB-S2X includes the higher-order 64APSK, 128APSK and 256APSK MODCODs that dramatically improve spectral efficiency over satellites with high signal strength. Operating in this range can achieve 30-40% bandwidth savings, even with existing RF equipment.

Service providers also benefit with efficiency improvement at even lower Carrier-to-Noise (C/N) ratio using the iQ Desktop in DVB-S2X mode compared to using legacy remotes in DVB-S2 mode. The efficiency advantage is driven by the DVB-S2X standard's optimized MODCOD sets, the remote electronics that exhibit excellent demodulation characteristics across the full range of MODCODs, and the efficient encapsulation of the data for over-the-air transmission. The adoption of Normal Frames with lower overhead compared to legacy Short Frames achieves optimal spectral efficiencies.

As seen in the following chart, service providers will start to experience benefits with satellite signal strength as low as 6 dB C/N. It's likely service providers will more readily access 32APSK and see 10-20% efficiency savings — even when using non-HTS platforms.

Anticipated DVB-S2X Efficiency Boost



Note: Maximum results assuming no roll-off factor for comparison, DVB-S2 (Evolution 3.5) on X1/X7 remotes, and DVB-S2X (Evolution 4.0) on iQ Desktop.

Universal Line Cards (ULCs)

Our DVB-S2X solution starts with the ULC, which can run in DVB-S2 or DVB-S2X mode in Evolution®, and operates in our existing Universal Hub chassis. The Universal Transmit Line Card (ULC-T) supports up to 45 Msps in DVB-S2 mode and up to 100 Msps in DVB-S2X mode.

Since the ULC-T is able to transmit both the DVB-S2 and DVB-S2X waveforms, it provides a pathway for service providers who currently have deployed DVB-S2 networks to manage migration onto DVB-S2X when the time is right for them. This means rapid access to technology innovation, with minimal interruption to business operations.

The ULC-T in DVB-S2X mode enables the highest possible efficiencies by implementing the highest possible MODCODs, reducing roll-offs to as little as 5%, and saturating wideband transponders as large as 125 MHz. The ULCs also harness Adaptive Coding and Modulation (ACM) to enable each remote to achieve the maximum data throughput by utilizing the most efficient coding and modulation scheme at any moment in time based on link conditions.

Intelligent Gateway

The Evolution DVB-S2X solution relies on the Intelligent Gateway, a virtualized platform based upon the Dell PowerEdge FX2s, to handle the massive processing required for DVB-S2X network throughputs. The FX2 enclosure includes four modular server bays, enabling servers and memory to share power, cooling, and networking in a highly compact form factor.

The DVB-S2X Starter Kit includes two Dell PowerEdge FC630 blade servers. The FC630 is a workhorse designed for data centers seeking new levels of efficiency and density in a small footprint, containing dual Intel Xeon microprocessors and high-speed solid state drives.

Through the extensive use of virtualization, each FC630 blade server within the platform is able to achieve

exceptional processing densities and reach up to 500 Mbps of total bi-directional traffic, divided across one to four beams and supporting as many as 2,500 remotes. This order of magnitude improvement in scale dramatically reduces physical infrastructure and decreases IT management expenses while sustaining future growth.



ULC-T



Intelligent Gateway

Dell PowerEdge FX2s XL Chassis

Network Connection	4 x 1 Gb Ethernet ports per blade
Power Supply	Redundant 2000 Watt power supplies
Expansion Bus	PCI Express 3.0

Dell PowerEdge FC630 Blades

Processor	Dual Intel Xeon E5-2683 v4
Processor Speed	2.1 GHz
Cores/Threads	Each CPU has 16 C / 32 T
RAM Memory	64 GBs of RDIMM (2400 MT/s)
Drive Memory	400 GB (6 Gbps) SSD

iQ Series Remotes

Our iQ Modem series exploit the higher throughputs and efficiencies generated by the DVB-S2X waveform through powerful, reprogrammable electronics. The design employs multi-core processing and multiple GigE VLAN-aware networking ports.

Traditionally, remote features were largely encoded in hardware. As such, these remotes were constrained by fixed designs and inflexible. Today, service providers want to adapt to changing requirements and only pay for the capabilities used at any given time. The iQ Series is based on a software-defined and reprogrammable remote architecture, so it can be continually upgraded over-the-air to increase network capabilities and throughput levels, extending the field deployment life.

The iQ Modems consists of the iQ Desktop Series, the iQ 200 Series and the iQ LTE. While the iQ Desktop series is designed to meet the needs of broadband and low-to-middle enterprise networks with a wide range of performance scenarios, the iQ 200 Series available in board level and rackmount form factors is ideal for enterprise, cell backhaul, disaster response, maritime and land-mobile applications. The iQ Modem Series is very flexible due to software-enabled licensing on each of these form factors, allowing service providers to address a number of market needs and pay for only the services needed.

Enhanced Software

The Evolution software has been rewritten to improve processing density and throughput:

Software Virtualization – The Evolution protocol processors have been virtualized, using the KVM Hypervisor for RedHat Linux. The total resources available across all the blade servers becomes a common pool of protocol processor equivalents and the software distributes workload accordingly. Each blade server can run up to seven virtual machine instances of the protocol processing stack.

Streamlined Architecture – The protocol processing architecture is streamlined such that packets only pass through subroutines when absolutely necessary, making the processing more efficient. The introduction of



iQ Desktop

virtualization combined with this updated architecture results in massively improved densities, achieving 10x better processing per blade server.

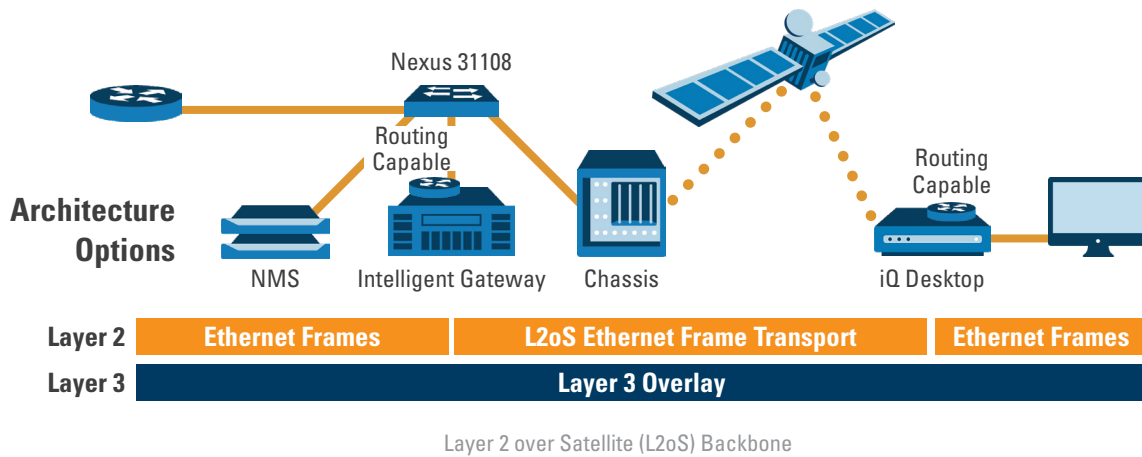
Frame Encapsulator – Before the Intelligent Gateway, transmit line cards had to encapsulate BBFrames before modulation and encoding. This intensive process strained the line cards, resulting in a throughput bottleneck of around 150 Mbps. To avoid this limit in DVB-S2X networks, the blade servers are now responsible for BBFrame encapsulation. The more powerful blade servers enable a forward channel information rate approaching 500 Mbps.

Layer 2 over Satellite (L2oS) Backbone

ST Engineering iDirect uses L2oS to pass data over-the-air, so Ethernet headers are retained all the way to the edge of the network, providing a transparent end-to-end data pipeline.

The iQ Modem Series provides Service Providers with the option to implement either Layer 2, Layer 3, or Hybrid L2/L3 networks.

Since an iDirect DVB-S2X network is designed for high-throughput and scalable Layer 2 functionality, it includes an enterprise-quality Cisco Nexus 31108TC-V switch at the hub. The Nexus 31108 is able to manage Layer 2 or Layer 3 switching, and can scale to 4,096 VLANs and 288,000 MAC addresses.



ROHCv2 Compression

Data packet overhead eats into over-the-air capacity. For example, Ethernet headers alone range from 14 to 22 bytes, which is a significant burden for smaller packets. So for DVB-S2X networks, ST Engineering iDirect has introduced Robust Header Compression (ROHCv2) to streamline packet overhead and use bandwidth more efficiently.

ROHCv2 replaces the older Compressed Real-time Transport Protocol (cRTP) method. Not only does ROHCv2 perform faster than cRTP, but it is more reliable than cRTP, especially over lossy channels. Our implementation of ROHCv2 is capable of reducing all the headers (Layers 2 through 4) to only a few bytes, depending on the protocol stack.

By default, ROHCv2 compresses Ethernet headers (as well as VLAN/Q-in-Q tags) and provides the option to expand compression to IPv4, IPv6, UDP, ESP and RTP headers. Compression can also be applied to IP-in-IP and GRE tunnels. Bandwidth savings vary depending on the protocol headers used, but can easily total 25%+ for smaller packets.

Total Platform for Success

ST Engineering iDirect DVB-S2X enhances an already strong platform. Service providers harness HTS bandwidth more efficiently while continuing to enjoy our proven bandwidth management and group QoS features. Our platform manages total capacity as a shared pool, enabling service providers to dynamically allocate bandwidth as needed to create tiered SLAs and customized service plans that effectively monetize capacity.

Combining DVB-S2X with our advanced mobility features improves maritime and aero customer throughputs. Service providers will be able to build out massive networks with greater speed and reduced costs, protect investment while migrating from DVB-S2 to DVB-S2X, and prepare for future satellite innovations like beam hopping and dynamic channelizers.

To learn more, please visit www.idirect.net.