Evaluation results of µTCA equipment

xTCA Interest Group, 6th meeting
09/04/2013

Collaboration (PH/ESE)
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PH-ESE-BE

Outline

Introduction
- xTCA Evaluation Project
- ESE-BE xTCA Equipment

Testing MicroTCA equipment
- Test tools
- Test performed
- Labview Test GUI
- Polaris Tester
- IPMI Sniffer

Test example: Power Module NAT DC780
- Test setup
  - Load Sharing-Interoperability problems
- Results discussion
- Comparison with Vadatech UTC010

Conclusions
- Failures and reparations
- Observation
- Future work

Outline

- **MicroTCA evaluation project in PH-ESE group launched in 2011**
  - Technical evaluation of components for MicroTCA and MTCA.4 systems
  - Technical evaluation of AC/DC converters
  - Development of tools (H/W and S/W) for the testing of commercial components
  - Conduct market surveys
  - Report and share results

- **Recently expanded the evaluation project to also include ATCA**

- **Longer term goal**
  - Try to standardize MicroTCA and ATCA shelves and power supplies
    - Many options (backplanes, cooling, RTMs, power supply, …)
  - Propose acceptance test procedures
  - Propose a selected set of equipment to the experiments
  - Provide centralized support for these items

MTCA Crates

Vadatech VT892 MTCA.0
(12 AMCs, 2 MCHs, 2PMs, 2CUs)

ELMA 043-012 MTCA.4
(12 AMCs, 12 RTMs, 2 MCHs, 4PMs, 2CUs)

Schroff MTCA.4 + AC/DC CM100
(6 AMCs, 6 RTMs, 1 MCHs)

PMs

4xNAT DC780
(792W)

Vadatech UTC010
(792W)

Wiener AC/DC
(Prototype, 800W)

MCHs

Vadatech

NAT MCH

Kontron
AM4904

AMCs

ELMA Load Board

Kontron AM5030

ESD ADIO24

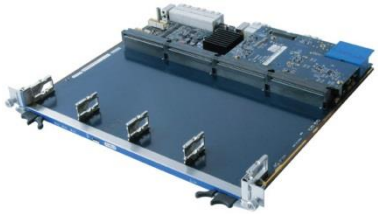
CCT AM31

ATCA Crates

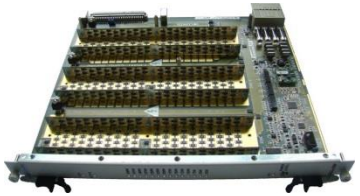
Schroff 14-slot 13U ATCA shelf with SHMM

ATCA boards

Kontron AMC Carrier



Comtel load boards (including RTM)



AC/DC Power Supply

Emerson network power NetSure501

PowerOne Aspiro

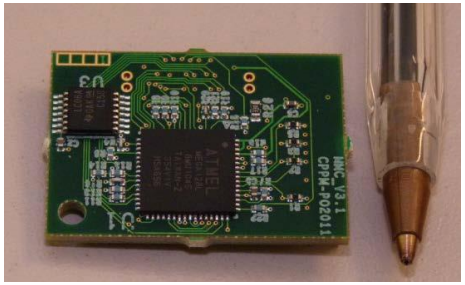
PowerOne Guardian

Lineage Power CPS

Outline

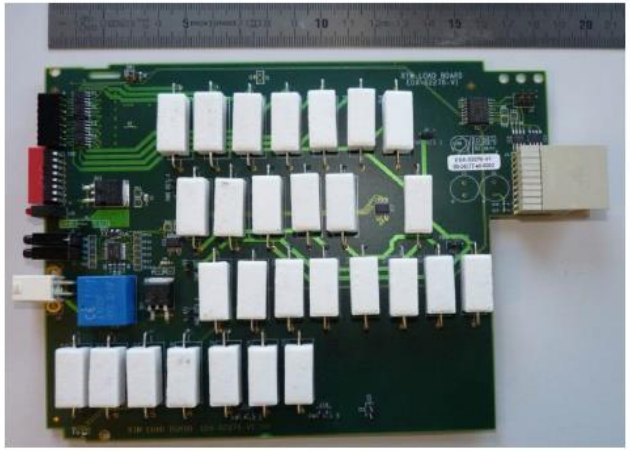
AMC and **RTM** load modules developed in-house Based on switched resistive loads

- Used for power supply and cooling performance measurements
- Control via **MMC**
  - Based on design CPPM/Marseille
  - Based on code DESY



MMC

AMC Load Board



RTM Load Board

- **Electrical Evaluation of Power Modules**
  - **Static Tests**
    - Load Regulation
    - Line Regulation
  - **Dynamic Tests**
    - Load transient Response
    - Ripple and noise
  - **Efficiency and Power Factor**
  - **Overcurrent protection**

Instruments

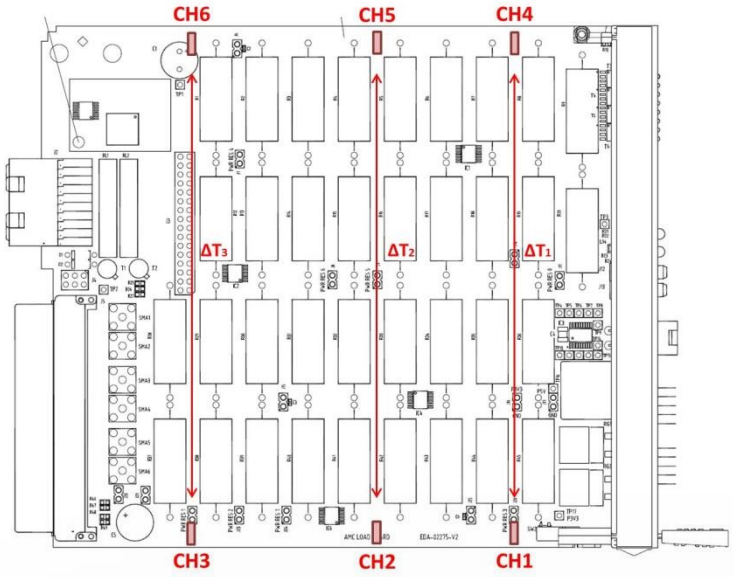
LeCroy 104Xi

LeCroy API015
Current probe

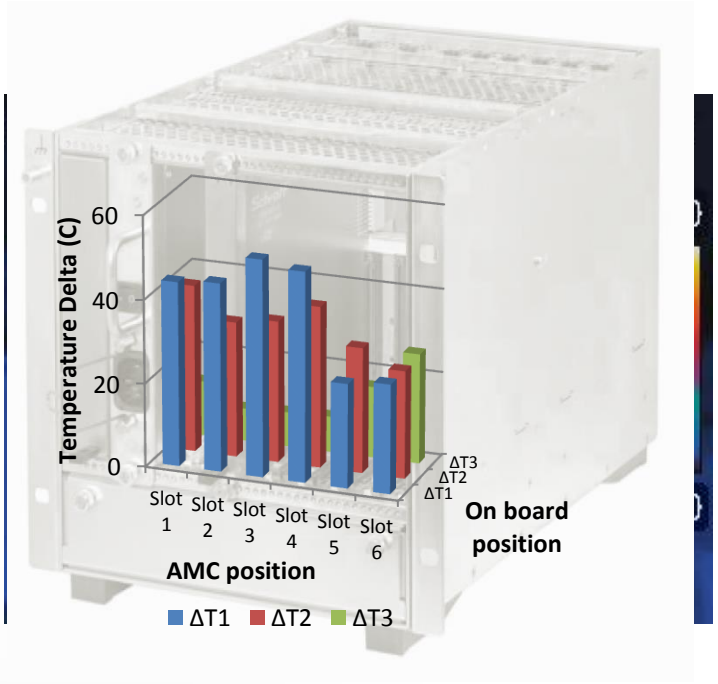
Agilent 34970A
Data Logger

Agilent N3300A
Electronic Load

- Thermal Evaluation
  - Cooling performance



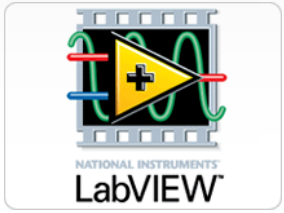
ALB temp sensors position

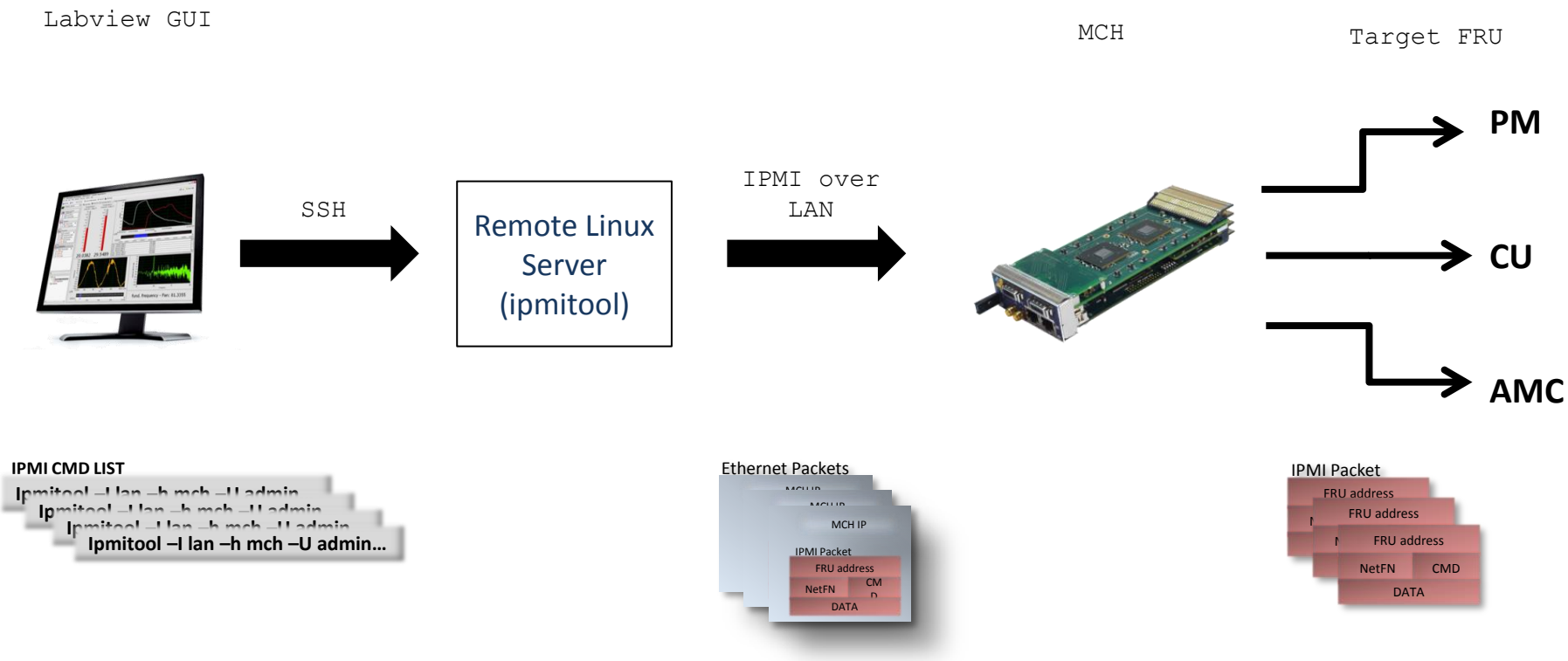


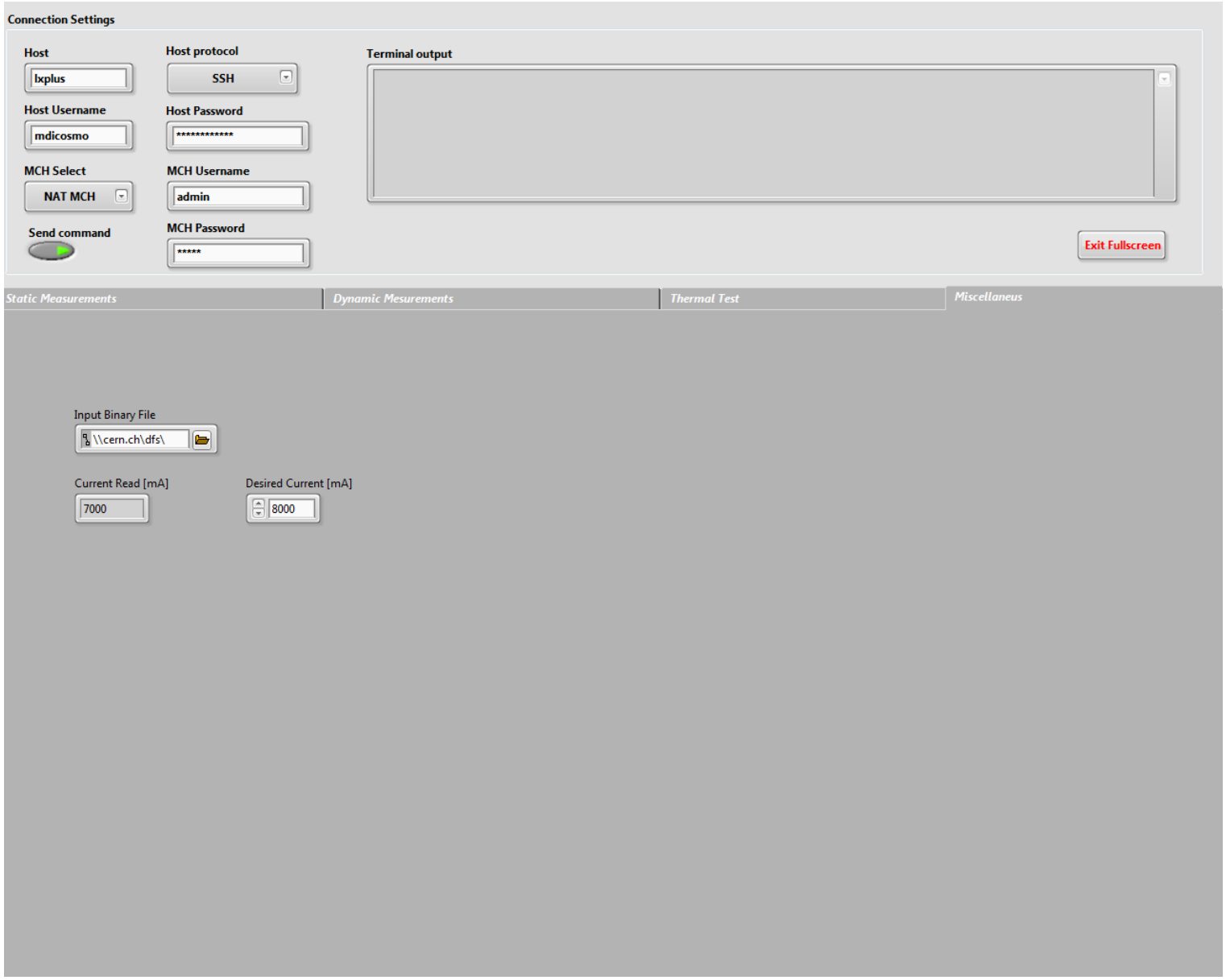
Instruments

Agilent 34970A
Data Logger

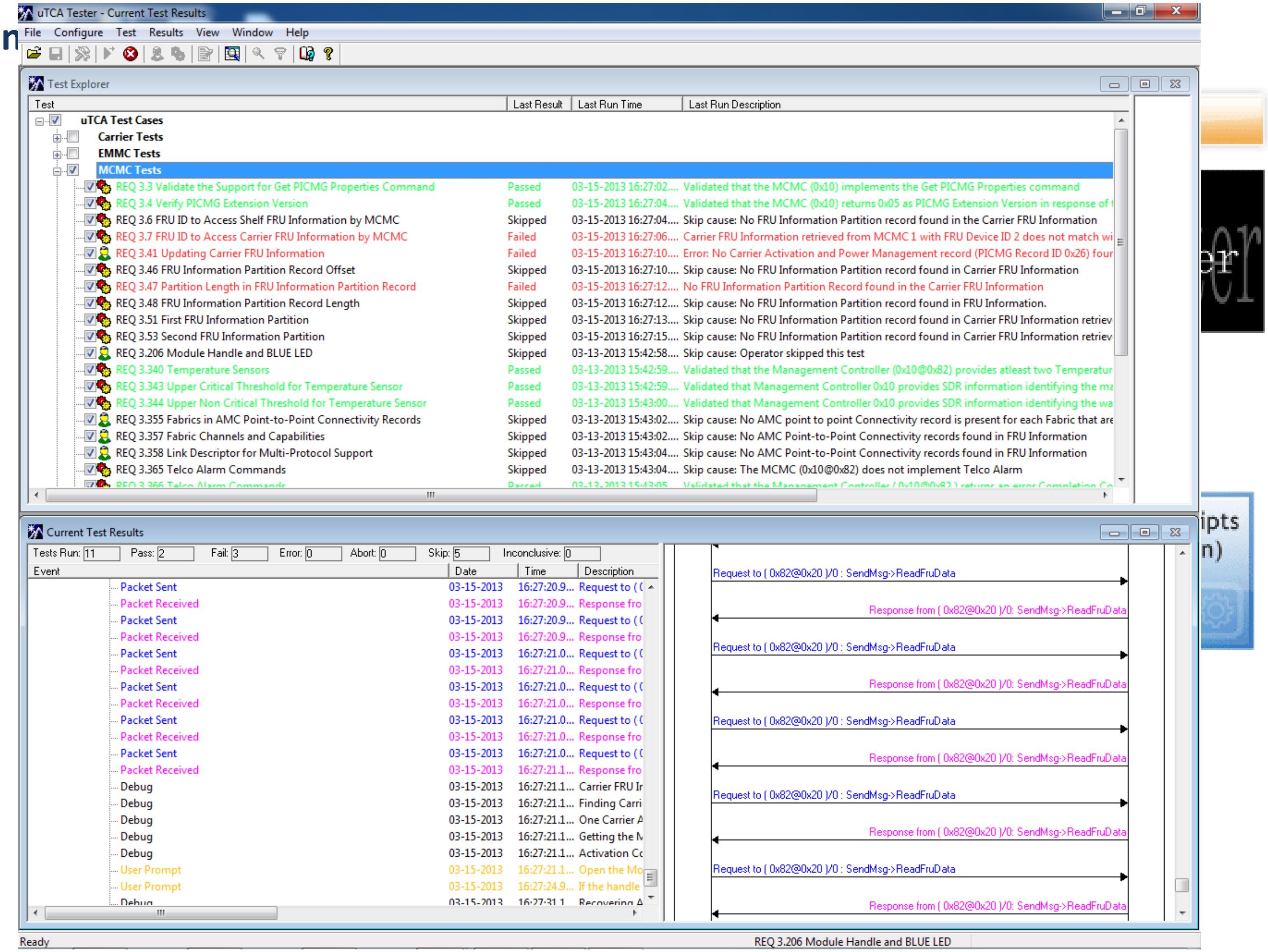
34901A 20
Channel Multiplexer




Labview GUI
MCH
Target FRU
SSH
Remote Linux Server (ipmitool)
IPMI over LAN
PM
CU
AMC
IPMI CMD LIST
Ipmitool –I lan –h mch –U admin…
Ethernet Packets
MCH IP
IPMI Packet
FRU address
NetFN
CMD
DATA
IPMI Packet
FRU address
FRU address
FRU address
NetFN
CMD
DATA

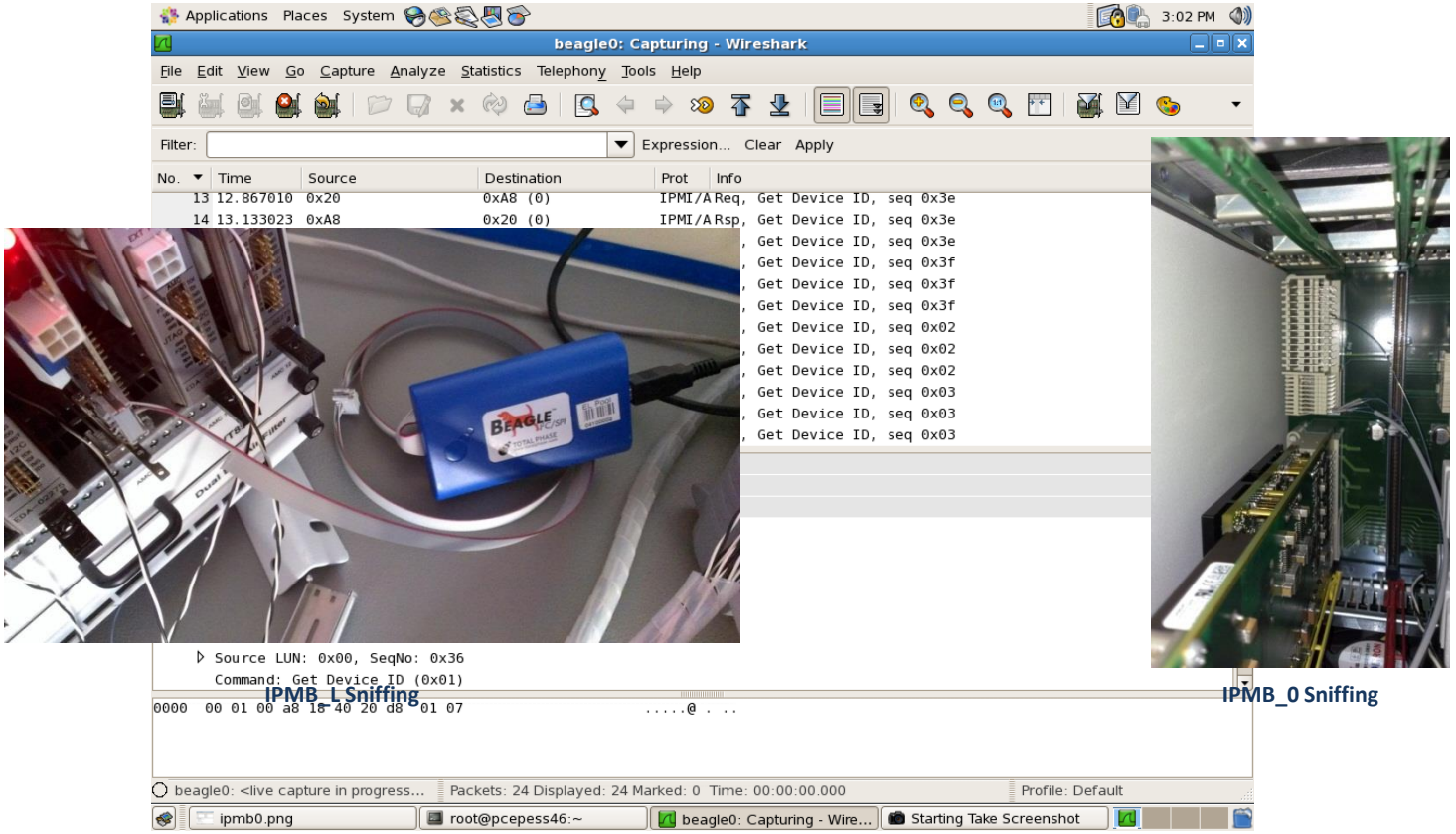

Connection Settings
Host
lxplus
Host protocol
SSH
Terminal output
Host Username
mdicosmo
Host Password
****
MCH Select
NAT MCH
MCH Username
admin
Send command
MCH Password
*****
Exit Fullscreen
Static Measurements
Dynamic Mesurements
Thermal Test
Miscellaneus
Input Binary File
\\cern.ch\dfs\
Current Read [mA]
7000
Desired Current [mA]
8000

Function


uTCA Tester - Current Test Results
File Configure Test Results View Window Help
Test Explorer
Test | Last Result | Last Run Time | Last Run Description
uTCA Test Cases
Carrier Tests
EMMC Tests
MCMC Tests
REQ 3.3 Validate the Support for Get PICMG Properties Command | Passed | 03-15-2013 16:27:02.... | Validated that the MCMC (0x10) implements the Get PICMG Properties command
REQ 3.4 Verify PICMG Extension Version | Passed | 03-15-2013 16:27:04.... | Validated that the MCMC (0x10) returns 0x05 as PICMG Extension Version in response of
REQ 3.6 FRU ID to Access Shelf FRU Information by MCMC | Skipped | 03-15-2013 16:27:04.... | Skip cause: No FRU Information Partition record found in the Carrier FRU Information
REQ 3.7 FRU ID to Access Carrier FRU Information by MCMC | Failed | 03-15-2013 16:27:06.... | Carrier FRU Information retrieved from MCMC 1 with FRU Device ID 2 does not match wi
REQ 3.41 Updating Carrier FRU Information | Failed | 03-15-2013 16:27:10.... | Error: No Carrier Activation and Power Management record (PICMG Record ID 0x26) four
REQ 3.46 FRU Information Partition Record Offset | Skipped | 03-15-2013 16:27:10.... | Skip cause: No FRU Information Partition record found in Carrier FRU Information
REQ 3.47 Partition Length in FRU Information Partition Record | Failed | 03-15-2013 16:27:12.... | No FRU Information Partition Record found in the Carrier FRU Information
REQ 3.48 FRU Information Partition Record Length | Skipped | 03-15-2013 16:27:12.... | Skip cause: No FRU Information Partition record found in FRU Information.
REQ 3.51 First FRU Information Partition | Skipped | 03-15-2013 16:27:13.... | Skip cause: No FRU Information Partition record found in Carrier FRU Information retriev
REQ 3.53 Second FRU Information Partition | Skipped | 03-15-2013 16:27:15.... | Skip cause: No FRU Information Partition record found in Carrier FRU Information retriev
REQ 3.206 Module Handle and BLUE LED | Skipped | 03-13-2013 15:42:58.... | Skip cause: Operator skipped this test
REQ 3.340 Temperature Sensors | Passed | 03-13-2013 15:42:59.... | Validated that the Management Controller (0x10@0x82) provides atleast two Temperatur
REQ 3.343 Upper Critical Threshold for Temperature Sensor | Passed | 03-13-2013 15:42:59.... | Validated that Management Controller 0x10 provides SDR information identifying the ma
REQ 3.344 Upper Non Critical Threshold for Temperature Sensor | Passed | 03-13-2013 15:43:00.... | Validated that Management Controller 0x10 provides SDR information identifying the wa
REQ 3.355 Fabrics in AMC Point-to-Point Connectivity Records | Skipped | 03-13-2013 15:43:02.... | Skip cause: No AMC point to point Connectivity record is present for each Fabric that are
REQ 3.357 Fabric Channels and Capabilities | Skipped | 03-13-2013 15:43:02.... | Skip cause: No AMC Point-to-Point Connectivity records found in FRU Information
REQ 3.358 Link Descriptor for Multi-Protocol Support | Skipped | 03-13-2013 15:43:04.... | Skip cause: No AMC Point-to-Point Connectivity records found in FRU Information
REQ 3.365 Telco Alarm Commands | Skipped | 03-13-2013 15:43:04.... | Skip cause: The MCMC (0x10@0x82) does not implement Telco Alarm
Current Test Results
Tests Run: 11 Pass: 2 Fail: 3 Error: 0 Abort: 0 Skip: 5 Inconclusive: 0
Event | Date | Time | Description
Packet Sent
Packet Received
Debug
User Prompt
Request to (0x82@0x20)/0 : SendMsg->ReadFruData
Response from (0x82@0x20)/0: SendMsg->ReadFruData
Ready
REQ 3.206 Module Handle and BLUE LED

IPMI Sniffer

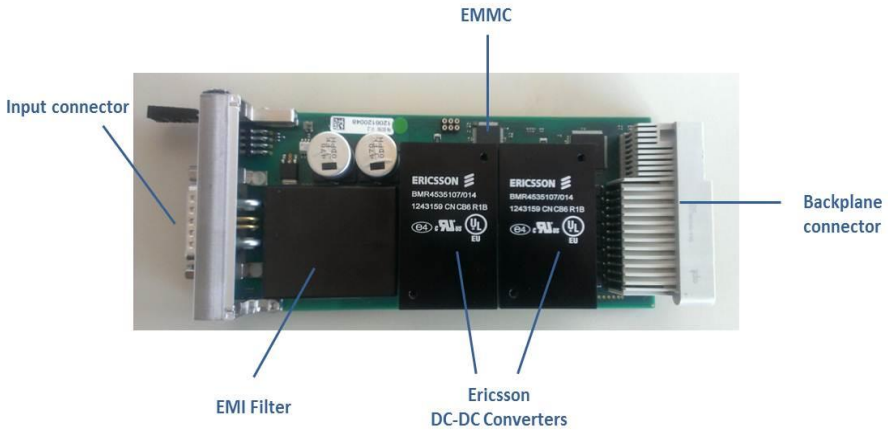
- Useful for test, debug and development purposes.
- Many I2C Analyzer available but no universal commercial IPMI real-time monitor
- The solution consists in using a Totalphase i2c Beagle Protocol Analyzer and Wireshark



Outline

NAT DC780 PM

- Standard MicroTCA DC/DC PM
- 792 W, Minimum efficiency 95.5%
- Support for
  - 12 AMCs,
  - 2 CUs
  - 2 MCHs



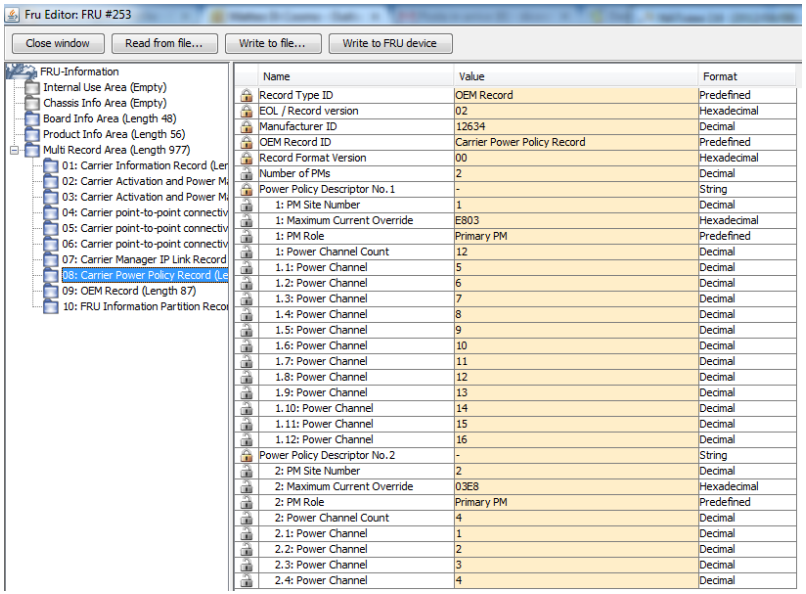
Test Setup

- Host: Vadatech VT982 Crate
- External AC/DC Power Source (1.5kW)
- *Shared LOAD* configuration needed..

2 PM DC780 in a Vadatech VT982 crate

Load Sharing configuration

- Necessary to fully power the crate
- Useful for testing (current control and ripple)
- Load configuration defined in Backplane FRU Info
- More than one Primary PM
- Each PM powers a defined set of FRUs



Name	Value	Format
Record Type ID	OEM Record	Predefined
EOL / Record version	02	Hexadecimal
Manufacturer ID	12634	Decimal
OEM Record ID	Carrier Power Policy Record	Predefined
Record Format Version	00	Hexadecimal
Number of PMs	2	Decimal
Power Policy Descriptor No. 1	-	String
1: PM Site Number	1	Decimal
1: Maximum Current Override	E803	Hexadecimal
1: PM Role	Primary PM	Predefined
1: Power Channel Count	12	Decimal
1.1: Power Channel	5	Decimal
1.2: Power Channel	6	Decimal
1.3: Power Channel	7	Decimal
1.4: Power Channel	8	Decimal
1.5: Power Channel	9	Decimal
1.6: Power Channel	10	Decimal
1.7: Power Channel	11	Decimal
1.8: Power Channel	12	Decimal
1.9: Power Channel	13	Decimal
1.10: Power Channel	14	Decimal
1.11: Power Channel	15	Decimal
1.12: Power Channel	16	Decimal
Power Policy Descriptor No. 2	-	String
2: PM Site Number	2	Decimal
2: Maximum Current Override	03E8	Hexadecimal
2: PM Role	Primary PM	Predefined
2: Power Channel Count	4	Decimal
2.1: Power Channel	1	Decimal
2.2: Power Channel	2	Decimal
2.3: Power Channel	3	Decimal
2.4: Power Channel	4	Decimal

NatView FRU Editor

PM1 Under Test Primary

MP,PP →

AMCs slots (Channels 5-16)

PM2 Auxiliary Primary

MP,PP →

MCH, CUs (Channels 1-4)

Load Sharing configuration

- Seems not to be a trivial setup
- Various and serious interoperability problems encountered
- Different behaviors for different manufacturer modules
- NAT and Vadatech mainly concerned

NAT: Problems being solved in cooperation with the support. Full load sharing support will require PM firmware modification.

" … not all vendor PM and MCH modules are capable of handling this configuration well.
You cannot mix PM modules from different vendors, that is not something you want to do. Two vendor PM may not synchronize and operate properly on a chassis." **Vadatech Support, 05 March 2013**

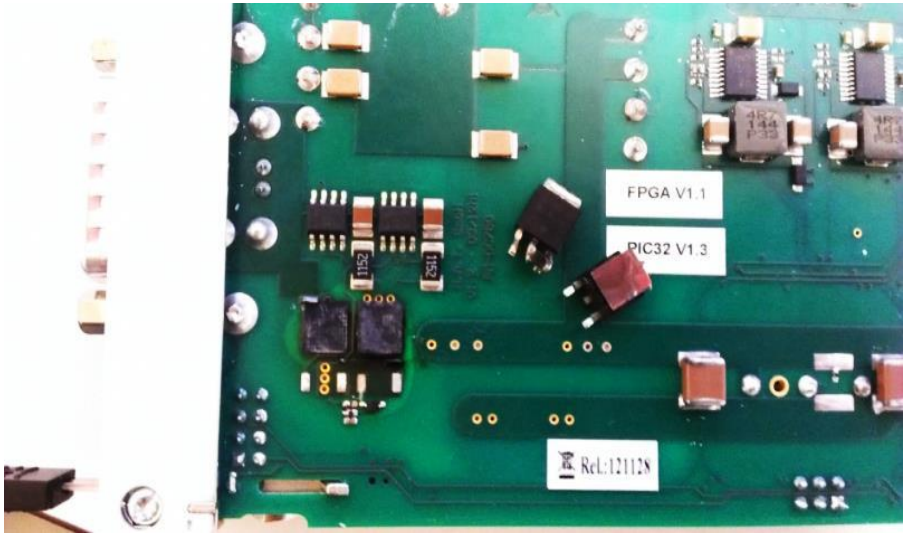
→ **NAT MCH + 1 NAT or Coredge PM as auxiliary PM**

NAT DC780 PM

- Results discussion: Input Voltage/Line Regulation

DC780 Specs: -60V<Vin<-40V

NAT DC780



PM PCB bottom layer after failure

According to the manufacturer:

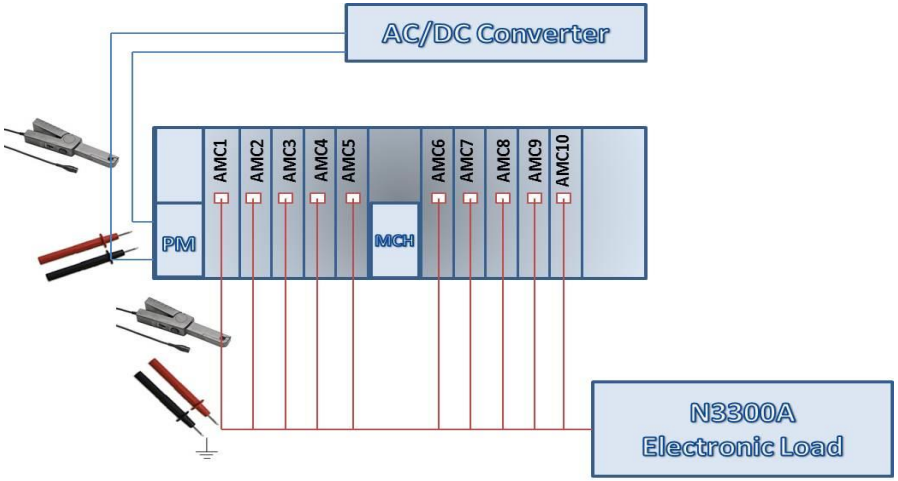
- The input FET experienced much current causing the rupture of the PM.
- A modification of the existing specification will be required (min -48V)

NAT DC780 PM

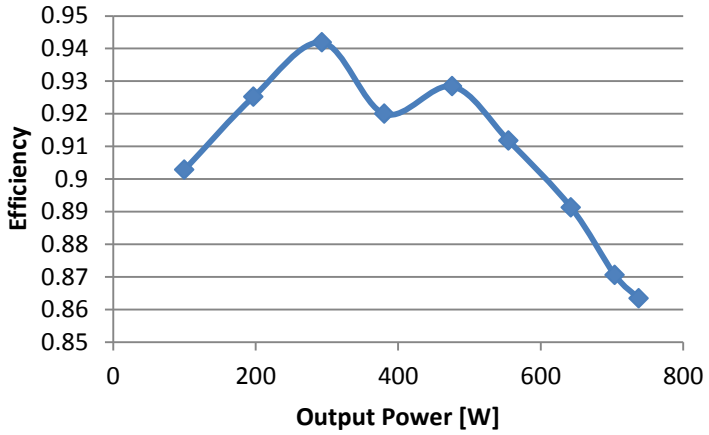
- Results discussion: Efficiency

DC780 Specs: 95.5% (min)

NAT DC780



Efficiency measurement setup



Efficiency measurement

NAT DC780 PM

- Results discussion and comparison with Vadatech UTC010

NAT DC780

	Test Conditions	Measured	DC780 Specs
Maximum Power	Vi=-48V	730W	780W
Input Voltage		-48V to -53V	-40V to -60V
Load Regulation	Full power	8.6%	10%
Line Regulation	Full load, Vin: -40V to -53V	2mV (max) before failure	Not reported
Efficiency	Vi = -48V, 1-100% of full power	94% (max)	95.5% (min)
Ripple	Full power	20mV	Not reported
Voltage transient deviation	Load step from 25% to 75% of full load	±0.5V	Not reported

TTR ≦ 3d

Vadatech UTC010

	Test Conditions	Measured	UTC010 Specs
Maximum Power	Vi=-48V	600W	780W
Input Voltage		-38V to -53V	-36V to -75V
Load Regulation	Full power	1.2%	Not reported
Line Regulation	Full load, Vin: -38V to -53V	1.93V	Not reported
	Minimum load, Vin: -38V to -53V	1.22V	Not reported
Efficiency	Vi = -48V, 1-100% of full power	93% (max at 300W)	95% (full load)
Ripple	Full power	73mV	Not reported
	Minimum Power	700mV	Not reported
Voltage transient deviation	Load step from 25% to 75% of full load	±0.4V	Not reported

TTR ≦ 13d

PP Voltage within the MTCA Specification (10V-14V)

TTR = Time To Reply

Availables on the uTCA Repository

Evaluation Report of a NAT DC780 MTCA Power Module

Abstract:

The purpose of this document is to show the results of th
This includes electrical performance evaluation and funct

Version: 1.0
Date: 12/02/2013
Authors: Matteo Di Cosmo

Evaluation Report of a Schroff uTCA.4 Crate

Abstract:

The purpose of this document is to show the resu
MTCA.4 Crate (ref. 11850-019). This includes the
the efficiency of the cooling unit.

Version: 2.0
Date: 12/02/2013
Authors: Matteo Di Cosmo

Evaluation Report of a Vadatech UTC010 MTCA Power Module

Abstract:

The purpose of this document is to show the results of the evaluation performed on a Vadatech UTC010. This includes electrical performance evaluation and functionality tests.

Outline

NAT PM DC780. Input stage compromised after line regulation tests

- Being repaired under warranty

Schroff for Physics Crate. Management Power not available for MCH and first AMC slot. Same problem encountered two years ago on two AMC slots.

- Repaired under warranty

NAT MCH. i2c ports failing.

- Sent twice for repair under warranty, still waiting for a report
- Up to now one i2c port not working again

AMC Backplane connector mating cycles, equipment involved:

- Schroff for Physics Crate. Sent for repair last Christmas. (Backplane replacement)
- NAT AMC Extender (Connector replaced manually in the LAB)
- First six AMC slots on Vadatech VT982 will give up soon…
- Time wasting and serious problem for test

- The MicroTCA specification defines 200 minimum mating cycles for this connector. The main connectors distributors comply with this number. (Harting, CONEC,…)

- Precautions must be taken:
  - Use AMC Extender when/where possible
  - Save insertions cycles avoiding to reprogram the MMC to change the FRU info.
    - FRU Current Requirement Editor developed in labview
    - Write FRU using IPMI commands

Lesson learned and results obtained

- List of written evaluation reports
- System architecture knowledge
- Cooperation with manufacturers
- Detailed test procedure defined
- Test setup available
  - Load modules
  - LabView GUI
  - IPMI monitor
- Full IPMI test suite (Polaris Tester)

But also

- Several interoperability problems faced during test
  - Must be solved in collaboration with the manufactures
- Interoperability not always assured (standards lacks…)
- Complete technical specification not always verified or provided by manufacturers
- Importance of Support

- **Conclude MicroTCA Equipment evaluation (hopefully end April)**
  - Finish the evaluation of a Vadatech VT892 and ELMA MTCA.4 Crate
  - Polaris tester (IPMI test of MCHs) and MTCA.4 Beta Tester
- **Start AdvancedTCA Evaluation**
  - Schroff Crate and ATCA components evaluation
  - Annecy IPMC + Test Carrier
  - ASIS ATCA crate (Vertical airflow)
- **AC/DC Converters** (first results available)

ASIS ATCA Crate coming soon

Useful links

- MicroTCA Evaluation Repository https://espace.cern.ch/ph-dep-ESE-BE-uTCAEvaluationProject/default.aspx
- PICMG Website http://www.picmg.org/
- MicroTCA Short Form Specification http://www.picmg.org/pdf/MicroTCA_Short_Form_Sept_2006.pdf
- AMC Short Form Specification http://www.picmg.org/pdf/AMC.0_R2.0_Short_Form.pdf
- ATCA Short Form Specification http://www.picmg.org/pdf/PICMG_3_0_Shortform.pdf
- IPMI, IPMB Specification http://www.intel.com/content/www/us/en/servers/ipmi/ipmi-specifications.html
- Polaris Tester http://www.polarisnetworks.net/atca-test-tool.html
- NAT Website http://www.nateurope.com/
- Vadatech Website http://www.vadatech.com/

THANK YOU