

Mechanical Industrialization of SKA RXPU

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Outline

- Qamcom Research and Technology
- The RXS123 and RXPU units for SKA
- Industrialization for "mass production"
- EMC shielding – honeycomb filters, EMI gaskets, number of screws
- Airflow – heatsink and air duct
- Piece parts – simplicity and kinder tolerances

COMPANY FACTS.

**FOUNDED
IN 2001**

**150 HIGHLY
EXPERIENCED
PEOPLE**

**40%
HAVE
A PhD**

**AVERAGE
16-17
YEARS OF
EXPERIENCE**

Customer story – SKA

Reveal the secrets of the universe with the world's largest telescope

- Qamcom responsible for final design and industrialization of the subsystem that converts the collected analogue signals to digital signals – RXS123 and RXPU
- Providing advanced low-noise signal (electrical and mechanical) expertise
- Realizing and industrializing the research



“Qamcom’s impressive expertise within the field of low-noise signals, in relation to both electronics and mechanics, is considerably valuable for Chalmers, SKA Project and the astronomers.”

Paul Häyhänen
Chalmers Industriteknik Foundation and
Big Science Sweden

Receiver overview

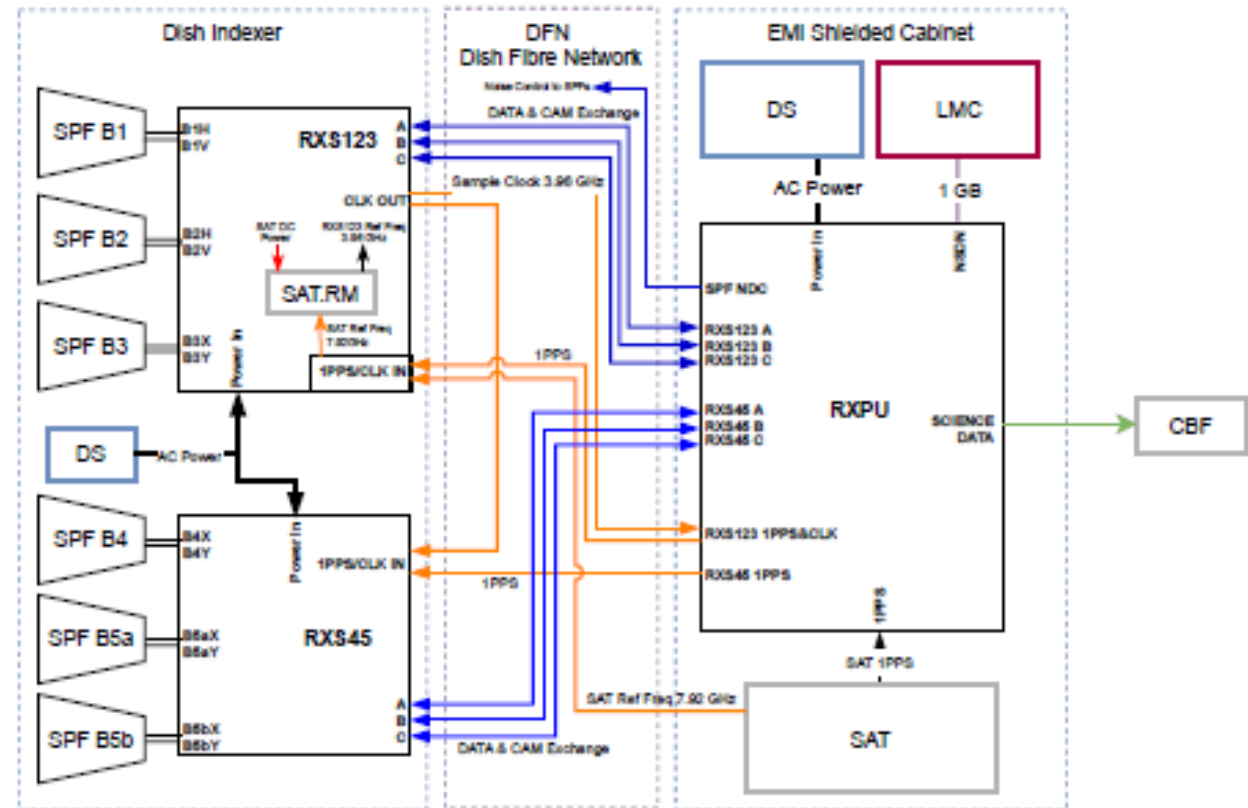
Qamcom is responsible for the RXS123 unit and the RXPU unit.

The RXS123 sits on the dish indexer. It receives and samples the RF signals for bands 1, 2 and 3 (but band 3 has been descoped).

The RXPU is in the EMI shielded cabinet. It processes, packages and distributes the sampled data.

Qamcom is also bidding for the RXS45 unit.

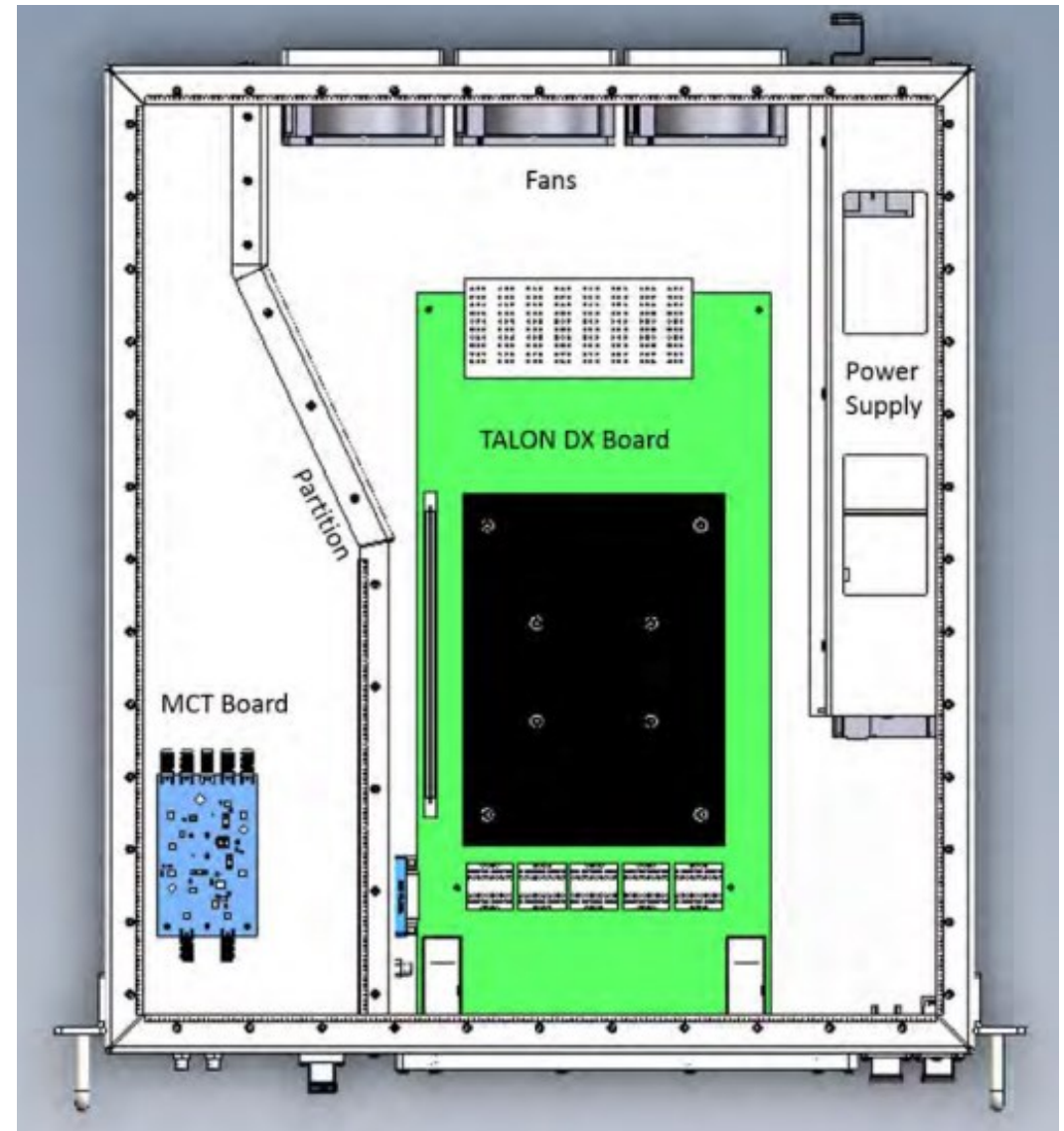
SPFRx Block Diagram



RXPU

The Talon DX board houses an FPGA that needs cooling. Fans and compartment partition ensure a good airflow.

Industrialization considerations are EMC shielding, FPGA cooling, piece parts manufacturing and assembly time, for example the number of screws.



Industrialization and "mass production"

- Assuming a personnel cost of 100 €/h, each hour spent on industrialization adds a cost per unit of
 - 100 € if only one unit is produced
 - 67 cents if 150 units are produced
 - 0.5 cents if 20 000 units are produced
 - 0.01 cents if 1 000 000 units are produced
- A reasonable level of manufacturing improvements for the SKA receiver units is some thousand hours.
- Both assembly time and piece part costs are addressed.
- It is not really mass production with a few hundred units.

RXPU EMC

Radiated emissions were measured with the RXPU lid taken off.

The margin to requirements for the EMI shielded compartment is still more than 20 dB.

Thus, no lid is needed (for EMC)!

No EMC gaskets are needed

The honeycomb ventilation at the fans can be as thin as we like.

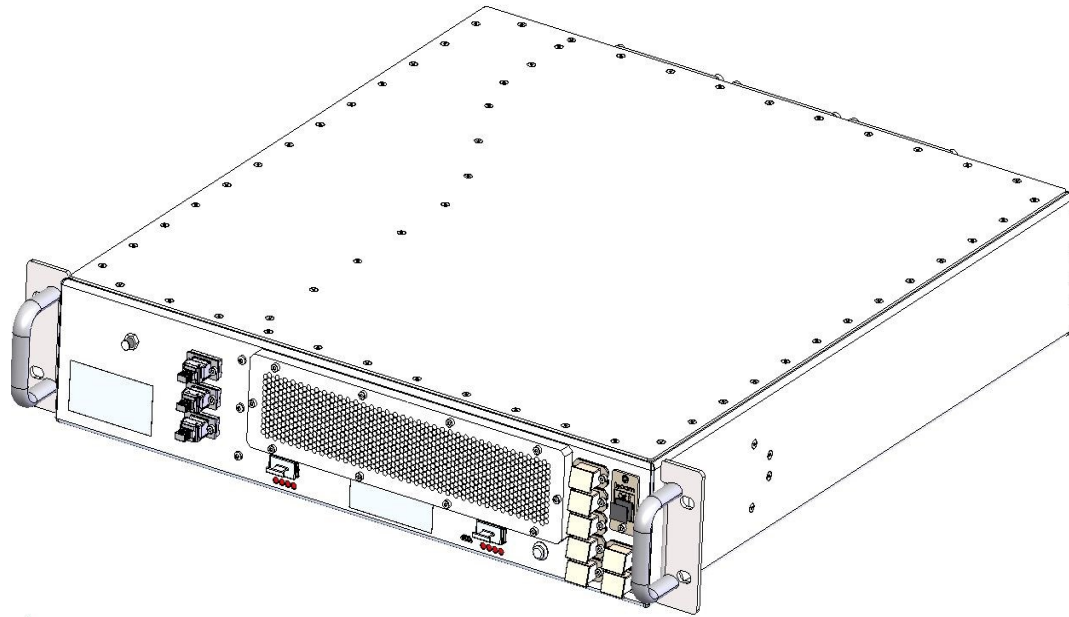
The screws holding the lid can be sparsely placed.



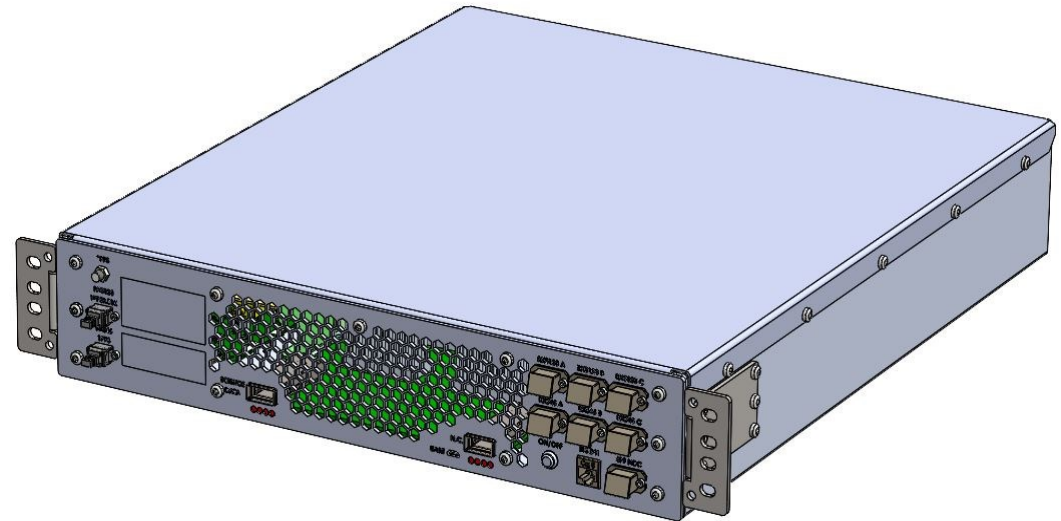
Much fewer screws

Honeycomb filter integrated into box

Before

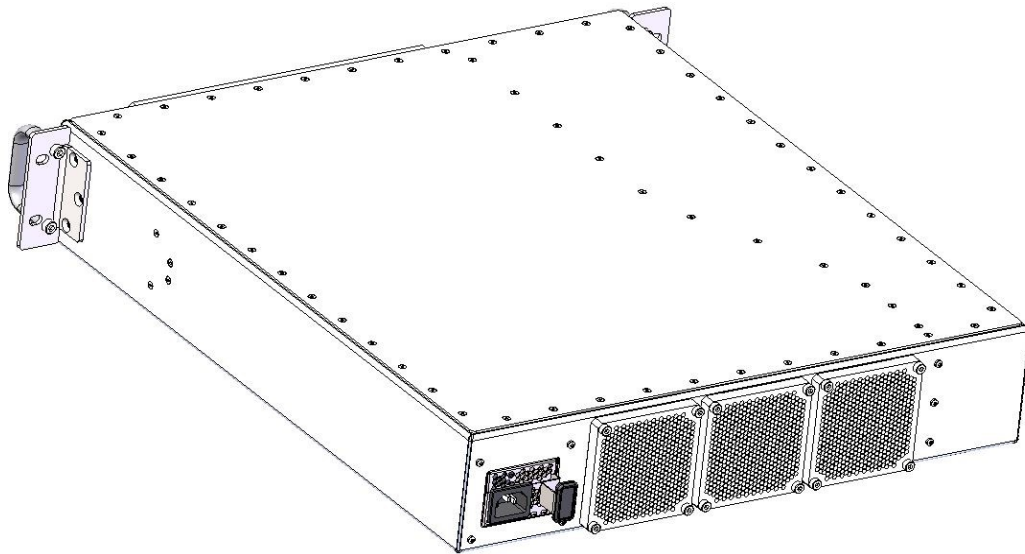


After

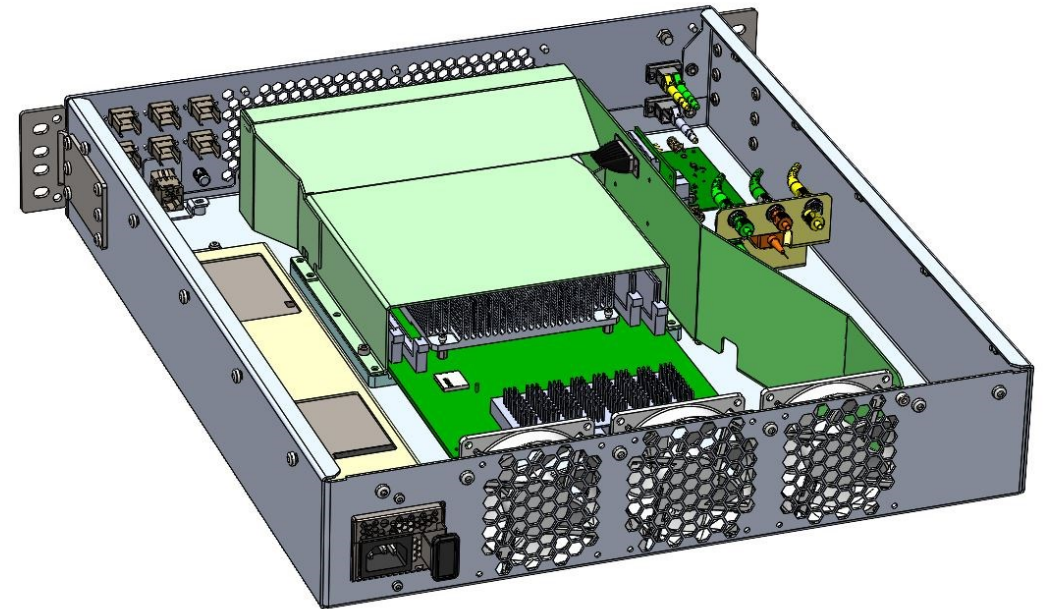


Honeycomb filters integrated into box

Before



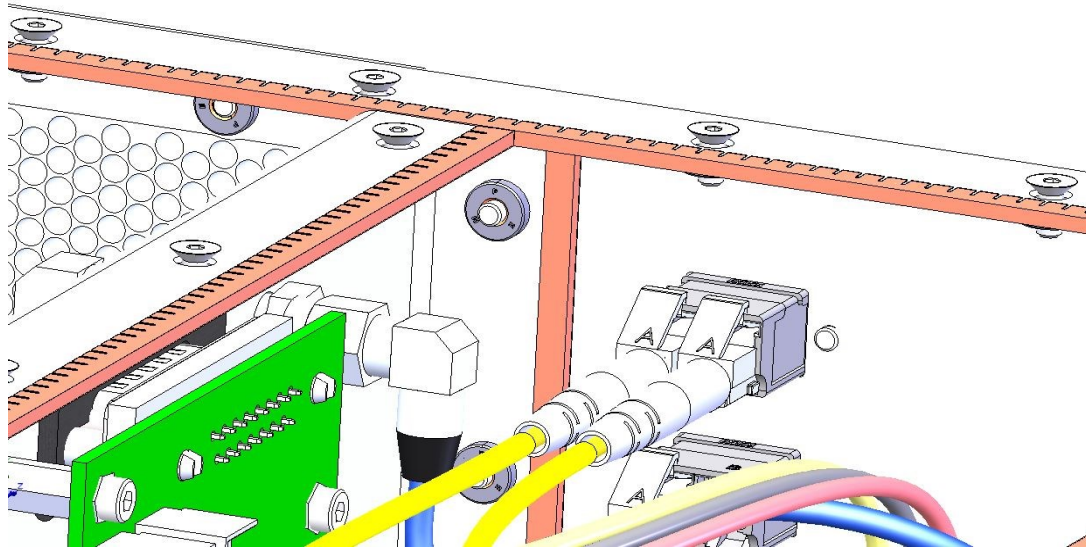
After



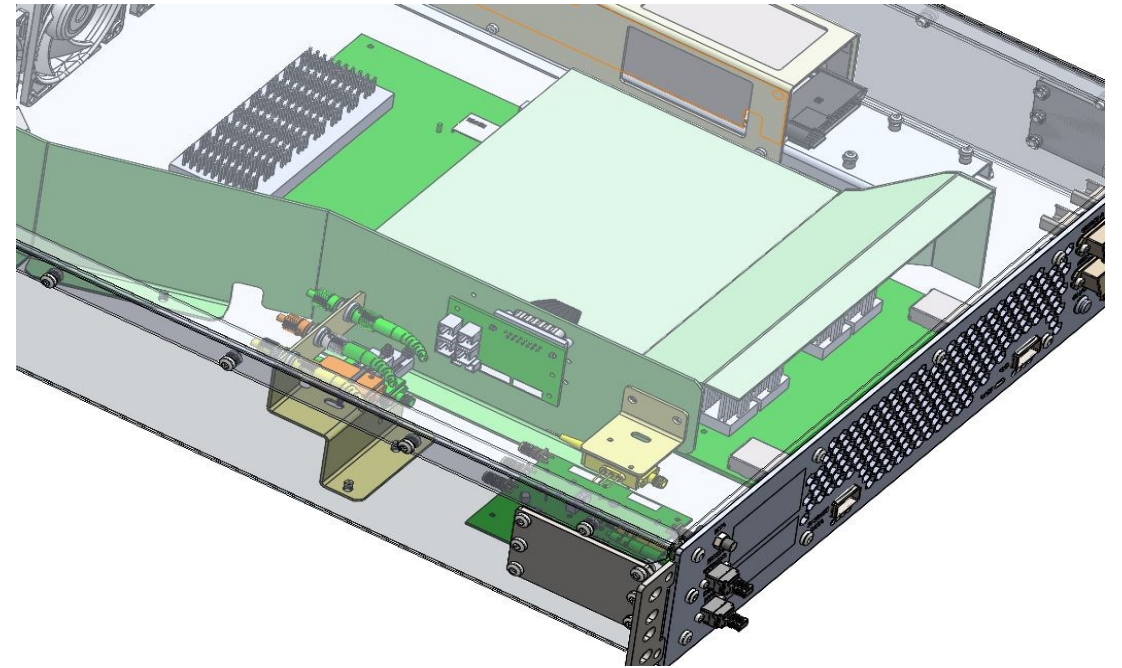
EMI finger gaskets removed

No screw interface to partition wall

Before

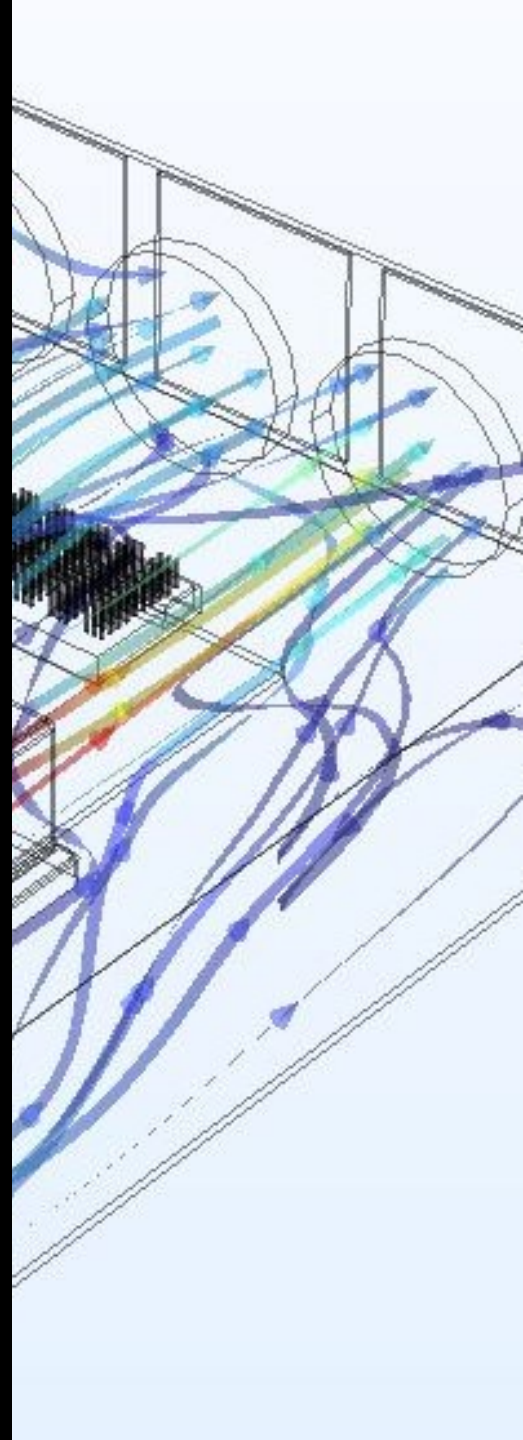


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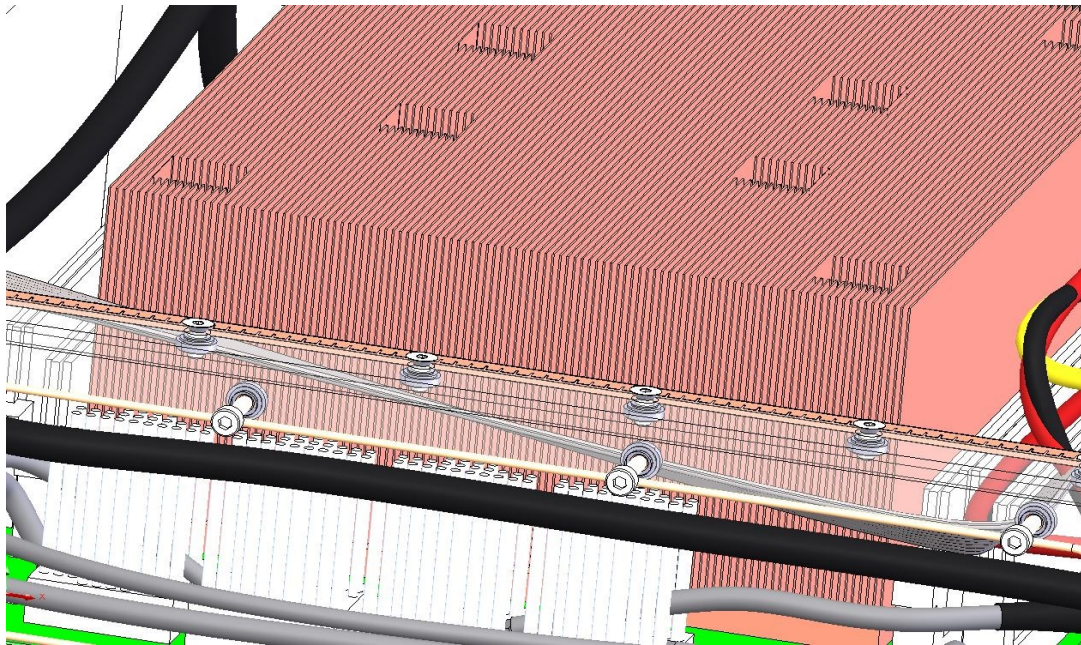
RXPU airflow

- Airflow and resulting temperatures were analyzed
- Heatsink can be simplified
- Air duct around heatsink and FPGA optimize the airflow

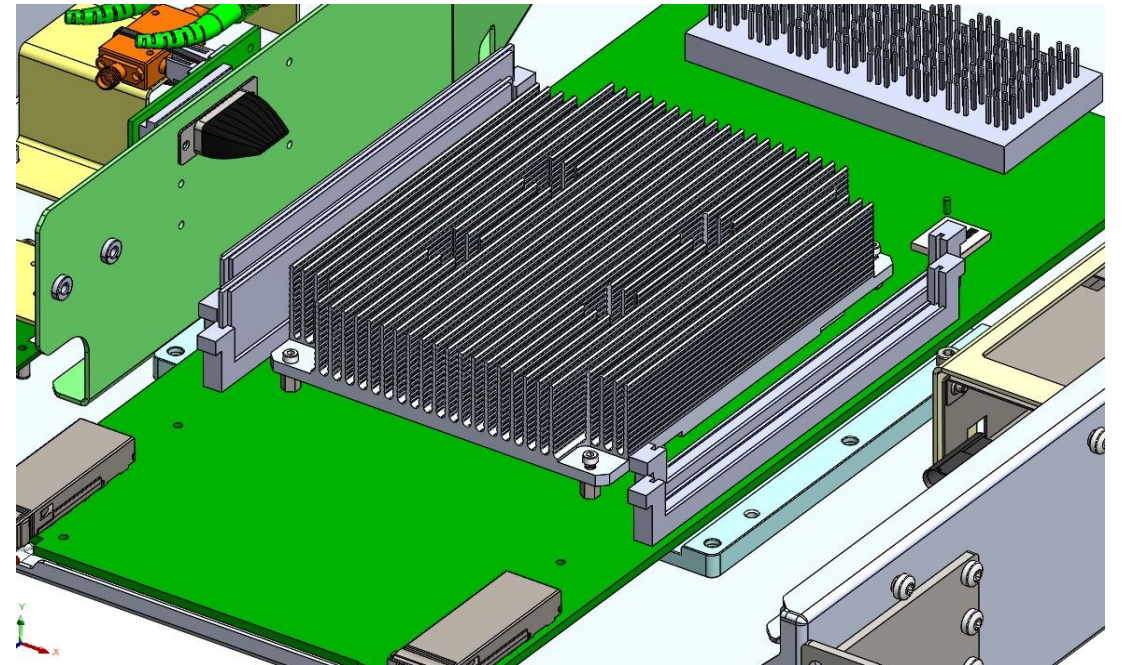


Custom made thin copper walled heatsink replaced with off-the-shelf based design

Before

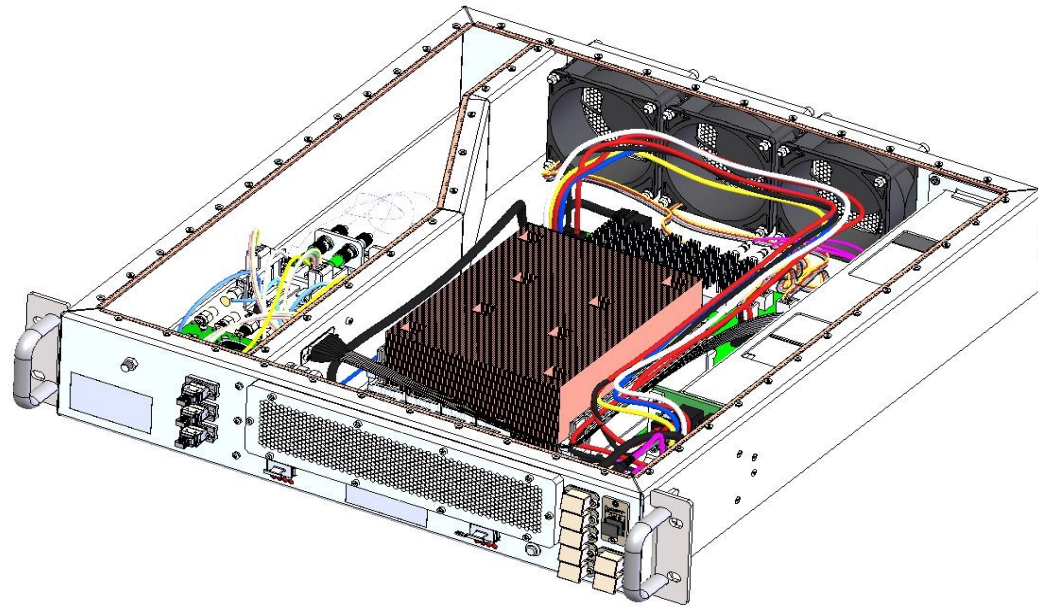


After

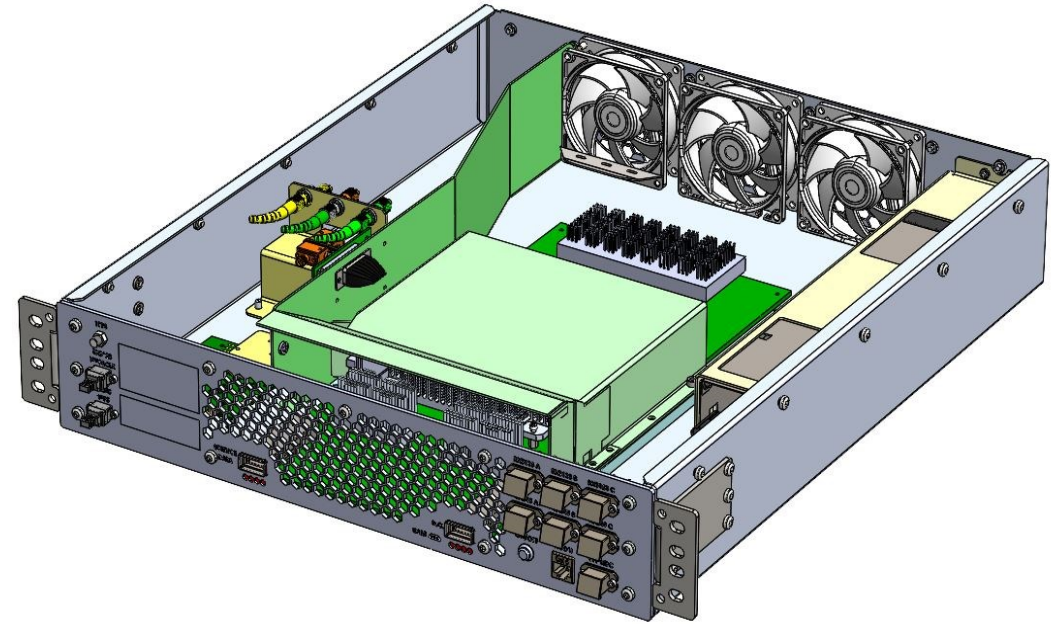


New air duct introduced
All box parts redesigned for easier manufacturing,
kinder tolerances and simpler integration

Before



After





Qamcom is a knowledge-based research and technology company within hardware, software and system development bridging the gap between research, technology and business.