

# Leading-Edge Satellite Services

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Application Note

## Introduction

Spectrum was recently approached by a world-leading satellite network provider who had a wireless signal processing problem to solve. This customer provides satellite access products to millions of customers with services such as video broadcast, two-way internet access and satellite-based telephony. The customer had a requirement for a new standards-based, high channel density solution to perform return link signal processing in their hubs. After researching the available products on the market, they selected Spectrum's flexComm technology for its off-the-shelf availability, high performance, design flexibility, and competitive price.

A satellite hub application involves bi-directional communications from the hub to remote terminals using a satellite as the transport mechanism, as depicted in Figure 1. A forward link is used to send data to the remote terminals using a TDM broadcast mechanism and is relatively simple in comparison to the return link. The return link is used by the terminals to send data back to the hub, typically using some form of multi-frequency TDMA (MF-TDMA) protocol. Multiple terminals can transmit on the return link simultaneously, in effect sharing the total bandwidth of the return link. The satellite receives the return link data from the terminals and then transmits that information down to the hub where the hub's return link subsystem has the task of allocating bandwidth to the various terminals, demodulating and demultiplexing the received return link data, ensuring it's accuracy, and forwarding the individual data streams to their final destination. The application can scale from hundreds to thousands of discrete data channels as subscriber count grows. Any solution to this customer's problem had to provide a high channel count per slot to reduce the overall footprint and cost of the hub, and at the same time had to be extremely reliable and highly scalable.

## The Spectrum Solution

The heart of the resulting system was Spectrum's Barcelona-HS CompactPCI board. Barcelona-HS, designed for high availability wireless signal processing applications, provides the power of four 1600 MIPS Texas Instruments C6201 DSPs and 64 MB of SDRAM in a single 6U CompactPCI slot. It also provides three mezzanine sites: one industry-standard PMC site, plus two high-bandwidth Processor Expansion Module (PEM) sites. These PEM sites permit direct hardware access to the four Digital Signal Processors (DSPs) on the board. Barcelona-HS' open architecture provided the customer with an easy path to customize the board so that it could meet their precise requirements.

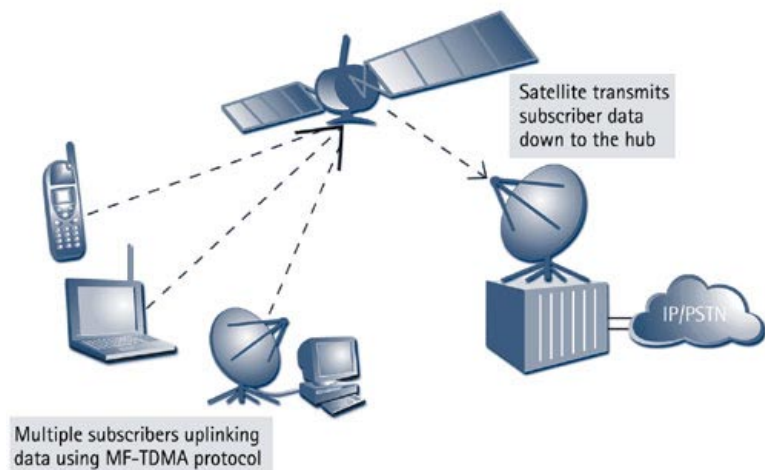


Figure 1: Satellite Hub Application

## High Availability

System availability and reliability were a key concern. With potentially thousands of customers using the system at any point in time it is unacceptable to shut down the return link processors for any reason. An availability target of five-9's was set (99.999% uptime), with the dual goals of maximizing both customer satisfaction as well as revenue generation.

Spectrum's solution to the high availability requirement was achieved through a combination of techniques:

- › The first was the use of CompactPCI hot swap technology and associated software, which permits the replacement of faulty cards without powering down the system.
- › The second was extensive ISO9001 design and production quality control, to minimize the likelihood of any board failures.
- › Finally the entire system was engineered to minimize any potential single points of failure. Used in conjunction with a Motorola CPX8216 family CompactPCI chassis, this system has demonstrated the ability to achieve the goal of five-9s reliability.

Software upgradeability and design flexibility are key requirements for satellite hubs. The satellite communications marketplace is constantly changing as new features and services are introduced, however, replacing hub hardware every six months is not an acceptable upgrade technique. By using Spectrum's programmable signal processing hardware plus other programmable devices, the customer's new system is highly software upgradeable; upgrades can be performed and new services can be added simply by loading in new software.

Like many of our customers, this customer had internal capabilities to develop a signal processing platform for this application. When reviewing their key differentiators, however, they realized that they could get to market faster and with a richer feature set if they outsourced the signal processing platform to Spectrum and focused their internal resources on system-level performance enhancements and new service offerings. Spectrum's hardware and software solution saved the customer man-years of development time and enabled them to get to market approximately one year earlier than if they had gone with an internally developed solution. Spectrum has since



tightly integrated our logistics processes with the customer's to ensure a consistent, stable source of supply, in effect becoming a virtual division of this customer's organization.

By leveraging off Spectrum's flexComm wireless signal processing products and taking advantage of other industry standards and commercial products, this customer has produced a highly reliable, flexible, and cost-effective hub solution to power their next generation of satellite applications.



Wireless Systems

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