

TB-2324

GENERAL PRODUCT SPECIFICATION FOR Paladin™ INTERCONNECT
SYSTEMS

Revision “H”

Specification Revision Status

Revision	SCR No.	Description	Initial	Date
A	S4207	Initial Pre-Release	M. Sloban	1/22/16
B	S4267	Revised specification title	M. Sloban	2/4/16
C	S4644	Added Note 13 and changed “1mΩ maximum” to “No change greater than 1mΩ” in Section 12.3	M. Sloban	6/2/16
D	S4668	Changed maximum engagement force to 40grams, general document clean up	M.Osbourne	6/8/16
E	S5035	Updated shield mechanical wipe to 2.75mm, added SE wipe.	M.Osbourne	10/14/16
F	S5362	Updated Note 7 engagement force to no greater than 45grams, general document cleanup	S.Yo euth	1/20/17
G	S10399	Added 2.1.4 to 2.1.8	T. Nierendorf	2/23/23
H	S10994	Added 2.1.8 Added 4.2 for RPO bulk resistances	T. Nierendorf	1/31/24

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1.0 **SCOPE**

1.1 Content

- 1.1.1 This specification covers the performance, test and quality requirements for the Paladin interconnect system. These connectors are two-piece devices that connect two printed circuit boards. Receptacle connectors and pin connectors are through hole devices with eye-of-the-needle compliant pin contacts. The Paladin connector family consists of modular configurations with custom guidance modules.
- 1.1.2 Paladin specification covers the traditional daughtercard to backplane, orthogonal midplane, direct orthogonal (no midplane), cabled backplane and mezzanine.

1.2 Qualification

- 1.2.1 When tests are performed on subject product line, procedures specified in EIA-364-B shall be used per the test sequences outlined in Amphenol TCS Technical Bulletin TB-2023. All inspections shall be performed using applicable inspection plan and product drawings.

2.0 **REFERENCE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein.

2.1 Amphenol TCS Documents

- 2.1.1 TB-2023 Amphenol TCS Commercial Connector Qualification Plan
- 2.1.2 TB-2322 Paladin Routing Guidelines
- 2.1.3 TB-2320 Paladin Direct Ortho General Guidelines
- 2.1.4 TB-2326 Paladin Daughtercard Press-Fit Installation Procedure
- 2.1.5 TB-2327 Paladin Daughtercard Module Removal and Replacement
- 2.1.6 TB-2332 Paladin Backplane Press-Fit Installation Procedure
- 2.1.7 TB-2333 Paladin Backplane Removal and Replacement
- 2.1.8 TB-2358 Paladin RPO Press-Fit Installation Procedure
- 2.1.9 TB-2367 Paladin Plus Press-Fit Installation Procedure

2.2 Commercial Standards

- 2.2.1 EIA-364-B - Electrical Connector Test Procedure Including Environmental Classifications
- 2.2.2 GR-1217-CORE - Generic Requirements for Separable Electrical Connectors Used in Telecommunications Hardware
- 2.2.3 GR-78-CORE - Generic Requirements for the Physical Design and Manufacture of Telecommunications Products and Equipment
- 2.2.4 IEC-512 - Electromechanical Components for Electronic Equipment – Basic Testing, Procedures and Measuring Methods

3.0 **MATERIAL FINISHES**

3.1 Contacts

- 3.1.1 Backplane signal contacts are 0.600 mm thick high performance copper alloy. Contacts are plated per EGS205.

- 3.1.2 Backplane shield blades are 0.102 mm thick high performance copper alloy. Contacts are plated per EGS205.
- 3.1.3 Daughtercard signal and shield plates are 0.102 mm thick high performance copper alloy. Contacts are plated per EGS205.

Notes:

- 1. All contacts meet lead free requirements, refer to EGS205.

3.2 Sub Components –

Component	Material	Specification
Insulative Dielectric	Glass Reinforced Polyester (LCP)	UL 94V-0 Rating, Color natural
Non-Insulative Plastic	Reinforced Nylon	UL 94V-0 Rating, Color Black
Stiffener	Stainless steel, Type 301	N/A
Daughtercard Key Bushing	Sintered stainless steel	Material Power Industries Federation Standard 35, SS 316NI-25
Backplane Guide Pins and Keys	Stainless steel	QQ-S-764, CL 303 or 303 SE Condition A

4.0 LENGTH OF TRACES & MATED BULK RESISTANCE – **Paladin™**

4.1 Standard Paladin Daughtercard and Backplane Connectors

Differential Pair	Contact Rows	Trace Length (mm)	Resistance (mΩ)
Signal Pair 1	A, B	20.2	19.8
Ground Shield Pair 1	Contacts 1-4	21.2	11.1
Signal Pair 2	C, D	26.9	27.9
Ground Shield Pair 2	Contacts 1-4	28.1	12.1
Signal Pair 3	E, F	35.0	37.3
Ground Shield Pair 3	Contacts 1-4	36.0	13.3
Signal Pair 4	G, H	43.0	46.9
Ground Shield Pair 4	Contacts 1-4	44.0	14.4
Signal Pair 5	J, K	51.2	53.7
Ground Shield Pair 5	Contacts 1-4	51.7	16.8
Signal Pair 6	L, M	59.0	62.4
Ground Shield Pair 6	Contacts 1-4	59.7	19.2
Signal Pair 7	N, P	67.0	71.0
Ground Shield Pair 7	Contacts 1-4	67.7	19.8
Signal Pair 8	Q, R	74.9	79.0
Ground Shield Pair 8	Contacts 1-4	75.6	23.2

4.2 Paladin RPO Daughtercard and Backplane Connectors

Differential Pair	Contact Rows	Trace Length (mm)	Resistance (mΩ)
Signal Pair 1	A, B	15.1	17.7
Ground Shield Pair 1	Contacts 1-4	16.3	11.1
Signal Pair 2	C, D	17.3	17.6
Ground Shield Pair 2	Contacts 1-4	17.5	11.1
Signal Pair 3	E, F	26.9	27.9
Ground Shield Pair 3	Contacts 1-4	28.1	12.1
Signal Pair 4	G, H	35.0	37.3
Ground Shield Pair 4	Contacts 1-4	36.0	13.3
Signal Pair 5	J, K	43.0	46.9
Ground Shield Pair 5	Contacts 1-4	44.0	14.4
Signal Pair 6	L, M	51.2	53.7
Ground Shield Pair 6	Contacts 1-4	51.7	16.8
Signal Pair 7	N, P	59.0	62.4
Ground Shield Pair 7	Contacts 1-4	59.7	19.2
Signal Pair 8	Q, R	67.0	71.0
Ground Shield Pair 8	Contacts 1-4	67.7	19.8

Notes:

- Mated bulk resistance values are typical values.
- Mated trace lengths are taken from the DC board surface to the BP board surface, including the compliant pin interface.
- Ground Shield and Signal Contacts are as follows (GC = Ground Contact and S = Signal):

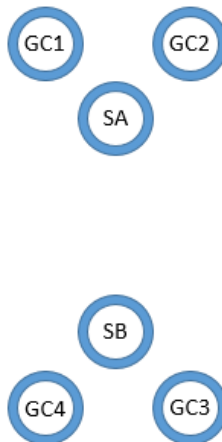


Figure 1: Footprint naming convention.

5.0 ELECTRICAL RATINGS

Description	Value
Mating Interface Contact Resistance Change	10mΩ Maximum
Compliant Pin to Plated Through Hole Resistance	1 mΩ Maximum
Insulation Resistance	1000 MegaΩ
Dielectric Withstanding Voltage	250 VAC Peak

6.0 CURRENT AND TEMPERATURE RATINGS

Description	Value
Maximum non-operating temperature rating (unmated)	125°C for 24 hours ⁽⁵⁾
Maximum operating temperature rating	85°C ⁽⁵⁾
Minimum operating temperature rating	-40°C

Notes:

- Per EIA-364-1000 the testing for 85°C (10 years) Field Temperature and Field Life at 105°C for 1600 hours. Testing for maximum non-operating temperature rating (unmated) at 125°C for 24 hours is pending.

7.0 MECHANICAL RATINGS

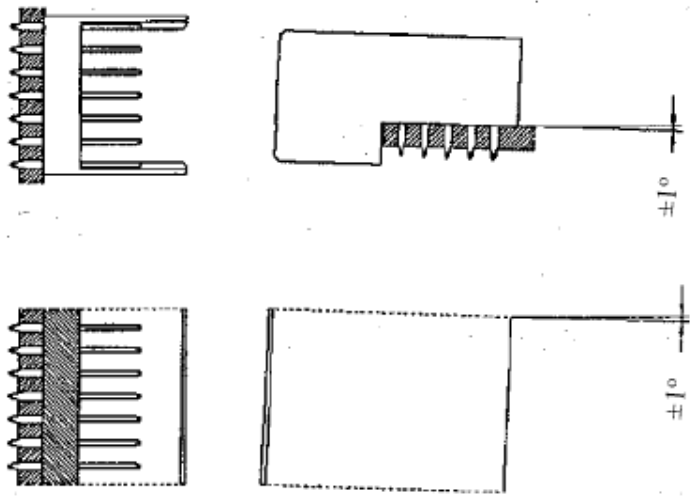
7.1 Mechanical Performance

Paladin™ Description	Value, per contact	
	Grams	Newtons
Signal Contact Normal Force (End of Life)	30 min (EOL)	0.29 min (EOL)
Shield Contact Normal Force (End of Life)	30 min (EOL)	0.29 min (EOL)
Signal and Shield Contact Engagement Force ⁽⁶⁾⁽⁷⁾	40 max	0.39 max
Signal and Shield Contact Separation Force ⁽⁶⁾⁽⁸⁾	15 min	0.15 min
Signal, Shield, and Power Contact Durability	Rated for 250 Mating Cycles	
Contact Mechanical Wipe Minimum Values	Signal 2.25mm/1.5mm Shield 2.75mm SE Signal 1.75mm/1.0mm	

Notes:

- These values are maximum and minimum expected forces, averaged over the number of mating points (contacts) in a connector. This data is to be used for purposes of system mechanical sizing.
- The average Signal and Shield Contact Engagement Force shall be no greater than 40 grams (0.39N) with no more than 10% of the engagement force values between 40 grams (0.39N) and 45 grams (0.44N) and no values greater than 45 grams (0.44N).
- The average Signal and Shield Contact Separation force values shall be no less than 15 grams (0.15N) with no more than 10% of the separation force values between 10 grams (0.10N) and 15 grams (0.15N) with no values less than 10 grams (0.10N).

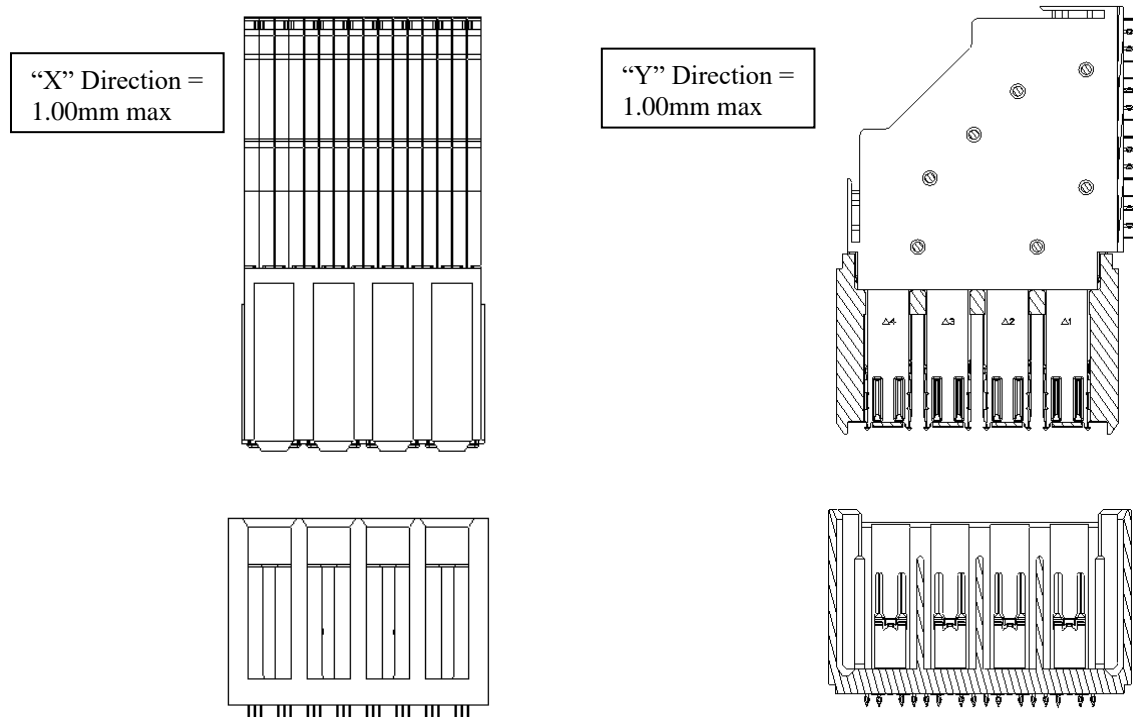
7.2 Connector Mating Angle



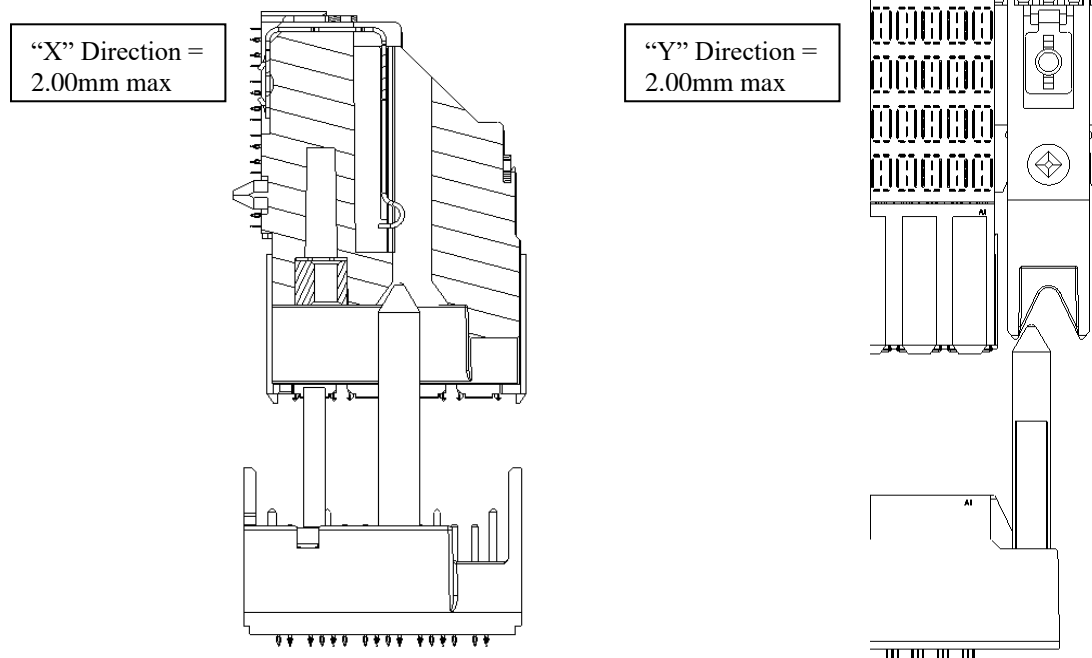
7.2.1 The maximum mating angle allowable in the X and Y axis is 1 degree.

7.3 Connector Gatherability

7.3.1 Without Guide Module



7.3.2 With Guide Module



7.4 Sequencing chart

7.4.1 Consult factory for sequencing charts.

8.0 COMPLIANT PIN INTERFACE Paladin

Description	Value per Pin, lbs
0.0157" Drill (Paladin Standard DC/BMA Pin)	
Signal and Shield Compliant Pin Insertion	5.0 Maximum ⁽⁹⁾
Signal and Shield Compliant Pin Retention	0.50 Minimum ⁽¹⁰⁾

- 8.1 Radial hole deformation not to exceed 70µm (0.0015") measured from drilled hole.
- 8.2 Axial hole deformation not to exceed 50µm (0.00197") per IEC 60352-5 measured in the vertical plane.
- 8.3 Three pin insertions max per Plated Through Holes (PTH).

Notes:

- 9. Ensure press machine can reach maximum force required to press connector with a safety factor of 1.2 [Maximum force= (Max value per pin)(1.2) (Number of pins on connector)].
- 10. The average compliant pin retention shall not be less than 0.5 lbf with no more than 10% of retention values between 0.5 lbf and 0.4 lbf and no retention values below 0.4 lbf.
- 11. Refer to technical bulletin TB-2322, Paladin Routing Guidelines, for drilled and finished hole requirements. Refer to technical bulletin TB-2320, Paladin Direct Ortho General Guidelines for pin locations and callouts.

9.0 QUALIFICATION TESTING

- 9.1 Sample Selection: Refer to Section 13 for minimum recommended connector sample size.
- 9.2 Test Sequence: Qualification testing shall be performed per the sequences listed in Section 13 of this document.
- 9.3 The qualification for the Paladin product line was performed with the 4 Pair x 8 Position interconnect and by similarity all other derivatives of the product line are considered qualified.

10.0 REQUALIFICATION TESTING

- 10.1 If changes affecting form, fit or function are made to the product or to the manufacturing process, Product Engineering and Mechanical Integrity Engineering shall coordinate re-qualification testing of all or part of the original testing sequence as required.

11.0 ACCEPTANCE

- 11.1 Acceptance is based on verification that the product meets the requirements of Section 12. Failures attributed to equipment, test set-up, or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Verification of corrective action is required before re-submittal.

12.0 SPECIFICATION SUMMARY

12.1 Material

Parameters	Specification	Paladin Value	Reference Document
Plating Integrity	Acceptable Porosity	No more than 3 Pores per mating surface ⁽¹²⁾	EIA-364-TP53 Exposed to nitric vapors
Contact Metallization	30µin Gold min over 50-150µin Ni	30µin Gold min over 50-150µin Ni	GR-1217-CORE Per section 6.1.8
Durability	200 Cycles	250 Cycles	GR-1217-CORE Per paragraph 9.1.1.2 EIA-364-TP09
Surface Finish	Surface finish is 16 RMS or otherwise specified	16 RMS on mating surfaces	GR-1217-CORE Per section 6.1.9
Lubrication	Must be present on all backplane blades/shields	Must be present on all backplane male pins/shield receptacles	GR-1217-CORE R5-67
Flammability Rating	94V-0	Must Pass Requirement	UL94

Notes:

- 12. Measured on as plated material prior to connector assembly.

12.2 Mechanical

Parameters	Specification	Paladin Value	Reference Document
Contact Normal Force	30 Grams End of Life (EOL)	30 Grams End of Life (EOL)	GR-1217-CORE EIA-364-TP04
Contact Strength*	Apply 0.25 lbs. Axial Force per contact	Apply 0.25 lbs. Axial Force per contact	GB-1217-CORE Per paragraph 6.1.7
Polarization Force*	100 N (22.5 lbs)	Mate Samples 180° out of Phase	GR-78-CORE Per section 4.2.2

12.3 Electrical

Parameters	Specification	Paladin Value	Reference Document
Contact Resistance Stability (LLCR)	Less than 10mΩ change from initial reading	Less than 10mΩ change from initial reading	GR-1217-CORE Per paragraph 6.2.1 EIA-364-TP23
Compliant Pin to PTH Resistance	No change greater than 1mΩ ⁽¹³⁾ Test current 100mA and 20mV open circuit	No change greater than 1mΩ	GR-1217-CORE EIA-364-TP23
Mated Bulk Resistance	N/A	SEE SECTION 4.0	N/A
Signal Continuity*	Less than 10 nanosecond interrupt	Less than 10 nanosecond Interrupt	GR-1217-CORE
Insulation Resistance	1,000 MegaΩ	1,000 MegaΩ	GR-1217-CORE
Dielectric Withstanding	250 VAC Peak	250 VAC Peak	GR-1217-CORE EIA-364-TP20

Notes:

13. Due to the size of the Paladin compliant pins, direct probing of the compliant pins can disturb the compliant pin and PTH interface, yielding unreliable measurements. In lieu of direct probing, ATCS has developed a process to measure the compliant pin interface resistance without directly probing the compliant pins. This method does add some bulk resistance to the measurement, which is why a change in resistance is the critical metric. This technique complies with Telcordia requirements per paragraph R5-103.

12.4 Environmental

Parameters	Specification	Paladin Value	Reference Document
Temperature Life*	No Change in LLCR greater than 10mΩ	10mΩ Maximum change	GR-1217-CORE EIA-364-TP17 Test condition 4 Per paragraph 6.3.2
Thermal Shock*	No Change in LLCR greater than 10mΩ 25 cycles for -65°C to 105°C	Same as above	GR-1217-CORE Per paragraph 6.3.3 EIA-364-TP32
Humidity Cycling*	No Change in LLCR greater than 10mΩ Relative Humidity 90 to 95% For 500 hrs	Same as above	GR-1217-CORE EIA-364-TP31 Procedure II

Dust*	No Change in LLCR greater than 10mΩ	Same as above	GR-1217-CORE Per paragraph 9.1.1.1 EIA-364-TP91
Vibration*	No Change in LLCR greater than 10mΩ Random Vibration 9.26 RMS	Same as above	GR-1217-CORE EIA-364-TP28 Per paragraph 9.1.2.1
Mechanical Shock*	No Change in LLCR greater than 10mΩ 30 G's for 11 milliseconds Half Sine 3 axis	Same as above	GR-1217-CORE EIA-364-TP27
Mixed Flowing Gas*	No Change in LLCR greater than 10mΩ 300 hrs at 105°C thermal conditioning also included	Same as above	GR-1217-CORE Per paragraph 9.1.3 EIA-364-TP65

Parameters marked with an asterisk () indicates that testing has not been performed/completed to this date.*

13.0 TELCORDIA QUALIFICATION TEST GROUP SUMMARY

13.1 Test Groups

Group 1: Vibration and mechanical shock with dust and durability

Group 2: Thermal shock and humidity with dust and durability

Group 3: Temperature life, 1000 hrs @ 105°C

Group 4: Mixed flowing gas, 4 gases with durability-thermal conditioning included prior to test.

Group 5: Porosity and plating thickness

Note: Compliant pins are tested separately.

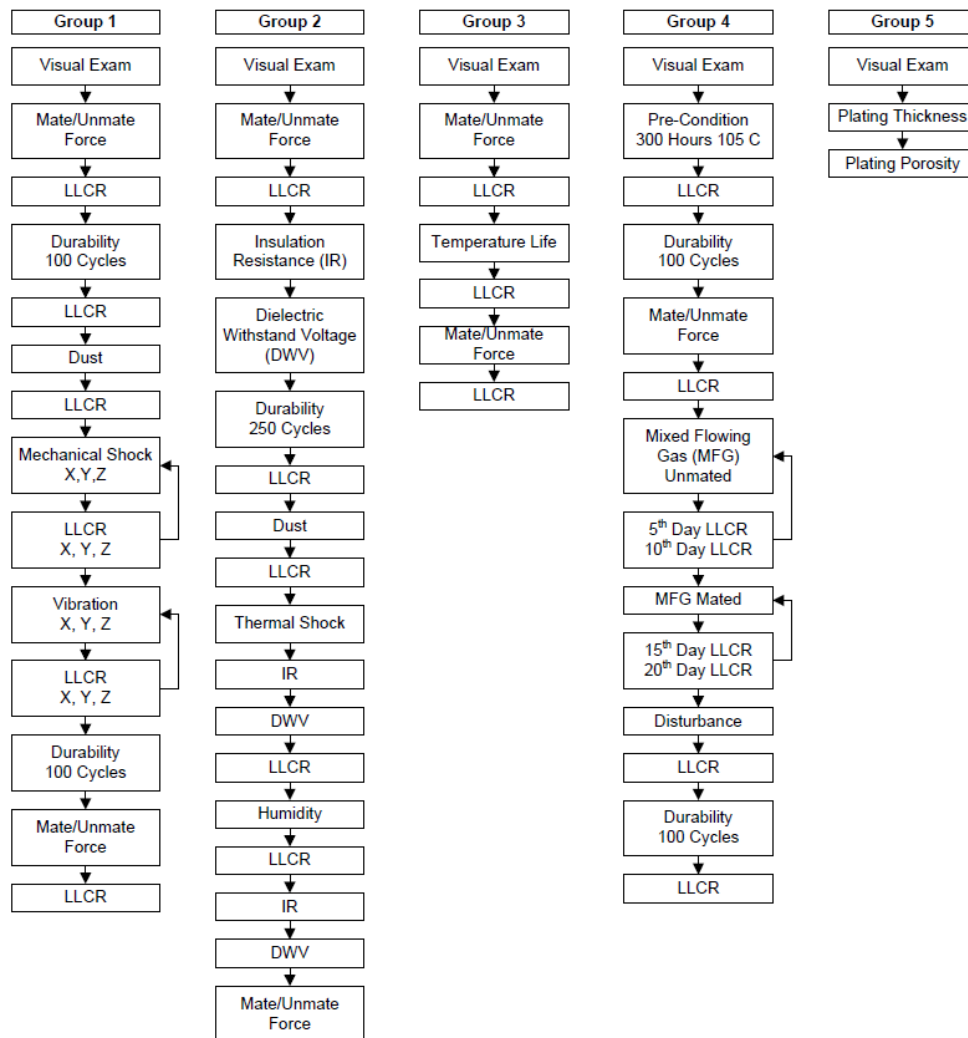


Figure 2: Telcordia Test Plan GR-1217-CORE, CENTRAL OFFICE

13.2 Each test group will have a minimum of 4 connectors and 100 LLCR measurements.

13.3 Definitions:

13.3.1 LLCR- Low Level Contact Resistance

13.3.2 DWV- Dielectric Withstanding Voltage

13.3.3 IR- Insulation Resistance

14.0 RESISTANCE MEASUREMENT SET-UP

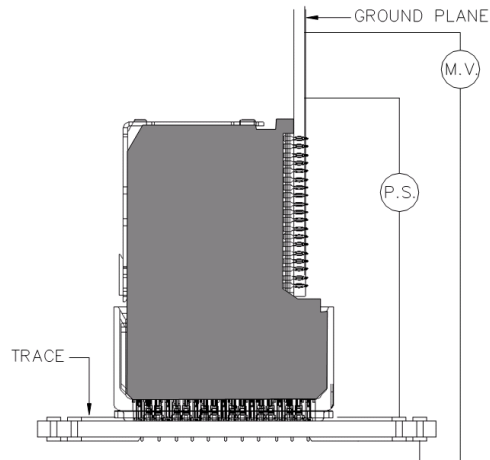


Figure 3: Shown above is an example of a typical contact resistance set-up. Kelvin 4 wire traces from connector hole to monitoring hole.

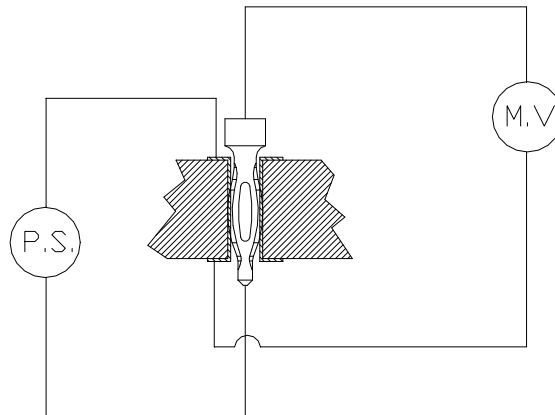


Figure 4: Typical compliant pin interface resistance (CPIR) set-up.