Innovative Thermal Management in HPEC VPX systems
More processing power in each VPX slot

- Customer demand for ever increasing processing power in each High Performance Embedded Computer (HPEC) VPX System
- Essential to find new ways for extracting the heat out of each system slot
- Thermal management cannot be considered anymore as an afterthought
- It has become as important as designing reliable hardware and efficient firmware
IC has developed fluid and thermal simulation models verified through experiment
High precision simulation for component placement and thermal interface design
Allow in particular improvement of air cooled solution
The VITA 48.1 open standard defines the mechanical specifications of air cooled VPX plug-in units.

- Improve the cooling of VITA 48.1 compliant products to extend the temperature range of operation.
  - to drive the costs down
  - To keep the weight low
  - to avoid the use of other less cost effective solutions based for instance on the VITA 48.2 conduction cooled or VITA 48.5 Air Flow Through standards that may prevent the cooling of the PCB itself (Components at the bottom)
IC-INT-VPX3d equipped with enhanced air cooled mechanical solution
Comparison standard/enhanced air cooled solutions

Experimentially Measured Performance

<table>
<thead>
<tr>
<th>Available CPU Power (W)</th>
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<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>P_Standard (Ta=55°C) (W)</td>
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<tr>
<td>P_Enhanced (Ta=55°C) (W)</td>
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<tr>
<td>P_Standard (Ta=70°C) (W)</td>
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<tr>
<td>P_Enhanced (Ta=70°C) (W)</td>
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<td>Xeon D1559 TDP_Max</td>
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Air Flow (m^3.h^-1)

0  | 10 | 20 | 30 | 40 | 50 | 60 | 70
Comparison standard/enhanced air cooled solutions

IC-INT-VPX3d $T_a = 75^\circ C$

Standard solution

Enhanced solution

![Graph showing the comparison between standard and enhanced solutions for IC-INT-VPX3d at $T_a = 75^\circ C$. The graph illustrates the power consumption ($P_{CPU}$) as a function of the airflow ($Q$) for both enhanced and standard solutions.]
IC-INT-VPX3d

operating point $P_{\text{CPU}}=30W$ with $T_a=75°C$

Standard solution $\rightarrow Q = 50m^3.h^{-1}$ et $\Delta P = 194Pa$

Enhanced solution $\rightarrow Q = 21m^3.h^{-1}$ et $\Delta P = 94Pa$
Example of an air cooled test bench

Simulated speed field

Mico-anenometer

Downstream

Upstream
New IC 6U VPX conduction cooling system
Enhanced conduction cooled system

Test with the new IC cooling system better than the aluminium classical conduction cooled approach by a factor of 7