AMC/ATCA Thermal Management
A Case Study

May 2008

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White Paper

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Written by: Interphase Corporation

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AMC/ATCA Thermal Management Case Study

Abstract

AdvancedTCA™ (ATCA) allows the development of flexible platforms by combining AdvancedMC™ (AMC) modules with ATCA Blades. ATCA blades that provide AMC Slots include AMC Carrier Blades, Processor Blades, and Switch Blades. Typically there is a strong desire to maximize the performance of the platforms. This drive for performance has a direct impact on power consumption and heat dissipation. In order to determine the limits to performance, the thermal characteristics of the integrated solution need to be analyzed and optimized.

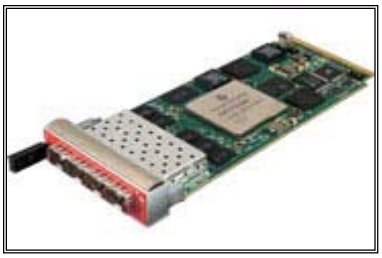
Interphase was requested to provide an AMC Carrier Blade with two Cavium processors AMC's and two Wintegra processor AMC's. Due to the high power consumption and the ATCA form factor, other vendors were not able to achieve this configuration. Based on initial analysis we were concerned that several components would exceed thermal limits. Under detailed analysis and simulation, we derived a solution that met all thermal requirements.

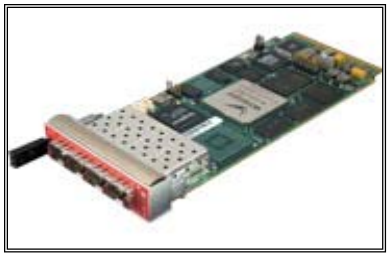
Introduction

A telecom customer wanted to package a femtocell product in an ATCA form factor. The required configuration included two Cavium Octeon Plus™ and two Wintegra WinPath2™ processors on an ATCA blade. Interphase provided a cost effective configuration that included two *i*SPAN® 36CA's, and two *i*SPAN® 3650's in an *i*NAV® 31K G2 carrier. The high power density of this configuration led to thermal concerns.

Module Descriptions

The Interphase iSPAN 36CA AMC module is a high-performance, high-power Quad gigabit Ethernet Packet Processor, based on the 8 core Cavium Octeon CN5840 processor. At 600MHz, the module draws 35W of power.





The Interphase iSPAN 3650 AMC module is a high-performance, high-power Dual OC-12/Quad OC-3/STM-1, based on the Wintegra Winpath2 processor. At 350MHz, the module draws 18W of power.

Interphase iNAV 31KG2 is an AMC carrier that hosts up to four AMC modules.

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Challenge

High power density AMC modules are designed as stand alone products, per the PICMG standard, with little consideration for downstream modules. However when multiple AMC modules are configured in a carrier, thermal issues may start to materialize.

Initial IcePak® Computational Fluid Dynamics (CFD) simulation for the required configuration showed several hot spots in the upper AMC bays that exceed the maximum allowable operating temperatures.

Problem

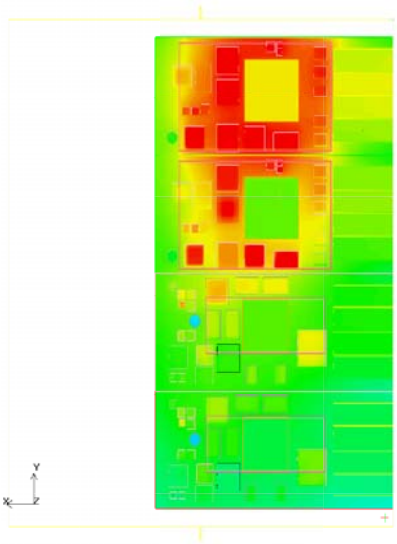
Common engineering practice is to put high power devices down stream (above) of lower power device to minimize preheating. In this configuration, IcePak thermal simulation identified critical hot spots. Would swapping modules between the bays solve this problem?

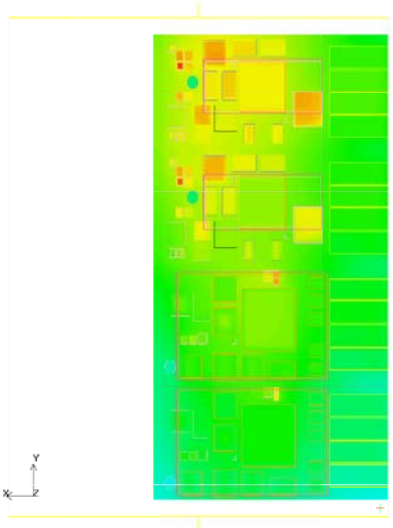
Solution

Several configurations were analyzed using IcePak. It was found that the devices on the 36CAs were being blocked by the Cavium heat sink. By applying a thermal compound to create a conductive path to the heat sink we were able to cool all the components on the 36CAs. The optimized solution configured two 36CAs in the lower 31K carrier bays (upstream) and two 3650s in the upper bays (downstream).

Icepak Simulation

The figure on the right shows the simulation results of the initial configuration with components exceeding operating temperature limits shown in red.

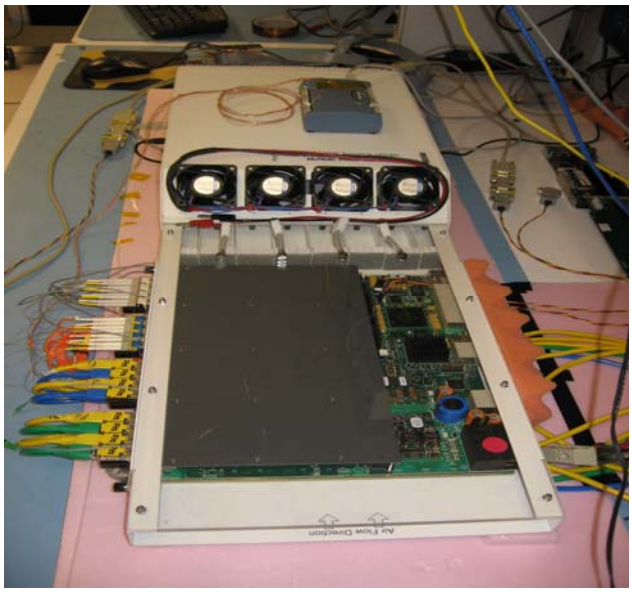




The figure on the left shows the simulation results of the optimized configuration with the additional thermal compound creating the conductive path to the heat sink. All hot spots are eliminated.

Validation

Using the Blade Profiler from Degree Controls, Inc, Interphase engineers validated the IcePak simulation results.



The Blade Profiler, with carrier and AMC modules installed, was used to validate the results. The Blade Profiler provides controlled airflow, emulating the chassis environment. Thermo-couples attached to critical components are used to accurately measure device temperatures.

Summary

AMC/ATCA integrators must be aware of the complexity of the thermal management for high-powered AMC modules. Interphase uses analytical and empirical methods to optimize its products and implement a successful thermal management strategy. Interphase has the technical expertise to perform complex AMC/ATCA thermal simulation and validation, and would like to extend this benefit to its customers who may not have the ability to perform these tasks.

For more information on the mentioned Interphase products, or how Interphase can help, please contact intouch@iphase.com or call 1.800.FASTNET / 1.214.654.5000. You can find Interphase on the web at www.interphase.com.

About the Authors

Tai Phan

Tai Phan is the Senior Manager of Hardware Development, North America Engineering at Interphase Corporation, responsible for overseeing the design and development of various enterprise and telecom products. Tai has over 25 years engineering experience in the electronics industries, and has been with Interphase since January 1990. Tai received a B.S. degree in Civil Engineering from Ho Chi Minh City University of Technology, and a B.S. degree in Electrical Engineering from the University of Texas at Arlington.

Joseph Steinman

Joe has over 20 years experience in engineering and management in the electronics industries. He has been instrumental in all aspects of electronics packaging including defining product requirements, creating complex electro-mechanical designs, performing thermal analysis and supporting agency testing. His vision and creativity has led to nine USA patents, two European patents and two World patents. Joe currently supports Interphase with complex thermal analysis using IcePak CFD tools.

About Interphase Corporation

Interphase Corporation (NASDAQ: INPH) delivers robust building blocks, highly integrated subsystems and innovative gateway appliances that provide network connectivity, content management, and packet processing for key applications in the wireless and wireline converged communications network. Incorporated in 1977, Interphase built its reputation providing advanced, high-speed input/output (I/O) solutions for telecom and enterprise applications and has established a key leadership role in bringing next generation AdvancedTCA® (ATCA) blades, AdvancedMC™ (AMC), PCI-x, PCI-e, and custom solutions to the marketplace. Headquartered in Plano, Texas with sales offices across the globe, Interphase clients include Alcatel-Lucent, Emerson Network Power, Fujitsu Ltd., Hewlett Packard, Nokia-Siemens Networks, Samsung, and Sun Microsystems. Visit www.interphase.com.