MicroTCA.3
Test Plan

Hardened Conduction Cooled MicroTCA System Testing
For
Validation of MicroTCA Backplane to AMC Connector System

Revision 1.2
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Revision History

Revision	Changes	Date
0.9	Draft copy	09/01/09
1.0	First review	11/30/09
1.1	Second review	12/01/09
1.2	Third review	12/17/09
1.2	Initial Release (updated approved by names)	12/21/09

SCOPE

Test plan for qualification testing of the MicroTCA Connectors as manufactured and submitted by the test sponsor on representative conduction Cooled MicroTCA test Modules.

This is based on MIL-STD-810 and RTCA/DO-160 environmental tests and the test sequences described in the VITA VPX Test Report; which can be downloaded at:

http://www.vita.com/VITA46ContechTestReportrev1.4.pdf

Goal

The goal of this test plan is to outline the testing sequence for the AMC and backplane connector used in Rugged MicroTCA.3 Systems. The module portion of the test plan is setting the goal of having test data available to show that the edge mounted connector system proposed for adoption for Rugged MicroTCA products meets the environmental requirements proposed for the Rugged and Hardened MicroTCA Product Specifications.

APPLICABLE DOCUMENTS

Unless otherwise specified, the following documents of issue in effect at the time of testing form a part of this report to the extent as specified herein. The requirements of sub-tier specifications and/or standards apply only when specifically referenced in this test plan.

Test Specifications:

The following specifications are provided for reference and the basis point for discussion of testing that is to be targeted as a result of this plan.

- MIL-STD-810F, Environmental Engineering Considerations and Laboratory Tests
- EIA-364, Electrical Connector Test Procedures
- EN-61000-4-2, Electrostatic Discharge Immunity Test
- ASTM G-85, Standard Practice for Modified Salt Spray Testing

TEST SAMPLES AND PREPARATION
The following test samples for module testing shall be submitted by the test sponsor for the evaluation to be performed by the test laboratory:

Module Testing:

(1) Qty. 18 Conduction Cooled MicroTCA Event Detector AMC (EDA) Modules compliant with AMC.0 Revision 2 as well as the following:

- PICMG AMC form factor with AMC edge connector capable of contact monitoring in accordance with MicroTCA.1 Section 10.2.3
- PICMG AMC form factor with AMC PWB edge fingers (qty 16) and plug connector (qty 2)
- See Appendix A to this Test Plan for the definition of the board characteristics required for module testing.

(2) Qty. 8 MicroTCA backplanes with connectors to support single size AMC modules.

Note: Test Group 3 (IR/DWV) is to be performed by the connector manufacturers and would require 2 EDA's and 1 Backplane, included in above quantities.

The following additional materials shall be submitted by the test sponsor to assist and perform the testing of items listed above.

(1) Holding Test Fixture with machined conduction rail slots and backplane retention, see Table 1 for resource allocation for required test fixtures/chassis'

The test samples shall be certified by the manufacturer as being fabricated and assembled utilizing normal production techniques common for this type of product and inspected in accordance with the quality criteria as established for the product involved.

Connector test samples are to be supplied assembled and terminated to test boards by the test sponsor for each of the respective test suites. These tests suites are for conduction cooled MicroTCA Modules.

All test samples module test pieces shall be coded and identified by the test sponsor to maintain continuity throughout the test sequences. Upon initiating testing, mated test samples shall remain with each other throughout the test sequences for which they were designated and are not to be interchanged with any other mated connections.

TEST SELECTION

All tests shall be performed in accordance with the applicable sequences and procedures as defined below.

TEST SEQUENCES

Figure 1 MicroTCA.3 Module Test Flow shows the test sequences for the module assemblies that are to be tested subsequent to the completion of the contact testing. This sequence of testing is for Module Assembly test to show compliance of the module to the environmental requirements stated within this document.

Figure 1. MicroTCA.3 EDA Test Flow

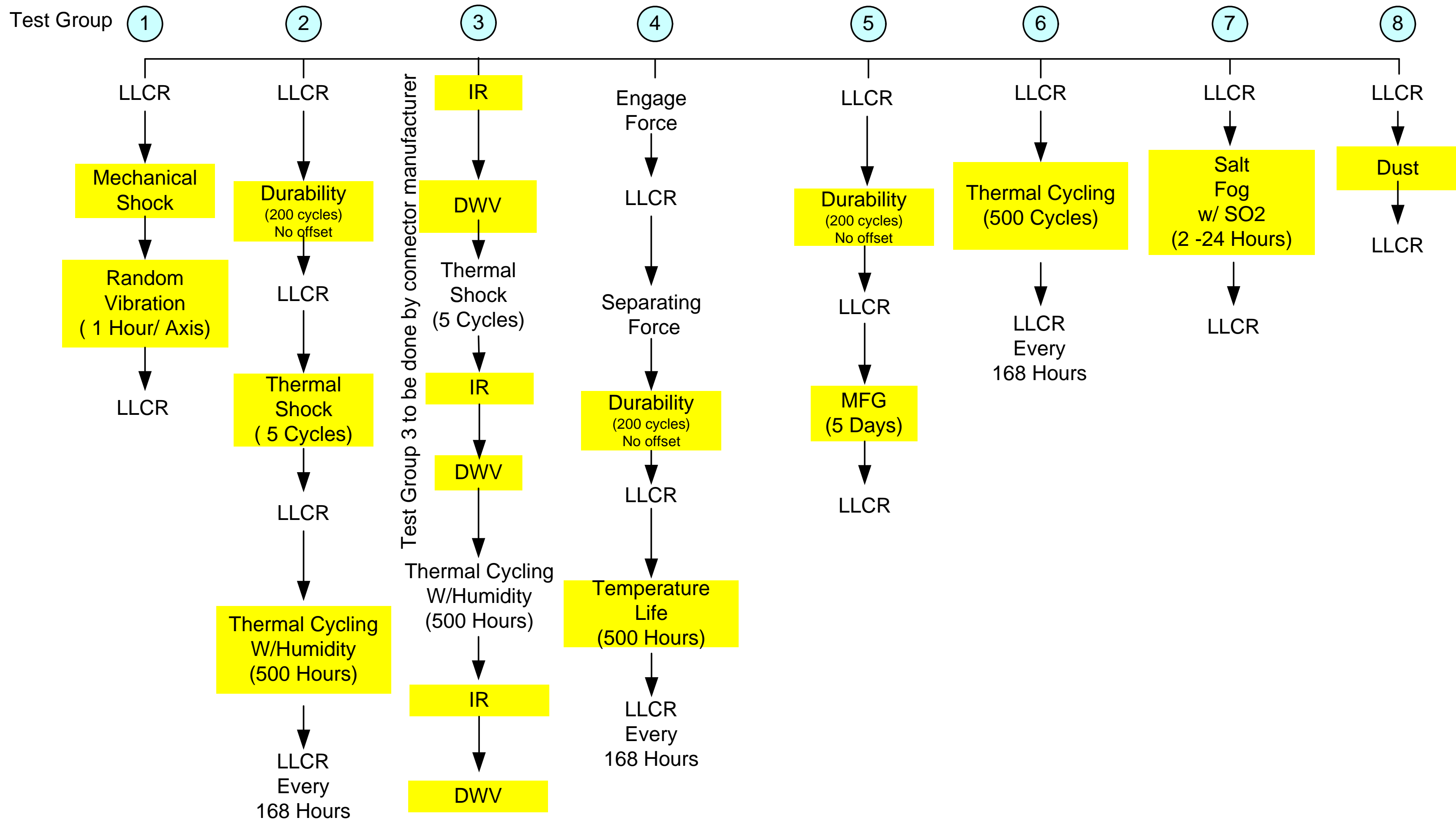

Table 1. Resource Allocation

	Group 1	Group 2	Group 4	Group 5	Group 6	Group 7	Group 8
# of Backplanes	1	1	1	1	1	1	1
# of EDA's	4[1]	2	2	2	2	2	2
Chassis Type	BAE	WT	WT	BAE	WT	BAE[2]	WT[3]

Notes:

WT:Wavetherm Chassis BAE: BAE Chassis

1. 2 EDA's with PWB edge fingers & 2 EDA's with plug edge fingers.
2. BAE Chassis for Group 7 Testing (Salt Fog) is taken following completion of the Group 1 Testing with a new backplane installed
3. Wavetherm Chassis for Group 8 Testing (Dust) is taken following the completion of Group 2 testing with a new backplane installed.

Legend

LLCR: Low Level Circuit Resistance
IR: Insulation Resistance
DMV: Dielectric Withstanding Voltage
MFG: Mixed Flow Gas
EDA: Event Detector AMC

All test groups are tested with a 0 offset of the EDA to backplane connector.

Test Flow Diagram
Revision E 12/14/09

Connector Vendor Input & Responsibility

The connector products shall have supporting test available showing compliance the for Group 3 testing. This can be presented either in the format of internal testing at the manufacturers' internal testing resources or via an independent test laboratory. See Figure 1, Test Flow for Group 3 testing requirements.

Tests

Mechanical Shock:

- EIA-364-27B-2009
- Test Condition A ; 50 G, 11 millisecond, half sine pulse
- **Requirements:**
  - **MS1:** No Physical Damage
  - **MS2:** No electrical anomalies/event greater than 10 nanoseconds, 8 daisy chained positions per test sample, for event detection

Random Vibration:

- EIA-364-28E-2006
- Test Condition V, Letter D, 11.95 Grms, 50 to 2000 Hz
- Duration: 1 hour per axis for all three orthogonal axes.
- **Requirements:**
  - **RV1:** No Physical Damage
  - **RV2:** No electrical anomalies/event greater than 10 nanoseconds, 8 daisy chained positions per test sample, for event detection
  - **RV3:** LLCR : + 10.0 milliohm maximum change

Thermal Shock:

- EIA-364-32E-2008
  - Test Condition A: -55 °C to 85°C, dwell at each extreme for 30 minutes, for five cycles, with a change in temperature that shall occur within 5 minutes between extremes
- **Requirements:**
  - **TS1:** No Physical Damage
  - **TS2:** Group 2 Samples: LLCR : + 10.0 milliohm maximum change
  - **TS3:** Group 3 Samples:
    - a) IR: 500 Mega ohm Minimum
    - b) DWV: 600 VAC

Thermal Cycle with Humidity

- EIA-364-31C-2008
- Test Condition III:
  - 25°C to 65 °C at 90 % to 95 % Relative Humidity (RH)
  - Eight Hours Cycles
  - 63 Cycles (500 Hours)
- **Requirements:**
  - **TCwH1:** No Physical Damage
  - **TCwH2:** Group 2 Samples: LLCR : + 10.0 milliohm maximum change on a weekly basis
  - **TCwH3:** Group 3 Samples:
    - a) IR: 500 Mega ohm Minimum
    - b) DWV: 600 VAC

Temperature Life

- EIA-364-17B-1999
- Test Condition A : 85 °C, Duration: 500 hours
- **Requirements:**
  - **TL1:** No Physical Damage
  - **TL2:** Group 4 Samples: LLCR: + 10.0 milliohm maximum change, measured on a weekly basis.

Mixed Flowing Gas (MFG)

- EIA-364-65A-1998
- Test Condition IIA:
  - Chlorine: 10 ppb
  - Hydrogen Sulfide: 10 ppb
  - Nitrogen Dioxide 200 ppb
  - Sulfur Dioxide: 300 ppb
  - Temperature: 30 °C
  - Relative Humidity: 70 % RH
- Mating Conditions:
  - Day 1 to Day 5: Samples Unmated
  - Day 6 to Day 10: Samples Mated
- Duration: 10 Days Total
- **Requirements:**
  - **MFG1:** No Physical Damage
  - **MFG2:** LLCR at both 5 and 10 days: + 10.0 milliohm maximum change

Insulation Resistance (IR)

- EIA/ECA-364-21D-2008
- Test all adjacent Contacts
- Level 500 Vdc
- **Requirements:**
  - **IR1:** 5000 Mega ohms Minimum

Dielectric Withstanding Voltage

- EIA-364-20D-2008
- Test all adjacent Contacts
- **Requirements:**
  - **DWV1:** No Breakdown or flashover arcing at 600VAC

Durability

- EIA-364-09C-2006
- Number of Cycles: 200 min, with a design goal of 500 Cycles.
- Rate: Ten Cycles per Minute
- **Requirements:**
  - **D1:** No Physical Damage
  - **D2:** LLCR: + 10.0 milliohm maximum change

Engaging Force/Separating Force

- EIA-364-13
- Measure the force to engage and separate the Event Detector AMC or connector samples
- **Requirements:**
  - **EF1:** Engaging Force: 100 N Maximum
  - **SF1:** Separating Force: 65 N Maximum

Thermal Cycle

- EIA/ECA-364-100-2006
- Test Condition C
    - 0°C to 110 °C
    - 10 minute dwell at temperature extremes
    - Ramp Rate between extremes: 5 °C to 10 °C per minute
- Duration 500 cycles
- **Requirements:**
    - **TC1:** No Physical Damage
    - **TC2:** LLCR: + 10.0 milliohm maximum change

Salt Fog

- ASTM G85, Annex A4 (cycle A4.4.4.1), two 24 hr. cycles
- **Requirements**:
    - **SF1:** LLCR: + 10.0 milliohm maximum change
    - **SF2**: No excessive corrosion product build up between backplane connector and EDA PWB edge finger contacts

Dust

- MIL-STD-810, Method 510.4, Procedure II
- **Requirements:**
    - **D1:** LLCR: + 10.0 milliohm maximum change

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Test Verification Methods

Low Level Circuit Resistance (LLCR)

- EIA-364-23C-2006, TP-23C
- 100 milliamp max., 20 millivolts, 52 resistance positions
- Data: Record Measured Level

Nanosecond Event Detection

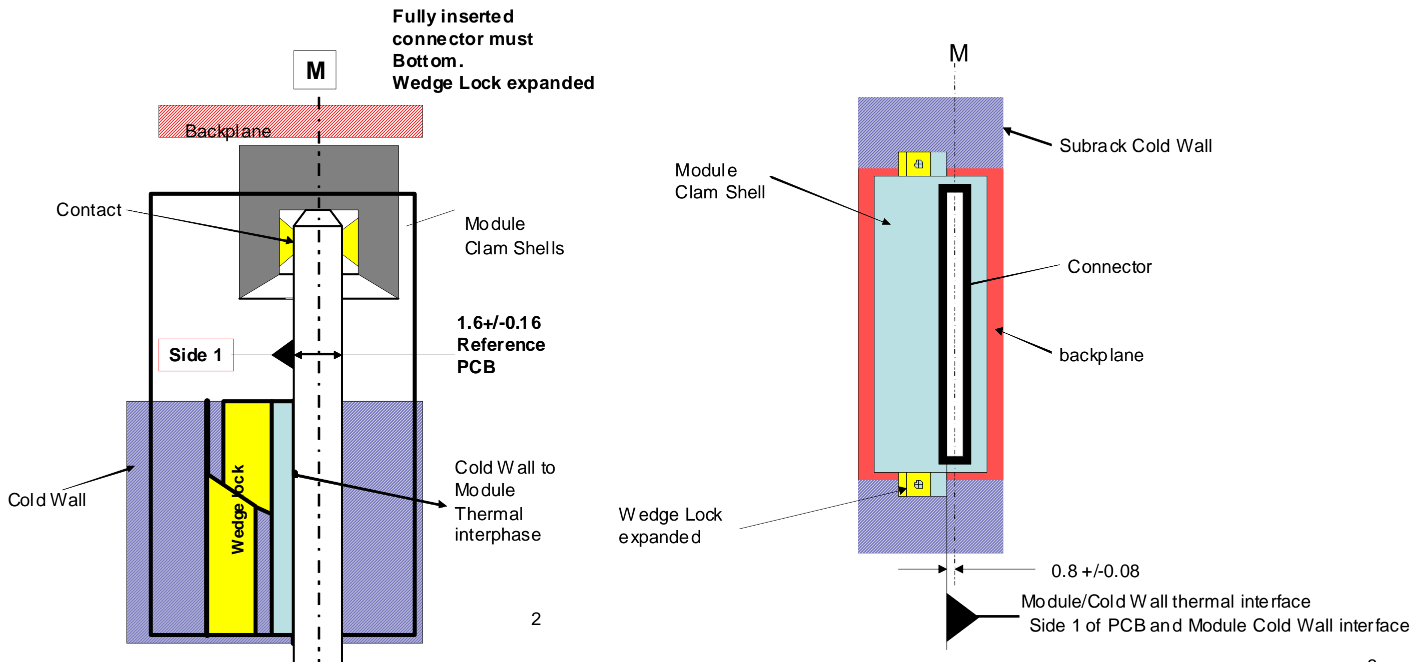
- EIA-364-87A, TP-87A
- No events greater then 10ns, 8 daisy chained positions
- Data: Record Measured Level

Appendix A: EDA & Backplane Requirements:

EDA to backplane alignment requirement:

All EDA boards (Unit Under Test [UUT]) to backplane connection interfaces shall be in accordance with the requirements in this test plan. The following figures and tables are provided to specify specific requirements for testing for the module taking into account system design issues and known good design practices for plating systems in dynamic environments.

Figure 1: EDA PCB To backplane connector Centerline normalized.



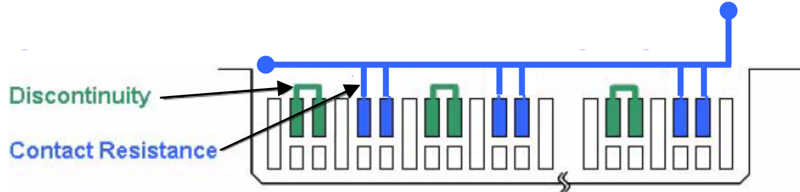
Requirement A1: All test groups shall be conducted with 0 offset between the EDA and backplane connector centerline to support the normalized system installation of the EDA, see figure 1 above.

Requirement A2: To align the backplane to the EDA, loosely screw in the backplane and insert EDAs into slots 2, 4, 6, and 8. Tighten all EDA wedgelocks (quantity 8) and then tighten all of the screws holding the backplane to the chassis to 5 +/-0.5 in-lbs.

Figure 2: Event Detector AMC Electrical requirements

Table 10-3 AdvancedMC and MCH pin assignment

Test	Contacts to Be Monitored
Discontinuity	5-6; 35-36; 59-60; 83-84; 90-91; 120-121; 144-145; 169-170
Contact resistance (Four-point measurement)	14; 15; 20; 21; 26; 27; 32; 33; 38; 39; 44; 45; 50; 51; 56; 57; 62; 63; 68; 69; 74; 75; 80; 81; 87; 88; 93; 94; 99; 100; 105; 106; 111; 112; 117; 118; 123; 124; 129; 130; 135; 136; 141; 142; 147; 148; 153; 154; 159; 160; 165; 166



Requirement A3: EDA wiring and pin assignments for determination of loss of contact and resistance during the testing shall be in accordance with the requirements of Figure 2 above, which is a requirements extraction of MicroTCA.1, Section 10.2.2.

Requirement A4: 52 contact resistance points shall be bussed together on the EDA and 2 electrical traces shall be brought to the front panel side of the EDA and terminated to a 0.040 plated thru hole for voltage and current measurements during LLCR testing, see figure 8, LLCR set up.

Requirement A5: The recommended clamshell arrangement for all module testing is recommended to be the mid-size, single module that is shown in Figures 4a & 4b.

Requirement A6: The EDA shall support both AMC PWB edge finger design and the Harting MicroTCA plug, see figure 7 per PICMG AMC.0 Rev. 2.0.

Requirement A7: The EDA shall have a maximum weight for a mid-size, single width AMC Module including lower & upper clam shell sections and wedgelocks, test weights screwed to PWB, and PWB of 650g (-5%, +0%). The weight shall be distributed in accordance with figure 3 below.

Figure 3: EDA mass loading (clam shell not shown)

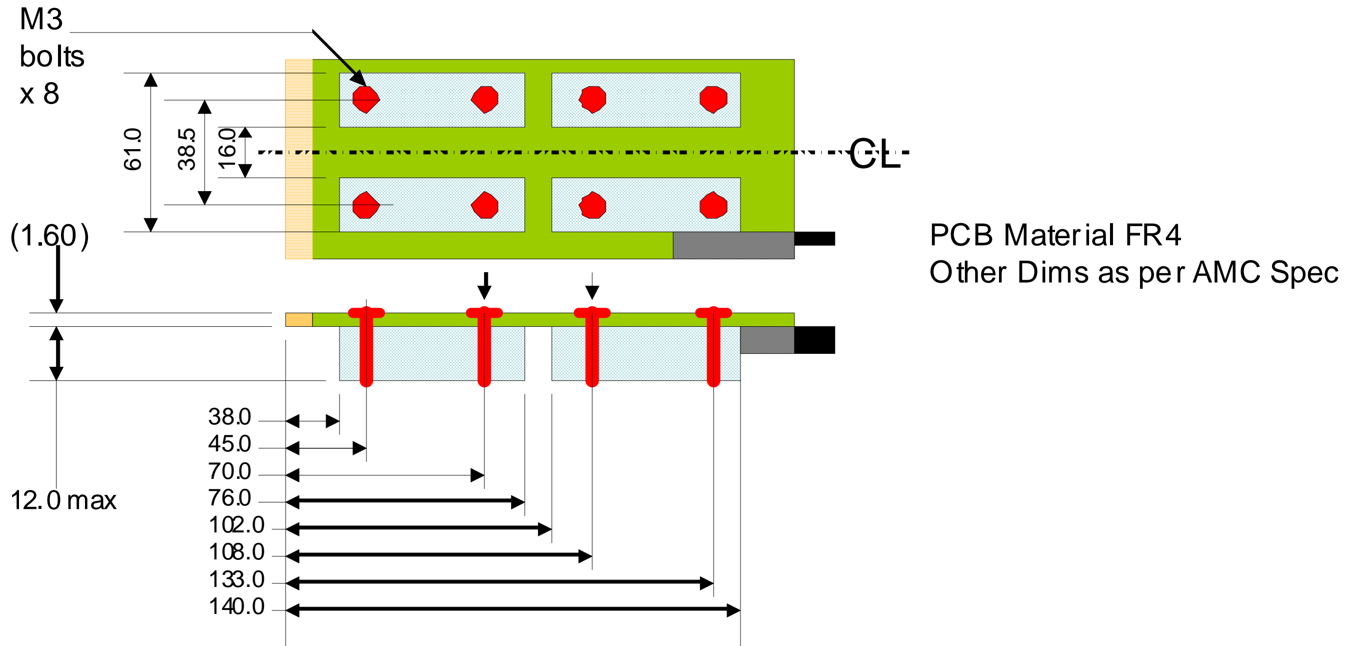


Figure 4a: AMC Mid-size, single module clamshell configuration

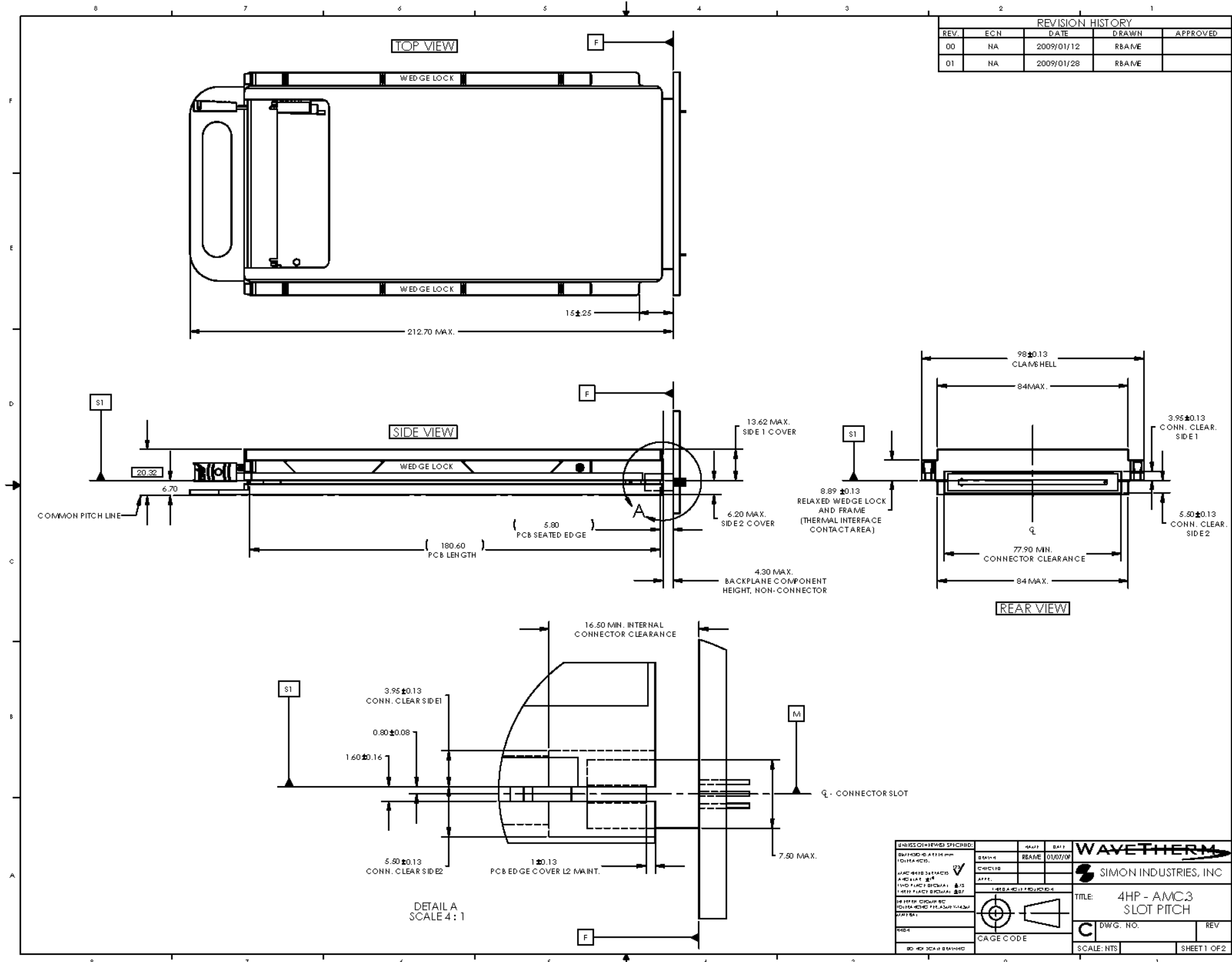


Figure 4b: AMC Mid-size, single module clamshell configuration

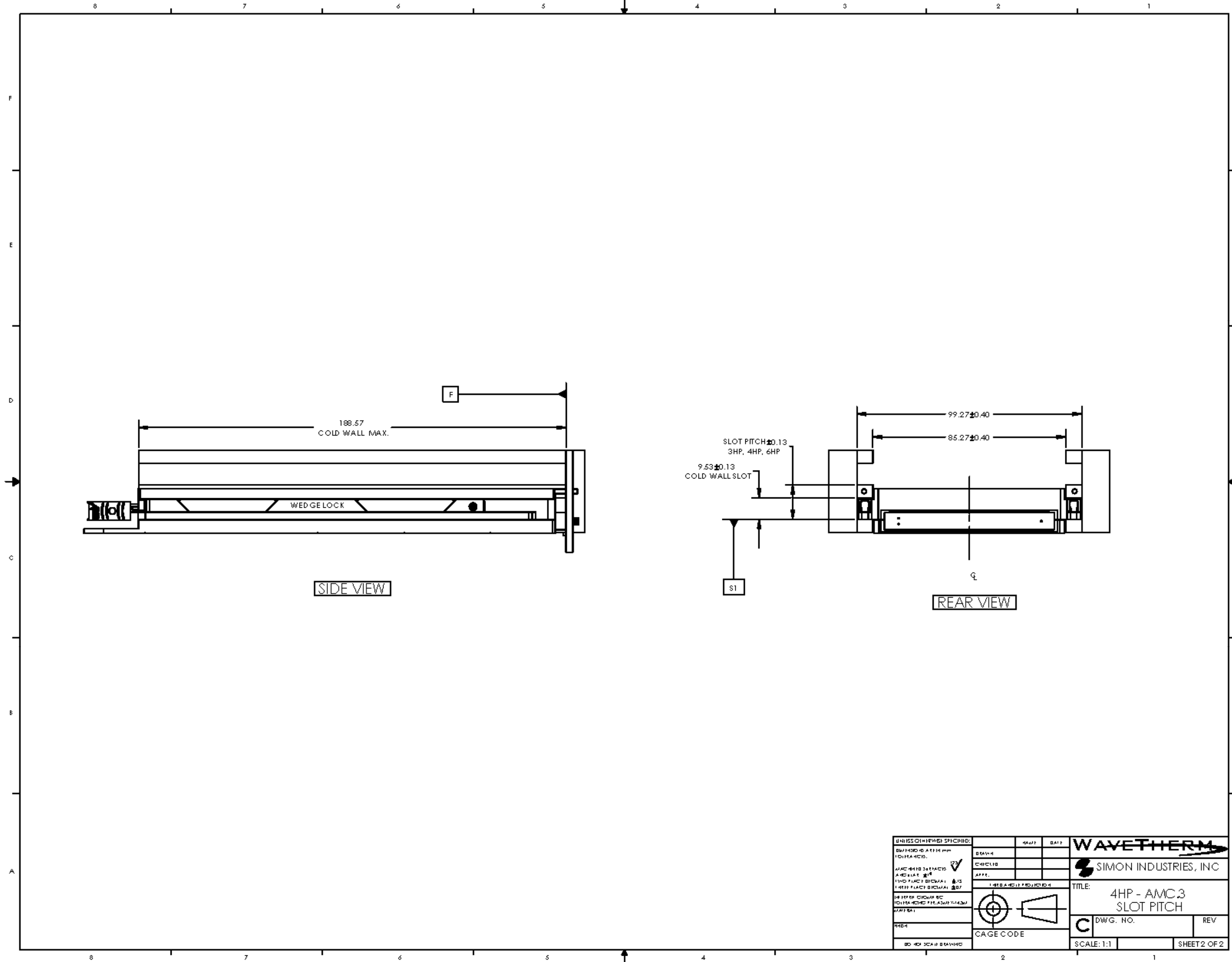


Table 1: Printed Wiring Contact & Connector Plating Requirements

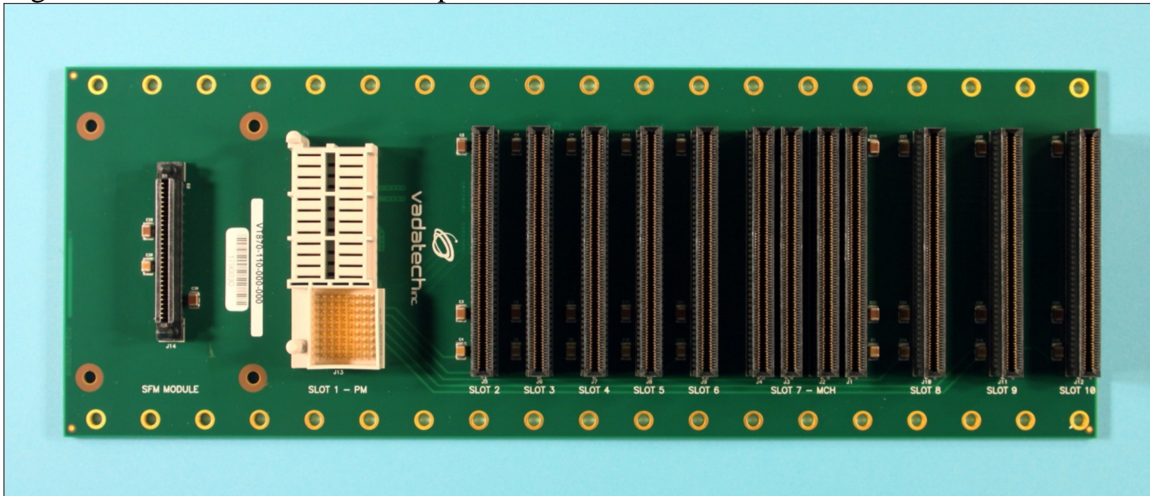
Plating Parameter	Specific Requirement:
Minimum Gold Plating Thickness	30 micro-inches
Gold Plating Thickness Preference	50 micro-inches
Gold Sub Plating	75 micro-inches, min. Nickel over Copper
Gold Plating Hardness	Hard Gold

Requirement A8: Contact and edge finger test item plating required to meet the minimum requirements for plating and plating system as shown in Table 1.

Backplane requirements

The VadaTech VT870 backplane, see figure 5 below will be modified to be used for the tests defined in this test plan. The backplane will be used with the BAE Systems MicroTCA ATR chassis and the Wavetherm MicroTCA test chassis. Only slots 2, 4, 6, 8 and 10 will be populated with the Harting MicroTCA connector, remaining connectors will not be populated. Slot 1, Power Module connector can be populated for future testing requirements.

Figure 5: VT870 MicroTCA backplane



Backplane Electrical requirements:

Requirement: All mid-size slots shall have the following:

- **A9:** All contact resistance contacts, defined in figure 2 shall be measured for voltage and current during LLCR on the back side of the backplane at the connector termination point, see figure 7.
- **A10:** Each discontinuity loop back contact pairs, defined in figure 2 shall be terminated to a Plated Thru Hole (PTH), 0.40 inches with a pair spacing of 0.10 inches on the back side of the backplane to solder RG174U coax cable for use with the event detector.

Backplane Mechanical requirements:

Requirement: Mechanical layout of the backplane shall not change except for the following:

- **A11:** MicroTCA connectors shall be changed to support the Harting MicroTCA 50 micro-inch gold over Ni connector defined in figure 6.
- **A12:** Electrical test points for the contact resistance contacts for all mid-sized slots added as defined above to facilitate LLCR testing.
- **A13:** Electrical test points for the discontinuity loop back contact pairs for all mid-sized slots added as defined above to facilitate event detection testing.

Data Reporting Recommendations:

Visual documentation and measured data should be presented in a formal report documenting the test performed and the conditions that these test were performed under. Significant results should be presented at measurements or presentation of significant results, both positive and negative results. Photographs, plating micrographs and test plots are all examples of test result data presentation and do not need to be limited to this list. The goal of this data presentation is to provide objective test evidence that the test items are meeting the aggressive environmental tests that are being specified for Conduction Cooled MicroTCA.3 modules.

Figure 6: Harting 50 miro-inch of Au over Ni MicroTCA connector

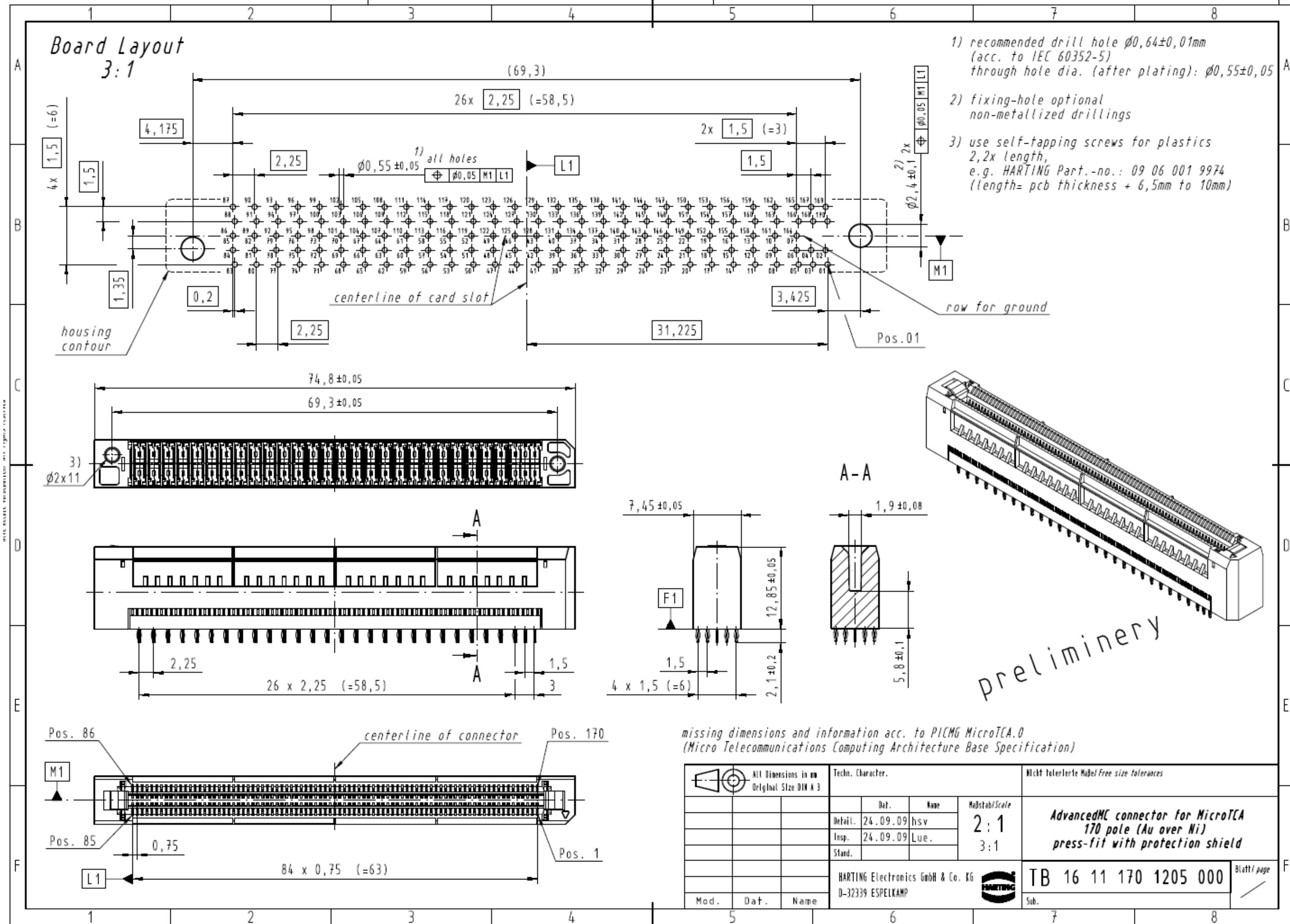


Figure 7: Harting AMC plug

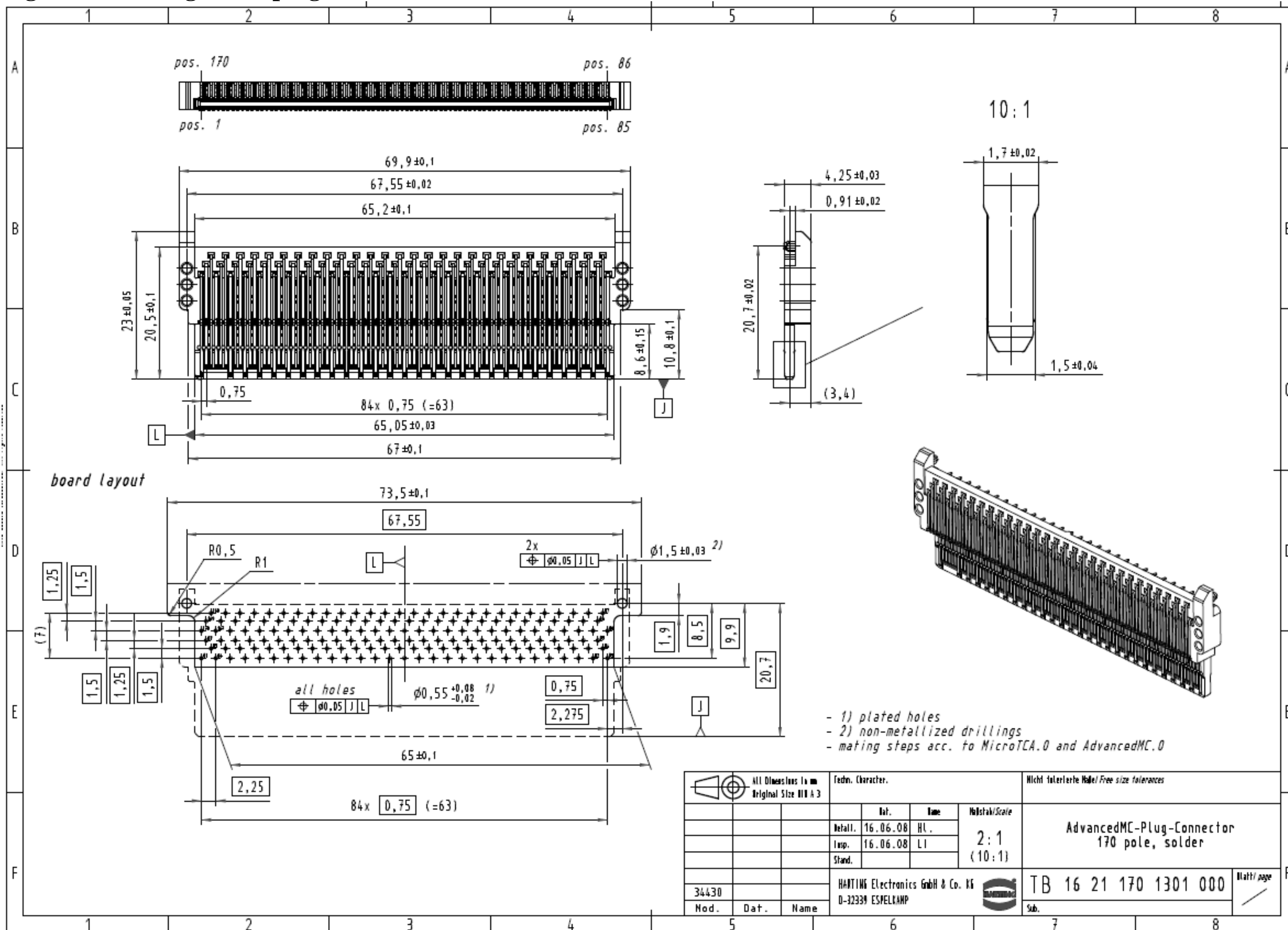
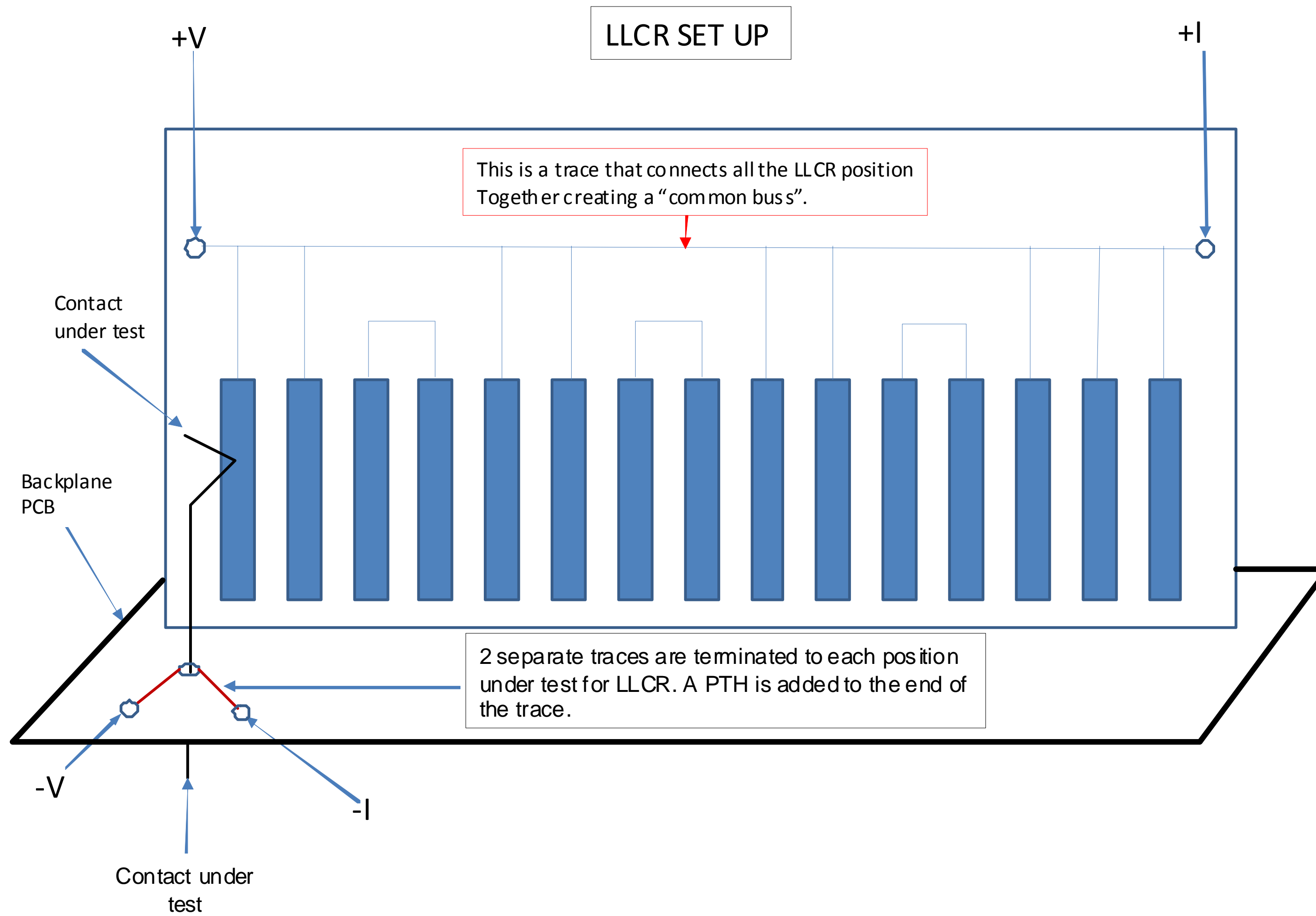


Figure 7: Harting AMC plug

Figure 8: LLCR Set Up



Note Above setup does not show all contacts under test.