SPAWAR

EFFICIENT CHANNEL CODING, INC.

HIGH-CODING-GAIN, HIGH-RATE TURBO PRODUCT CODES, FOR ROBUST DIRECT BROADCAST SATELLITE SYSTEMS

iPSTAR

Topic Number: N96-258 (SPAWAR)

SBIR Investment: $837.6K
Project Revenue: $9.9M

Efficient Channel Coding, Inc.

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About the Technology

Current information obtained from direct broadcast satellite systems indicates a higher than expected data implementation loss when compared to theoretical performance. Examination of theoretical coding implementation has also shown a sharp decline of data transmission, resulting in a nearly total loss of signal for small degradations in communication link performance. ECC has developed a powerful class of forward error-correcting codes that outperform those used in today's systems. Turbo Product Codes (TPCs) use a high-speed, flexible, Application-Specific Integrated Circuit (ASIC) and a low-speed, flexible, software-based decoder architecture that corrects transmission errors, thus increasing the reliability of digital communication links.

TPCs are ideally suited to systems where large coding gain is required, but only a limited overhead is acceptable. TPC offers a code rate of 4/5 and a coding gain of 7.0 dB at a bit error rate of 10 P-6P, which is 1.5 dB from the Shannon limit. To achieve this performance, ECC developed three decoding algorithms that exhibit an extreme reduction in complexity over existing techniques, resulting in a simpler decoder that enables the construction of a high-speed "turbo-like" codec on a chip.

ECC has applied TPCs to the next generation of direct broadcast satellites, satellite communication and terrestrial systems. Advanced Hardware Architectures, Inc., a seller of error correction ASICs, has partnered with ECC to make TPCs available commercially. ECC has also commercialized the technology in a semiconductor chip form that is used in a wide range of satellite communications products for Navy, DoD, federal, and commercial applications. Additional follow-on technologies have also been developed.

Military and Commercial Significance

The TPC's flexibility, combined with their iterative decoding, makes them useful in links with variable satellite network receivers and variable data rates affected by rain fade or multi-path interference. The technology improves performance over the most powerful error correction codes used in legacy modern digital communications, and provides an increase in the number of transmittable data bits per hertz of frequency.

About the Company

Efficient Channel Coding, Inc. (ECC) provides real-world digital communication solutions for some of the world's largest companies. The company provides expert engineering for satellite, optical and terrestrial wireless communication systems, as well as advanced air interface design, and standards participation. This SBIR effort was instrumental in allowing ECC to grow from three employees and less than $1M in revenue to over 40 employees and more than $10M in revenue. In December 2005, ECC was acquired by ViaSat, Inc. and now operates as a wholly-owned subsidiary.

APPLICATIONS

- Navy:
  Satellite-to-mobile systems, Phase III global broadcast service terminals, iPSTAR Broadband satellite communication to narrow-band undersea communication
- Commercial Application:
  Broadband satellite system, Intelsat satellite modems, satellite VSAT networks, wireless networks