

## 2D 16-State Forward Error Correction Coding

### Advances in Efficiency

2D 16-State Forward Error Correction (FEC) brings a new level of IP payload efficiency. Representing the most powerful inbound coding option available to the industry, iDirect is the first satellite technology provider to integrate 2D 16-State into its satellite communications platform.

2D 16-State dramatically enhances inbound link performance. Coupled with the introduction of demodulator improvements that also comes with iDX 2.0, 2D 16-State delivers improved efficiencies over Turbo Product Coding (TPC) and provides existing customers a 10-20% increase in their inbound IP throughput without sacrificing link availability.

Service Providers can benefit from increased flexibility and efficiency in network design resulting in better link margins, improved IP throughput and faster acquisition.

### Better Link Margin

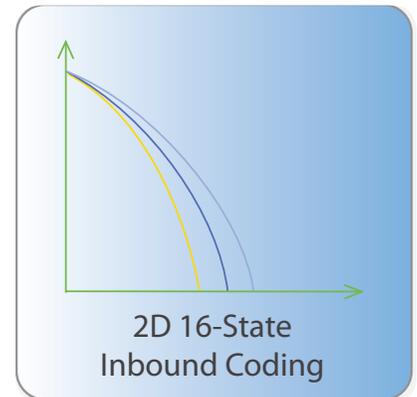
2D 16-State can operate at a lower threshold and utilizes an algorithm superior to TPC, particularly for code rates of 2/3 and lower. This results in additional link margins that can be exploited in several ways:

- Increases link availability in rain fade conditions
- Enables cost reductions by allowing smaller block up converters or antennas to be used
- Enables higher inbound throughput since the remote can operate at a higher carrier size

### Improved IP Throughput

Three TDMA payload block sizes are supported with the 2D 16-State codes compared to two for TPC. Previously customers had to choose between 1kbit and 4kbit and typically chose 1kbit to avoid the latency of larger blocks.

Because of the fixed TDMA overhead, using larger payload sizes like the 170 byte option will increase the amount of data that can fit into a given block size. Operators currently using small TPC blocks can switch to the new intermediate block size and realize a significant improvement.



In addition to the reduction in TDMA overhead, more efficient coding can be used to achieve the same carrier-to-noise detection level, further boosting the inbound efficiency.

### **Faster Acquisition**

An improved demodulator in the Evolution hub line cards can receive bursts with 12 times the frequency offset than the previous generation. This allows for significantly smaller acquisition times for both 2D 16-State and TPC return channels, particularly for large networks when used with Evolution hub line cards and either iNFINITI or Evolution remotes.

### **Implementation Made Easy**

Easy mapping between existing TPC to 2D 16-State FEC rates makes implementation quick and simple using the same RF equipment. Existing Evolution networks using TPC upstream coding can be upgraded to the 2D 16-State option to achieve higher IP throughput without sacrificing link performance. New networks can be provisioned with the same RF equipment and less satellite bandwidth to achieve the same network throughput.

For example, existing Evolution customers using QPSK Rate 0.66 TPC upstream coding may upgrade to the 170 Byte Rate 3/4 2D 16-State option and achieve 15-20% higher IP throughput without sacrificing link performance.

For more detailed information please refer to the iDX 2.0 Technical Reference document and the Link Budget Analysis Guide.

### **Technical Facts:**

Increased link performance, more flexibility and increased bandwidth efficiency gains with:

- More FEC coding choices ranging from 1/2 to 6/7
- Three new IP payload block sizes available: 100, 170 and 438 bytes BPSK, QPSK, 8PSK and SS BPSK (100 byte only)
- Faster acquisition due to tolerance of 12x larger frequency errors

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