

# HOW TO ENSURE YOUR DEDICATED, INTEGRATED MICROTCA CRATE WORKS WELL

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# THE MICROTCA CRATE

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## MAIN TOPICS TO ENSURE FLAWLESS OPERATION

- Mechanical construction / EMC / ...
  - Module alignment, EMC shielding, robustness, ...
- Cooling
  - All kind of AMC modules shall work in their specified temperature range
- Signal integrity / Backplane Topology
  - The needed transfer rates shall be realized with all kind of conform AMC modules
  - Non standard conform topologies shall be possible
- Firmware / FRU files
  - Crate shall behave in each situation as expected, MCH shall understand all FRU entries
- Interoperability
  - Crate must work with all MTCA conform components



# MECHANICAL CONSTRUCTION

## Mechanical / Backplane Alignment

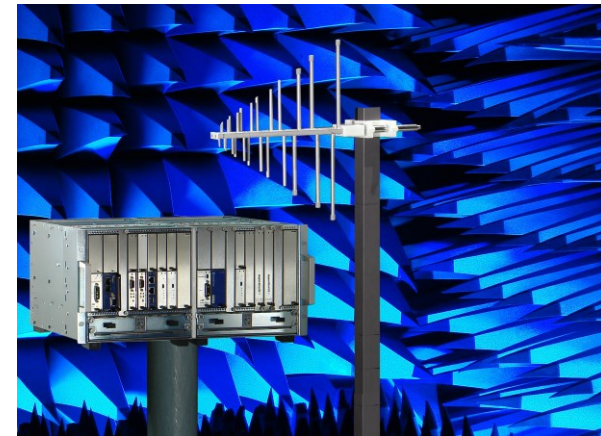
- AMC connector is fine pitch
  - Needs special production tools to reduce mechanical tolerances
  - Backplane positioning gauge to adjust backplane / connector to card cage

## Robustness

- Crate and installed electronics should survive transport and the whole life span of the application
- Small details might influence life span significantly (i.e. fan tray connector)
  - Package drop tests, shock and vibration tests, ...

## EMC Shielding / Magnetic Field

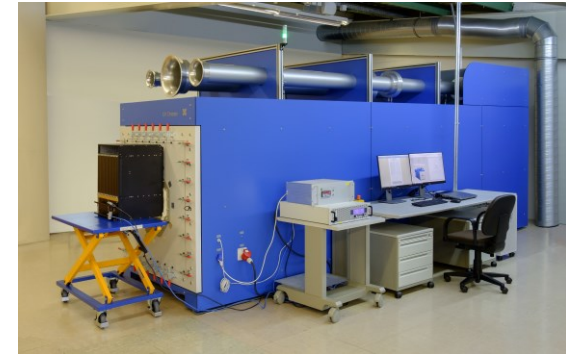
- Application must work within the specified parameters in the application environment
  - EMC tests, ...



# COOLING

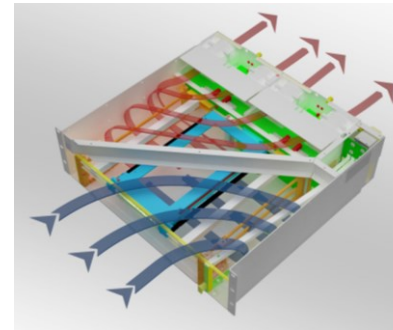
## Overall air volume in the crate (bulk air flow)

- Proof of crate concept
  - Evaluating the overall air volume with an thermal mock-up early in the development phase



## Air flow in each zone of each slot (air distribution)

- Verifying that each AMC gets sufficient air
- Even with very critical air path inside the Crate
  - Air flow test with dedicated test module



## Guiding the air to the right spots (filler panel, air blocker)

- In the application there will be modules with significant difference in air impedance
  - Might need air blocking devices on low impedance AMCs
- Empty slots disturb the air flow
  - Cover empty slots with filler panels, either with or without air blockers
  - Guide:

<https://schroff.pentair.com/wcsstore/ExtendedSitesCatalogAssetStore/Attachment/SchroffAttachments/Documents/Filler%20Module%20MTC.A.4>



# SIGNAL INTEGRITY

## Ethernet and PCIe Specifications

- IEEE and PCI-SIG defining the parameters for Computer busses like Ethernet and PCIe
  - They describe the channel from transmitter to receiver
- PICMG implements those computer busses into their specifications like ATCA or MTCA
  - Channel gets splitted into Board / Backplane / Board

## Channel simulation

- Simulation upfront the layout is essential to find routing strategies for a specification compliant backplane
  - Evaluating cross talk, insertion loss, return loss, ...

## Signal integrity measurements

- Verifying that the backplane meets the specification
  - Test results are also required to optimize the simulation models
- 40 / 100 G Ethernet and PCIe Gen 3 & 4 need proper routing strategies and dedicated printed circuit board materials

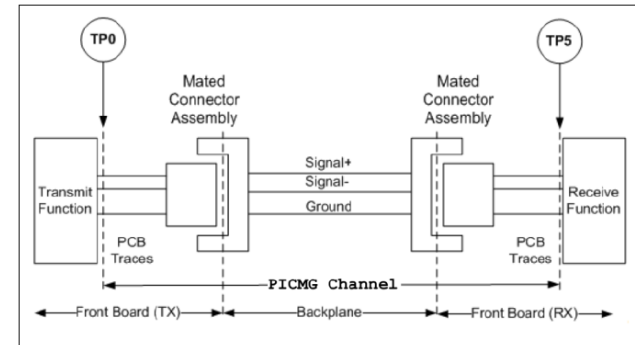


Figure 1: Test point locations for LCLASS 00xb Channels

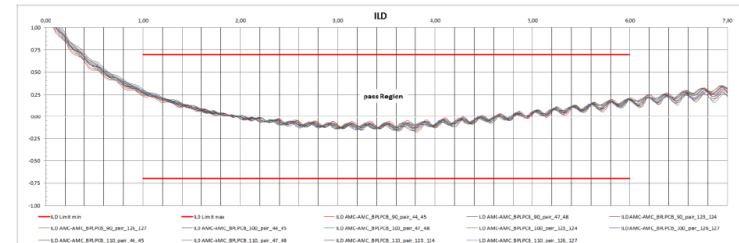


Figure 11: ILD limits and parameter from 16inch backplane PCB simulations

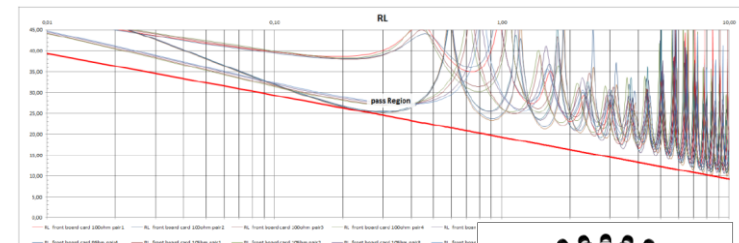


Figure 17: Return loss limits and parameter of Front Board test cards

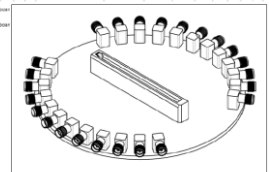


Figure 13: Example Front Board test assembly

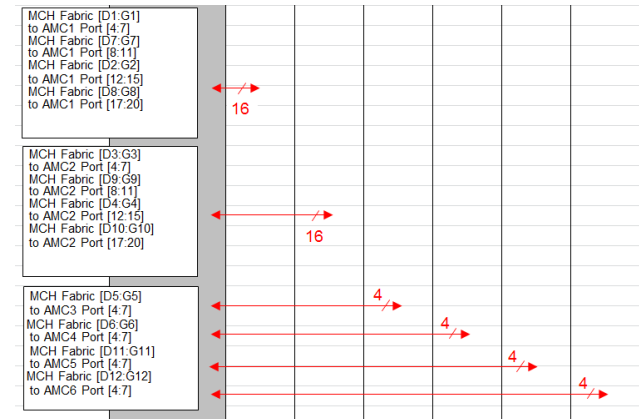
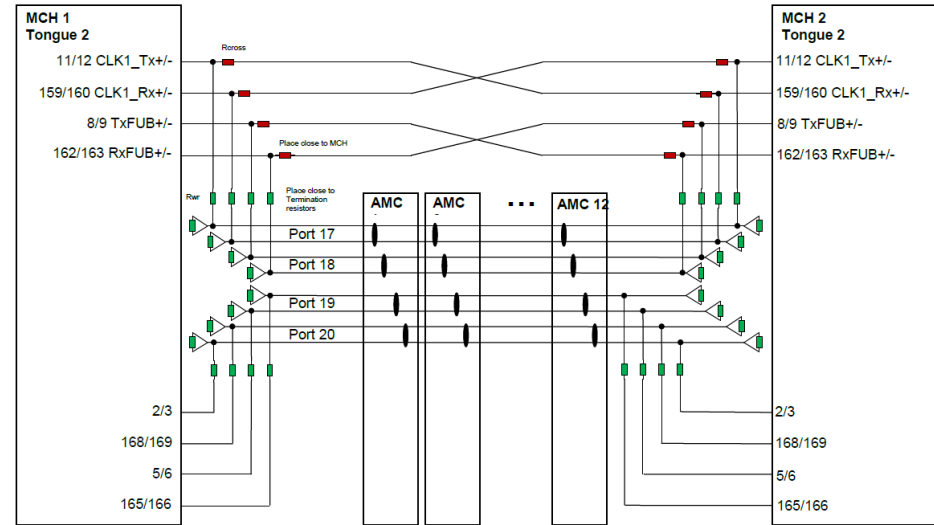
# BACKPLANE TOPOLOGY

## Implementation of enhanced features

- Some applications demand features which are not implemented in the current standard
  - Support for White Rabbit (deterministic Ethernet)
  - Fat pipes with x8 or x16 lanes

## Close cooperation with MCH / Board vendors

- Whenever some topology is not implemented into the MTCA specification, MCH, board and backplane vendors have to define a solution together to ensure the functionality
  - White rabbit implementation need pins of the MCH update channel
  - x8 and x16 fat pipe links must be supported by the PCIe switch of the MCH
- Close cooperation with NAT, Powerbridge and Institutes to define these forward looking solutions





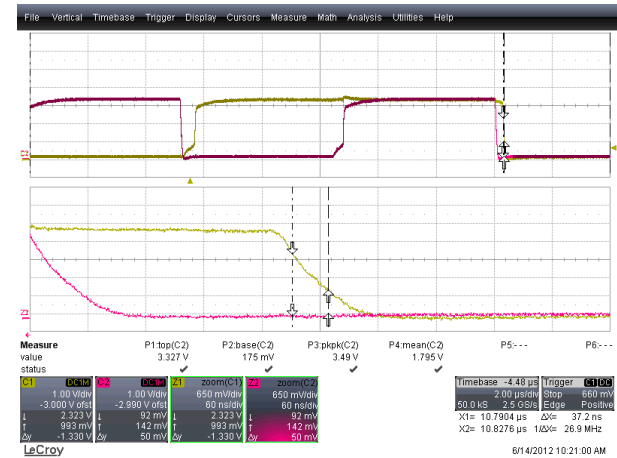
# FIRMWARE / FRU FILES

## Functional Tests

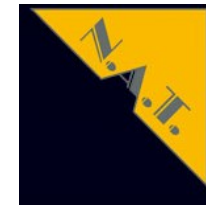
- Verify the functionality and stability of the hardware management
  - Power, hot swap, sensors, IPMI, redundancy, ...

## Ensure the proper operation of the integrated solution

- After the function of the IPMI, cooling units, Chassis FRU data, ... has been verified the functionality with PM and MCH has to be tested
  - Tests are performed internally and at NAT, Powerbridge and others
  - Engineering is directly exchanging observations in the test phase and during the product life cycle
  - Solutions get evaluated and implemented
  - Sample: Interpretation of module coordinates of the MTCA.4 specification has been different between NAT and Pentair. Engineers of both companies have defined a common understanding which is now implemented in the NAT MCH and in each new Schroff Crate FRU file



IPMB signal integrity test



# INTEROPERABILITY

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## Interoperability workshops

- Since the release of MTCA.0 PICMG and later Desy organized interoperability workshops for MTCA once or even twice per year

## Interoperability is daily business

- Besides the interoperability workshops observations from customers or from the main vendors of MTCA Crates, MCHs, PMs and AMCs are exchanged, evaluated and fixes get implemented on a regular base
- Close partnerships and open communications allow quick workarounds and bug fixes





