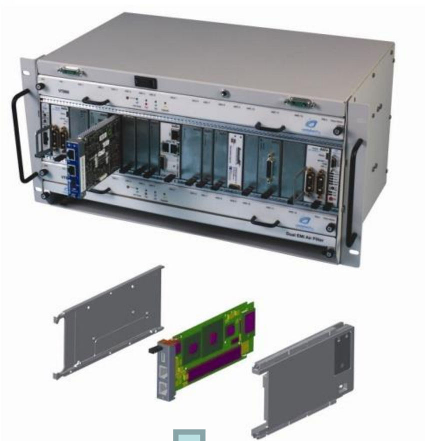
# Rugged MicroTCA Poised to Take on VPX for Mil/Aero Applications



# Hardened MicroTCA and OpenVPX

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# MicroTCA Today

- Early days – unestablished vendors not meeting spec, mostly Telco/networking, expensive shelf management, interoperability not coordinated
- Today – weak hands have been shaken out, true COTS across multiple industries, low-cost shelf mgmt options, AIWs & test data (MIL, Physics)

## Notable Features

- First 100G line cards in the embedded industry (out the front ports -- Processors and FPGAs)!
- 40GbE across backplane available (spec is in draft)
- MicroTCA.2 (Hybrid Air/Conduction) and MicroTCA.3 (Conduction Cooled) for Rugged applications.
- Expanding MicroTCA.4 Ecosystem with Rear I/O. Geared for High-Energy Physics and well-suited for Mil/Aero and many other industries.

# MOTS vs COTS

- *VPX is essentially a MOTS (Military Off The Shelf) architecture.*
- *MicroTCA is a true COTS (Commercial Off The Shelf) architecture, with primary markets of Communications/Networking, Mil/Aero, and High Energy Physics. Also some applications in Industrial, Medical, Transportation, Energy Exploration, and more.*

## Benefits of COTS

- Telco companies require leading-edge and bleeding-edge solutions, which drive the specification to higher levels of performance.
- Multiple markets provide diverse set of products/solutions as well as vendors.
- Improved economies of scale and volume in Telco/Other greatly reduce costs.

Sequestration’s focus on cost has benefitted MTCA.

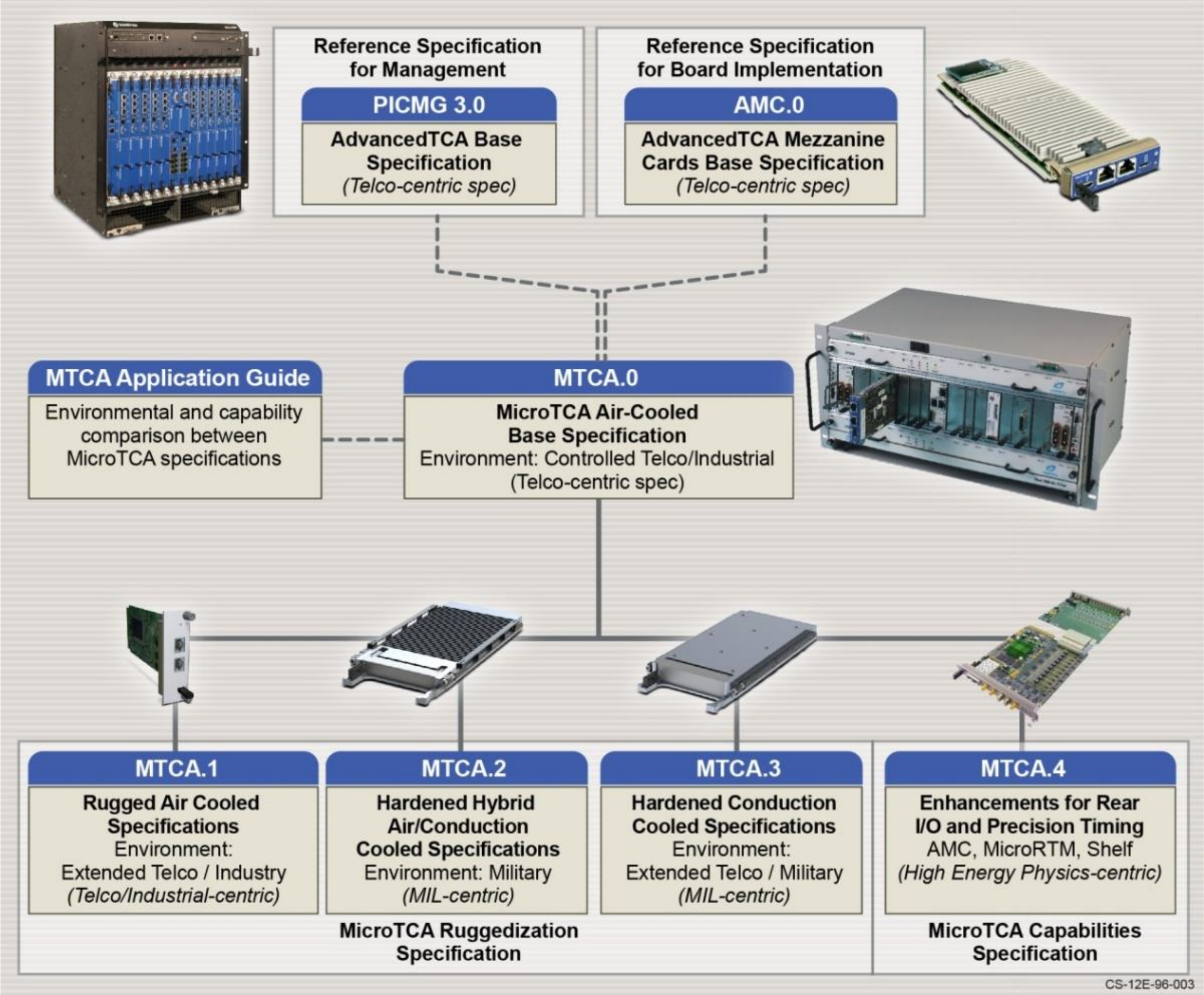
# But is MicroTCA Rugged Enough For Mil/Aero?

MicroTCA.3 and MicroTCA.2 were developed to provide hardened levels for Mil/Aero applications

- MicroTCA on satellite – rugged enough for space, it should be rugged enough for your application.
- Went through same testing (plus some extra) as VPX.
- Used best practices from PICMG/VITA community.

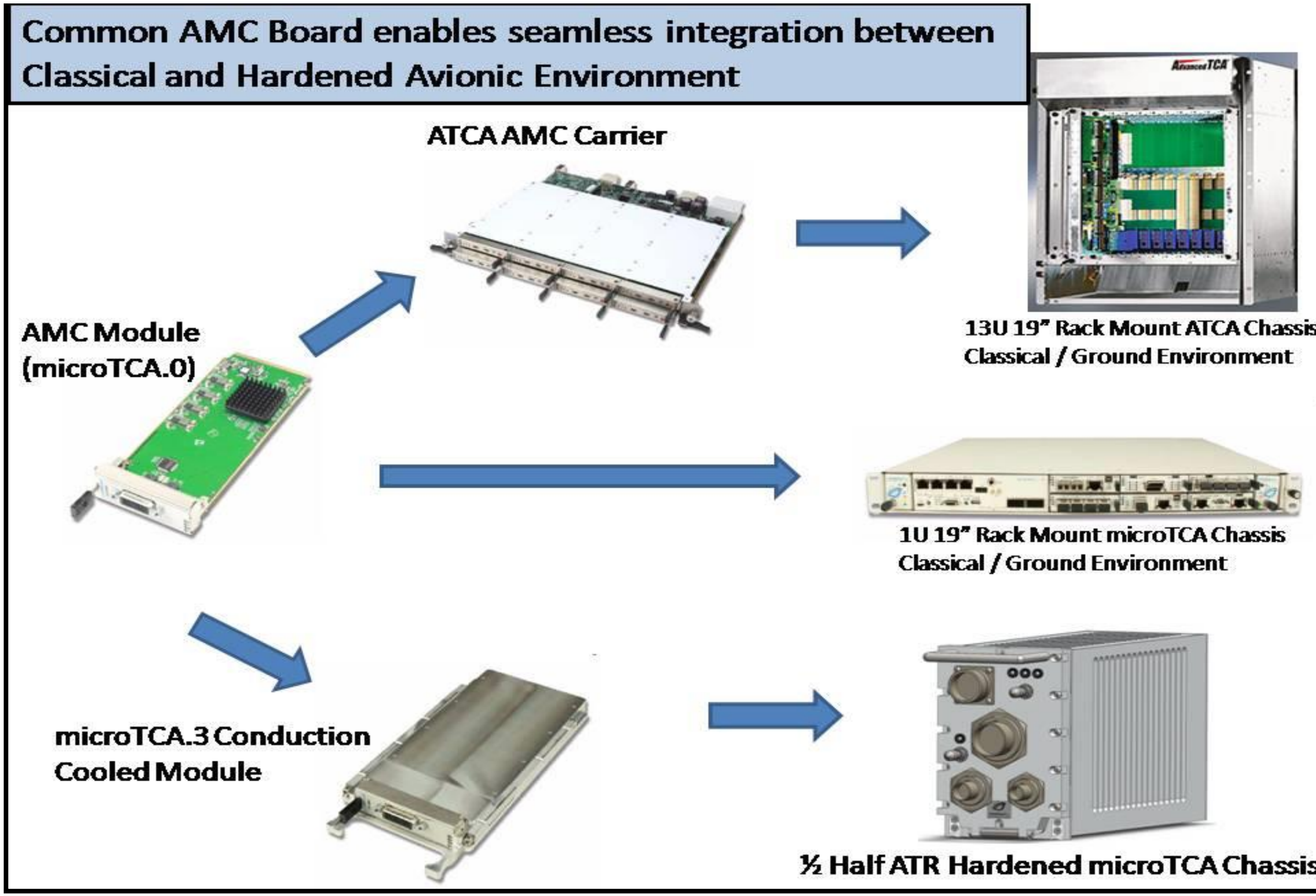
# MicroTCA Specification Relationships




*The MicroTCA family of specifications maximizes reuse from its ATCA and AMC parent specifications.* *Content derived from PICMG's MicroTCA Application Guide.*

# Same Modules Across Multiple Platforms



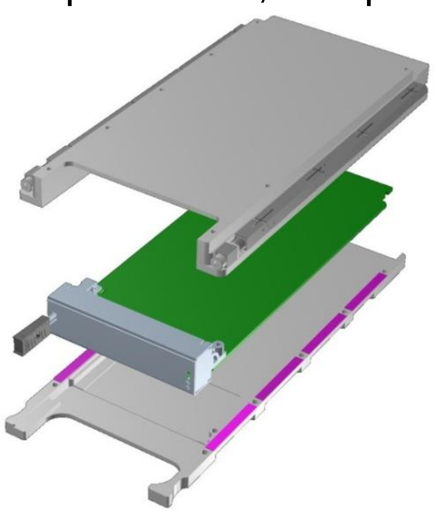

 

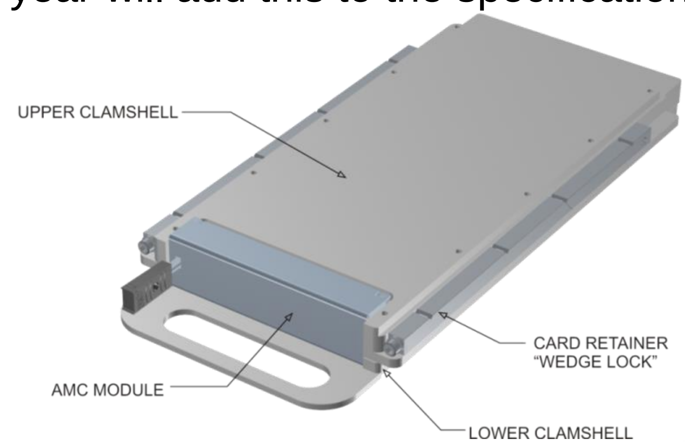
# MicroTCA.3 Ruggedization Levels

# MicroTCA.3 Mechanical

- Typical Conduction Cooled AMC
  - Mandated that AMC.0 modules are used as is to leverage large eco-system
  - There are five types of Modules sizes defined. They are the Compact, Mid-Size, Full Size, Power, and MCH in Single module configurations
  - Clamshell designed to support
    - Thermal interface to the chassis sidewall
    - Mechanical rigidity
    - 15KV ESD capability for 2 level maintenance
  - Double width modules are not defined, but may be designed following key ICD parameters for size & keep out area, an update early next year will add this to the specification

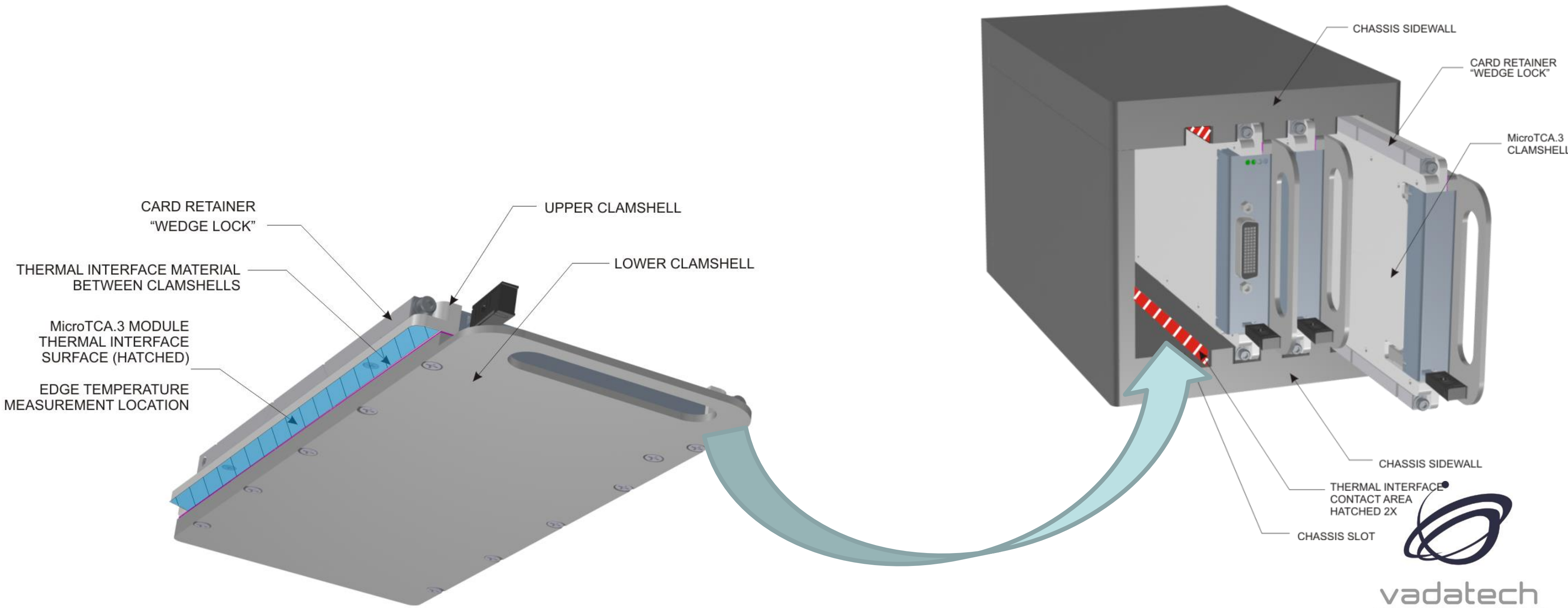




# MicroTCA.3 Thermal Levels

- The Thermal Interface surface
  - is the area of the Upper Clamshell (blue cross hatch) that contacts the Chassis Slot (red cross hatch)
  - is the location where the Module Edge Temperature is specified/measured
- The temperature specification does not include the associated temperature rise of the interface boundary layer between the MicroTCA.3 Module Thermal Interface surface and the Thermal Interface contact area on the Chassis Slot



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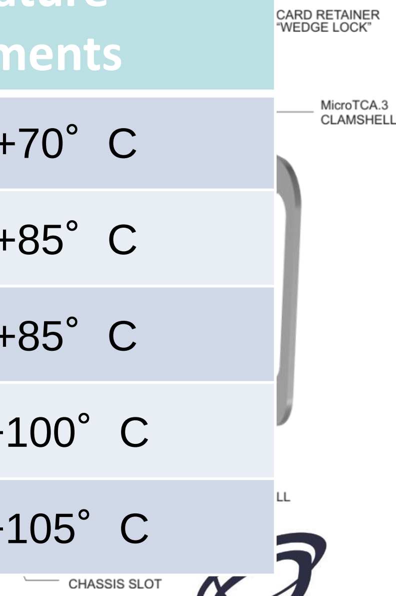
| Product Classification MTCA.3- | Operating Edge Temperature Requirements | Non-Operating Edge Temperature Requirements |
|---|---|---|
| TEL-1 | -5° C to +55° C | -40° C to +70° C |
| TEL-2 | -40° C to +85° C | -45° C to +85° C |
| MIL-CC2 | -40° C to +55° C | -40° C to +85° C |
| MIL-CC3 | -40° C to +70° C | -50° C to +100° C |
| MIL-CC4 | -40° C to +85° C | -55° C to +105° C |



# MicroTCA.3 Environmental

| Environmental category | Requirements per MicroTCA.3 product class | | | | |
|---|---|---|---|---|---|
| | MTCA.3-TEL-1 | MTCA.3-TEL-2 | MTCA.3-MIL-CC2 | MTCA.3-MIL-CC3 | MTCA.3-MIL-CC4 |
| Shock | IEC 61587-1, DL1, 15g | ANSI/VITA 47 OS1, 20g* | ANSI/VITA 47 - OS2, 40g; MIL-STD-810, Method 516, Procedure I* | | |
| Vibration | IEC 61587-1, DL1 (1g) sinusoidal | VITA 47 - V2 (8g) random* | ANSI/VITA 47 - V3 (12g) random; MIL-STD-810, Method 514, Procedure I* | | |
| Bench handling | Sect 2.9.3.2 | Sect 2.9.3.2** | MIL-STD-810, Method 516, Procedure VI* | | |
| Earthquake (Seismic) | ANSI T1.329 | ANSI T1.329** | Not applicable | | |
| ESD resistance | GR-1089-CORE; EN 61000-4-2 | GR-1089-CORE; EN 61000-4-2** | EN 61000-4-2 | | |
| Two-level maintenance | Not applicable | | See ESD Requirement | | |
| Corrosion resistance | GR-1089; ETS 300 019-1-3, Section 5.3, Table 3a | GR-1089; ETS 300 019-1-3 Section 5.3, Table 3a** | ASTM G85, Annex A4, Cycle A4.4.4.1* | | |
| Fungus resistance | ETS EN 300 019-1-3, Class 3.1, Section 5.1, Table 2; GR-63-CORE | ETS EN 300 019-1-3, Class 3.1, Section 5.1, Table 2; GR-63-CORE** | MIL-STD-810, Method 508* | | |
| Humidity | Operating Normal 5-85% non-condensing Op. Short Term 5-90% non-condensing | Operating Normal 5-85% non-condensing Op. Short Term 5-90% non-condensing** | 95% RH (5x48h); MIL-STD-810 Method 507* | | |
| Explosive atmosphere | Not applicable | | MIL-STD-810 (60,000 feet maximum) Method 511.4 Procedure 1 | | |
| Mixed flow gas | GR-63-CORE Section 4.5 | GR-63-CORE Section 4.5** | Not applicable | | |
| Altitude | -60m / 4,000m, EN 300-19-2-A1563; GR-63-CORE, Section 4.1.3 | -60m / 4,000m, EN 300-19-2-A1563; GR-63-CORE, Section 4.1.3** | -460m to 18,300m; MIL-STD-810, Method 500, Procedure II* | | |
| Rapid decompression | Not applicable | | MIL-STD-810, Method 500, Procedure III* | | |
| Attitude | Module shall meet all requirements in all orientations. | | | | |
| Acoustic | Not applicable | | ≤24dBA (Sound Pressure)* | | |
| Thermal | MicroTCA.3, Section 5 | | | | |
| Laser (module/system) | FDA/CDRH 21 CFR 1040.10, 140.11 | FDA/CDRH 21 CFR 1040.10, 140.11*** | Not applicable | | |
| Flammability | | | FAR-25, subpart D, section 869 | | |

- For the five product classes defined for MicroTCA.3 different environmental requirements are defined
  - TEL-1 & TEL-2 are based upon IEC & EN & ANSI requirements
  - MIL-CC2, MIL-CC3 & Mil-CC4 are based upon ANSI/VITA47, MIL-STD-810 requirements

# VPX Environmental Testing

- ***VPX backplane connector system has successfully passed all Military grade testing for mechanical, environmental and ESD requirements***
  - Prior to releasing VITA 46 (VPX) specification, holding fixture testing was performed to ensure a robust backplane to VPX module connector system
  - Testing was sponsored by the VPX working group and consisted of the 7 test groups
    - Qualification test summary, see http://www.vita.com/vpx.html for final test report, test plan not available

| | |
|---|---|
| Mechanical shock (50 G), | Insulation Resistance |
| Random Vibration/HALT (12 Grms, 50 – 2 KHz) | Dielectric Withstanding Voltage |
| Bench Handling/Vibration over Temperature | Durability @ std environment |
| | Engaging/Separating Force |
| Thermal Cycling with Humidity (240 hrs) | Salt Fog/$SO_2$ (2 days), Salt Fog |
| | Sand & Dust |
| | 15KV ESD |

  - Contech Research, Attleboro MA an independent testing & research company performed the testing

# MicroTCA.3 Environmental

- ***MicroTCA.3 backplane connector system has successfully passed all Military and Telcordia grade testing for mechanical, environmental and ESD requirements***
  - Prior to releasing MicroTCA.3 specification, chassis level testing was performed to ensure a robust backplane to Advanced Mezzanine Card (AMC) connector system
  - Testing was sponsored by the PICMG MicroTCA.3 working group and consisted of 8 full life test groups plus a separate ESD test
    - Qualification test summary, see http://www.picmg.org/v2internal/resourcepage2.cfm?id=14 for test plan& final test report

| | |
|---|---|
| Mechanical shock (50 G), | Insulation Resistance |
| Random Vibration (12 Grms, 50 – 2 KHz) | Dielectric Withstanding Voltage |
| Thermal shock (-55° C to +85° C) | Durability @ **extreme environments** |
| Thermal Cycling with Humidity **(500 hrs)** | Engaging/Separating Force |
| Temperature life **(500 hrs)** | Salt Fog/$SO_2$ (2 days) |
| Mixed Flowing Gas (10 days) | Sand |
| | 15KV ESD |

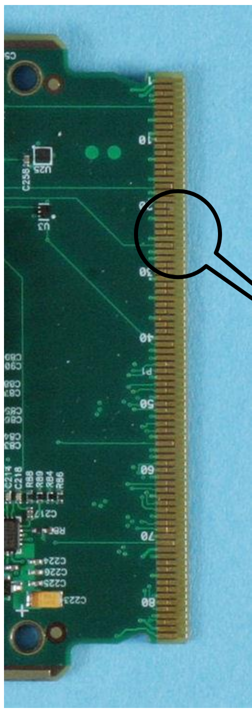
  - Contech Research, Attleboro MA an independent testing & research company performed the testing for MicroTCA.3 & VPX (A SFF competing standard )

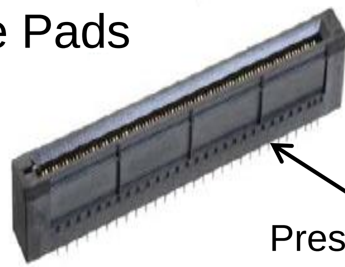
- MicroTCA.3 testing was more comprehensive, tested over a longer life duration and tested against more failure mechanisms than VPX
  - 500 hours for MicroTCA.3 vs. 240 hours for VPX

# MicroTCA versus VPX
# Backplane Interconnect Comparison

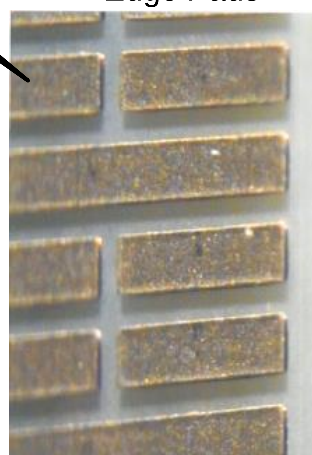
MicroTCA PWB Edge Pads



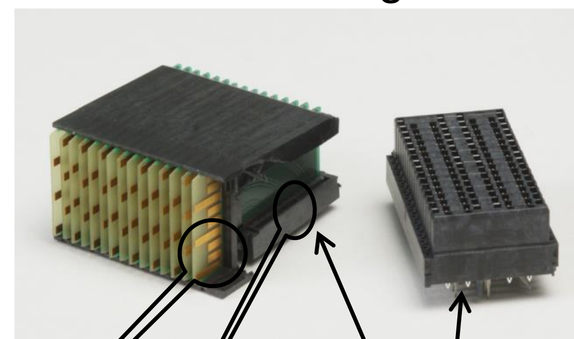


Press fit contacts

External
Edge Pads



VPX MultiGig RT Connector
Wafer Dual PWB Edge Pads



Press fit contacts

External
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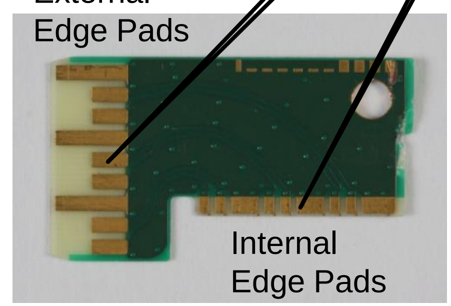


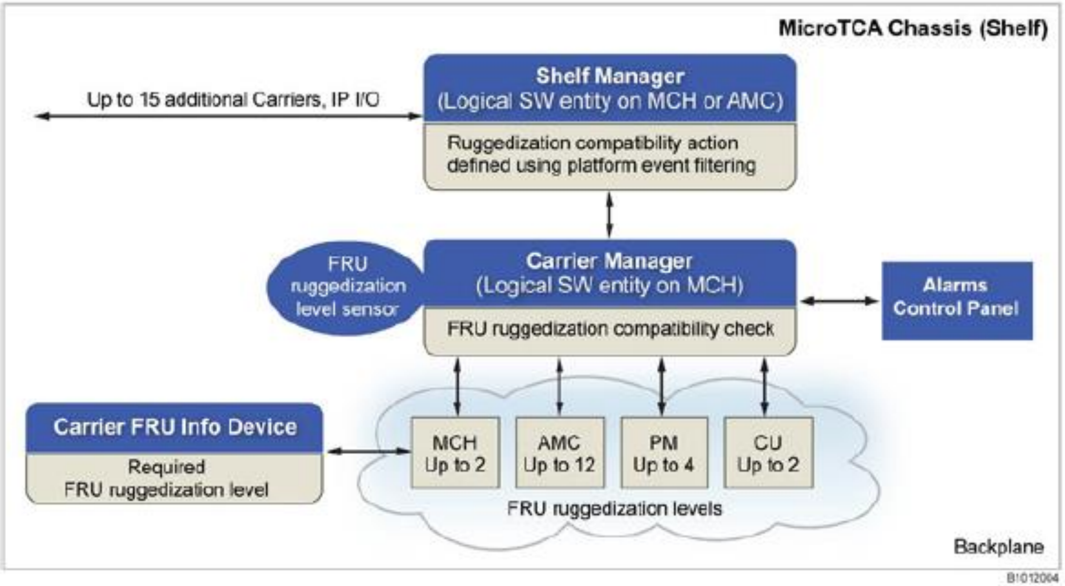
Internal
Edge Pads

**MicroTCA & VPX both use PWB Edge Pads for High speed interconnect**

# Hardware Platform Management (HPM)

- MicroTCA.3 HPM supplement to base specification
  - All FRUs (Field Replaceable modules) have their ruggedization level defined in its FRU information record
  - Carrier FRU info device contains required ruggedization level of the FRU's defined by system integrator or chassis design authority
  - Carrier manager has a FRU ruggedization level sensor that reports the compatibility between all the FRUs and the carrier to determine if the system is configured correctly
  - Shelf manager can use the carrier ruggedization compatibility event to determine action to be taken
    - The action is user defined by the system integrator using Platform Event Filtering



# MicroTCA and VPX Comparison

| Parameter | MicroTCA.2 & MicroTCA.3 | Open VPX (ANSI/VITA65)<br>VITA 47/48 (EAC6 & ECC4 Environment) |
|---|---|---|
| **Serial technology (Fabrics) on backplane** | Gigabit Ethernet (GigE)<br>PCI-Express Gen 2/3<br>SAS/SATA<br>10GigE (40GbE in draft)<br>SRIO<br>Simultaneous support for two or more fabrics with two MCHs | Gigabit Ethernet (GigE)<br>PCI-Express Gen 2/3<br>**No**<br>10GigE<br>SRIO<br>**No** |
| **Redundancy** | Power modules with failover<br>Fabrics (GigE, 10GigE, SAS, SRIO) | Not currently<br>Custom only |
| **Bandwidth (PCI-Express)** | 8 Gen 3 lanes per slot, 64GTps | 8 Gen 3 lanes per slot, 64GTps |
| **Hardware Platform Management (HPM)** | Mature Hardware Platform Management based on ATCA<br>- SNMP, HPI, HTTP, GUI, CLI<br>Defined in specification | Used code from MicroTCA base, dependent upon other sources for support<br>**Vendor specific or custom implementations, VITA 46.11 in trial use** |
| **Board size** | 6 sizes defined<br>Single/Double Modules: 2.9/5.9 x 7.1"<br>Compact/Mid/ Full size: 0.6”/0.8”/1.2" pitch | 6 sizes defined<br>3U/6U Modules: 3.9/7.9" x 6.3"<br>1.0" and 0.80” pitch typical (optional 0.85")<br>**Only defined board/backplane profiles are interchangeable between systems** |
| **Connector System** | Multi-tongue edge finger:<br>BP connector: 50 micro-inches of Au<br>Multi vendor open source connector<br>Low Cost | Multi-wafer dual edge finger:<br>BP connector: 50 micro-inches of Au<br>**Two connector vendor solutions – not interchangeable (approx 95% of market one vendor)**<br>**High Cost** |
| **Overall Cost (normalized to MicroTCA®)** | **1** | **Approx. 1.5 - 2x, higher with HPM** |

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# Recent Rugged MTCA Design Wins

- Won major European RADAR platform project
- Prime Contractor using MTCA on many platforms and several planned, including hardened versions
- Prime Contractor announced they chose MTCA over VPX on rugged vehicle platform
- Selected in satellite system via national lab
- Used by Lockheed, BAE, Harris, Northrop Grumman, Boeing, Raytheon, etc.

 

# Summary

- Advantages of MicroTCA
  - MicroTCA supports additional fabrics & capability to run two or more fabrics simultaneously
  - Built in redundancy for power and fabrics
  - Full system and health management capabilities leveraged from mature, proven ATCA system
  - MicroTCA brings an economy of scale advantage to the end user, roughly half the hardware cost of VPX

- Leverage existing AMC Modules (also around for 10 years in ATCA) for rugged harsh environments without modification except for screening, staking & conformal coating as required
- Hardened conduction cooled MicroTCA.3 went through same testing as VPX (more comprehensive in some areas)
- 100G line cards and 40GbE speeds provides powerful performance
- Vast ecosystem – VadaTech alone has over 200 AMCs (processors, graphics, storage, FPGAs, carriers, network interface, serial I/O and specialty products) and dozens of chassis configurations, MCHs, Power Modules, and Application-Ready Platforms.

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