

Paladin P1 4 Pair RAF Qualification Testing

TB-2335

AMPHENOL TCS MECHANICAL INTEGRITY LABORATORY

Product Line:	Paladin
Test Description:	Preliminary Telcordia GR-1217-CORE CO Qualification

Revision	Description	Date	SCR Number
A	Initial Release	1/23/18	S6703
B	Added final LLCR measurement to Group 2	2/6/18	S6756
C	Updated test sequence flowchart Group 2	2/8/18	S6760

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1.0 Purpose

1.1 The purpose of the test is to qualify the Paladin P1 right angle female (RAF) product plated with the standard nickel sulfamate plating system in accordance with Telcordia GR-1217-CORE Central Office (CO) requirements.

2.0 Reference Documents

- 2.1 Telcordia GR-1217-COREiO2 Generic Requirements for Separable Electrical Connectors Used in Telecommunication Hardware
- 2.2 EIA-364 Test Procedures Test Standards and Procedures for Electrical Connectors
- 2.3 TB-2023 Connector Qualification Plan

3.0 Qualification Test Plan and Test Conditions

- The qualification test plan contains 4 test sequences.

3.1 Group 1: Mechanical shock and random vibration

3.1.1 Mechanical shock test conditions – EIA-364-TP27

- 3.1.1.1 'G' Level : 50 G's
- 3.1.1.2 Duration : 11 Milliseconds
- 3.1.1.3 Wave form : Half Sine
- 3.1.1.4 No. of Shocks : 3 axis and 3 each direction (18 total)

3.1.2 Random vibration test conditions – EIA-364-TP28

- 3.1.2.1 Frequency : 50 to 2000 Hz
- 3.1.2.2 PSD : 0.06 G² /Hz
- 3.1.2.3 'G' Level : 9.26 G's RMS
- 3.1.2.4 Duration : 2 hrs/axis, 3 axis (6hrs total)

3.1.3 Dust test conditions – EIA-364-TP91 Benign Dust

- 3.1.3.1 Chamber size : 9 ft³
- 3.1.3.2 Amount of dust : 9.0 grams/ft³
- 3.1.3.3 Exposure time : 1.0 hours
- 3.1.3.4 Fan speed : 956 ft/min

3.2 Group 2: Thermal shock, durability, dust, humidity cycling (dielectric withstanding voltage and insulation resistance are also included in this group)

3.2.1 Thermal shock test conditions – EIA-364-TP32

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- 3.2.1.1 Number of cycles : 25 cycles
 - 3.2.1.2 Hot temp extreme : +105°C (+3°C, -0°C)
 - 3.2.1.3 Cold temp extreme : -65°C (+0°C, -3°C)
 - 3.2.1.4 Exposure at temperature : 30 minutes
 - 3.2.1.5 Transfer time : < 1.0 minute
 - 3.2.2 Durability 250x test conditions – EIA-364-TP09
 - 3.2.2.1 Number of cycles : 250X
 - 3.2.2.2 Rate : 300 cycles/hour
 - 3.2.3 Dust test conditions – EIA-364-TP91 Benign Dust
 - 3.2.3.1 Chamber size : 9 ft³
 - 3.2.3.2 Amount of dust : 9.0 grams/ft³
 - 3.2.3.3 Exposure time : 1.0 hours
 - 3.2.3.4 Fan speed : 956 ft/min
 - 3.2.4 Humidity test conditions – EIA-364-TP31 Procedure II
 - 3.2.4.1 Relative humidity : 90% to 95%
 - 3.2.4.2 Temperature conditions : 25°C to 65°C
 - 3.2.4.3 Duration : 500 hours
 - 3.2.4.4 Cycle time : 8 hours per cycle
 - 3.3 Group 3: Temperature life
 - 3.3.1 Temperature life test conditions – EIA-364-TP17
 - 3.3.1.1 Temperature : 105°C ± 2°C
 - 3.3.1.2 Duration : 1000 hours
 - 3.4 Group 4: Mixed flowing gas
 - 3.4.1 Pre- and post-durability test conditions – EIA-364-TP09
 - 3.4.1.1 Number of cycles : 100X pre- and post-durability
 - 3.4.1.2 Rate : 300 cycles/hour
 - 3.4.2 Temperature pre-conditioning test conditions – EIA-364-TP17
 - 3.4.2.1 Temperature : 105°C ± 2°C
 - 3.4.2.2 Duration : 300 hours
 - 3.4.3 Mixed flowing gas test conditions – EIA-364-TP65 Condition IIA
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- 3.4.3.1 Temperature : 30°C ± 1°C
- 3.4.3.2 Relative humidity : 70% ± 2%
- 3.4.3.3 Exposure time : 20 days (10 days unmated/10 days mated)
- 3.4.3.4 Gases and concentrations, see Table 1.

Gas	Concentration
NO ₂	200 ppb ± 50 ppb
Cl ₂	10 ppb ± 3 ppb
H ₂ S	10 ppb ± 5 ppb
SO ₂	100 ppb ± 20 ppb

Table 1: MFG gas concentrations

3.5 Test Equipment

- 3.5.1 Keithley Micro-Ohm meter
- 3.5.2 Instron
- 3.5.3 Thermotron temperature chamber
- 3.5.4 Cincinnati Sub-Zero thermal shock chamber
- 3.5.5 Blue M. Temp-Humidity chamber
- 3.5.6 Corrosive dust chamber
- 3.5.7 MB Elect. Vibration table
- 3.5.8 Mixed flowing gas chamber

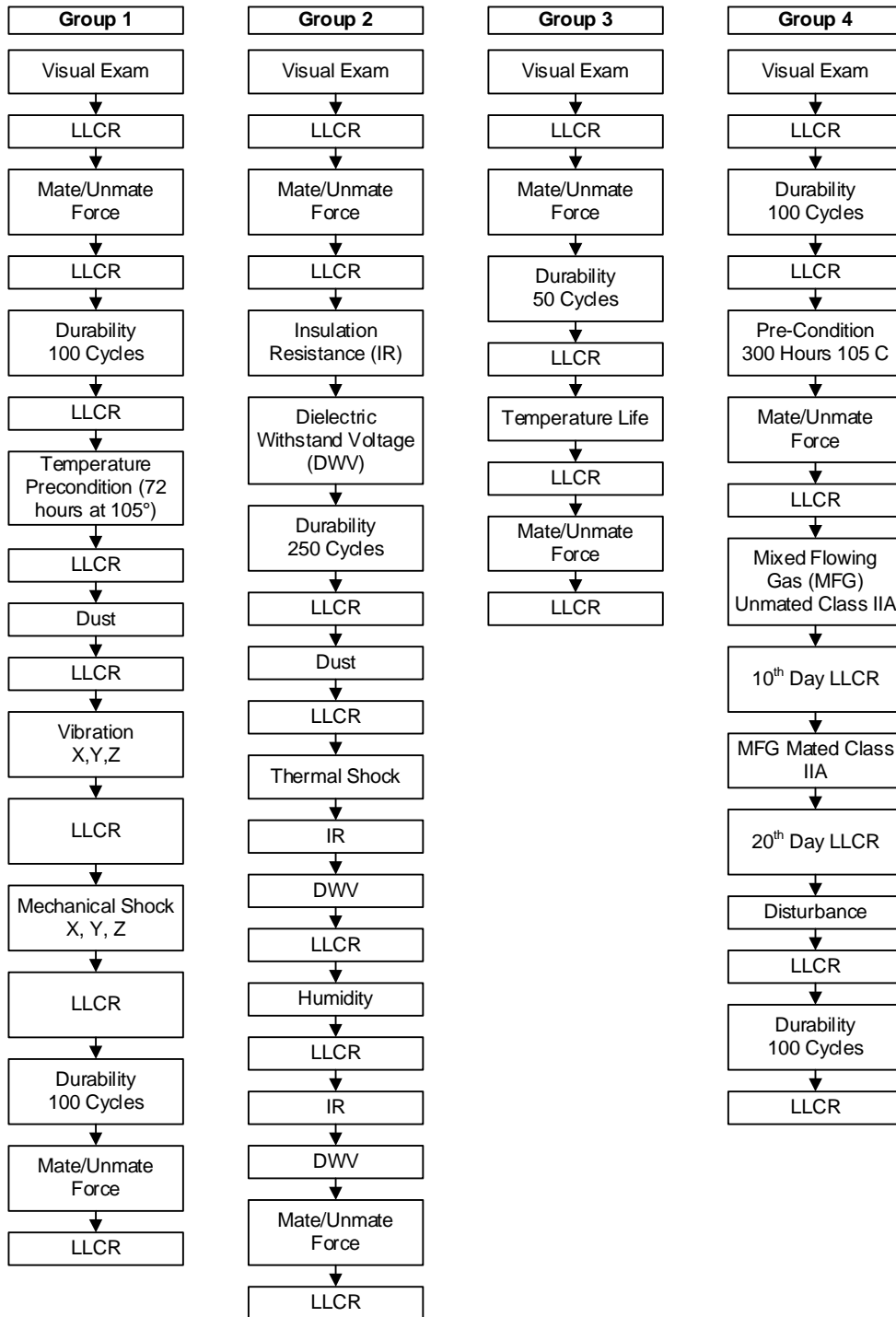
3.6 Test Samples

- 3.6.1 The test samples are Paladin P1 4 Pair RAF daughtercard and backplane connectors. The test connector configuration is three 4 pair modules of eight positions (4x24).
- 3.6.2 Test samples were mounted onto ATCS standard Telcordia qualification printed circuit boards (PCBs) as shown in Figure 1. There are 72 signal contacts and 72 ground contacts which were set up to measure low level contact resistance (LLCR) per PCB.



Figure 1: Qualification test sample.

3.7 Test Sequences ⁽¹⁾



NOTES:

1. Low level contact resistance (LLCR)

4.0 Test Results⁽¹⁾

4.1 Group 1: Mechanical shock and random vibration

4.1.1 Four test samples were exposed to mechanical shock and random vibration, and a total of 288 signal and 288 ground contacts were monitored for LLCR. The connectors were mechanically shocked to 50 G's in all three axes and exposed to 9.26 G's random vibration in all three axes with pre- and post-durability cycles. See Figure 2 for test results.

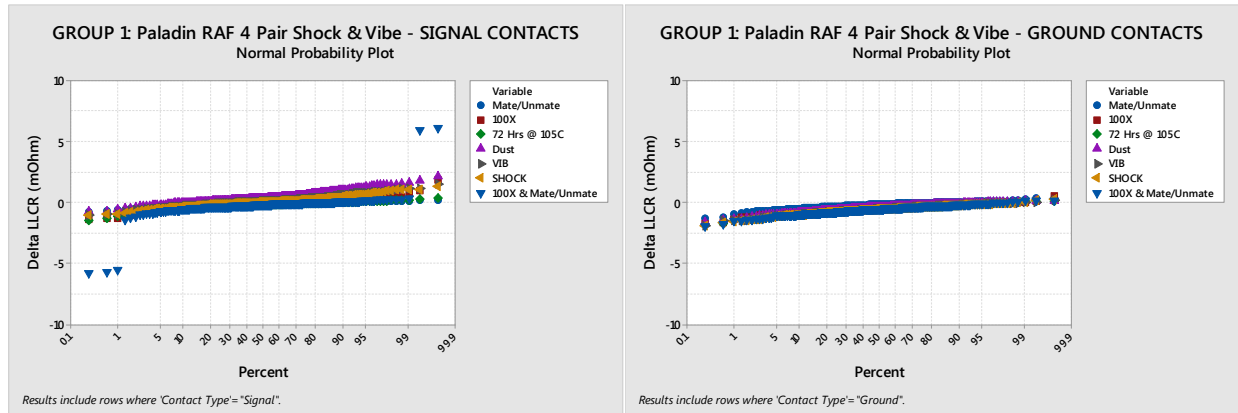


Figure 2: Delta LLCR results for all Group 1 samples - signal and ground contacts.

4.2 Group 2: Thermal shock, durability, dust, humidity cycling (dielectric withstanding voltage and insulation resistance are also included in this group)

4.2.1 Four test samples were exposed to thermal shock, 250 durability cycles, dust, and humidity cycling, and a total of 288 signal and 288 ground contacts were monitored for LLCR. See Figure 3 for test results.

NOTES:

1. The Telcordia GR-1217-CORE delta LLCR (low level contact resistance) requirement is less than 10 milli-ohms increase after exposure to test environments.

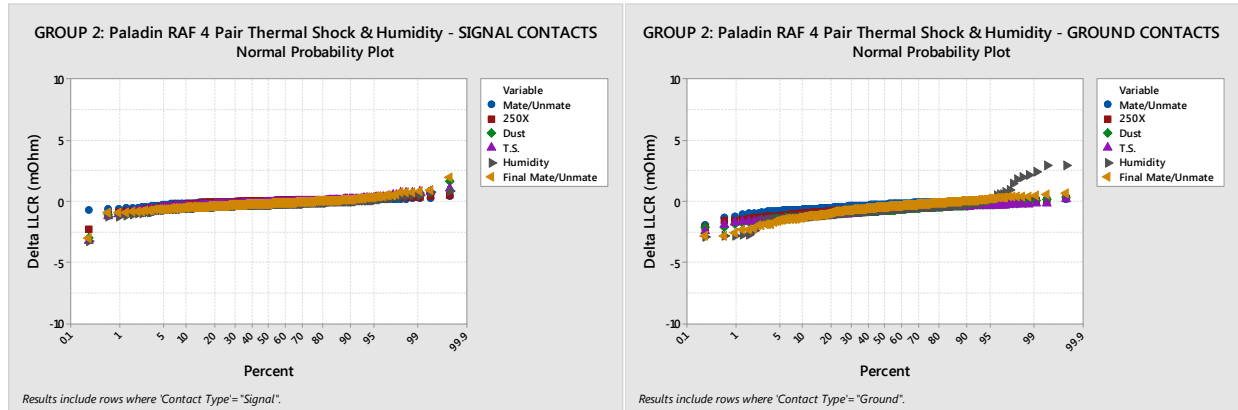


Figure 3: Delta LLCR results for all Group 2 samples - signal and ground contacts.

4.3 Group 3: Temperature life

4.3.1 Four test samples were exposed to 105°C for 1000 hours, and a total of 288 signal and 288 ground contacts were monitored for LLCR. See Figure 4 for test results.

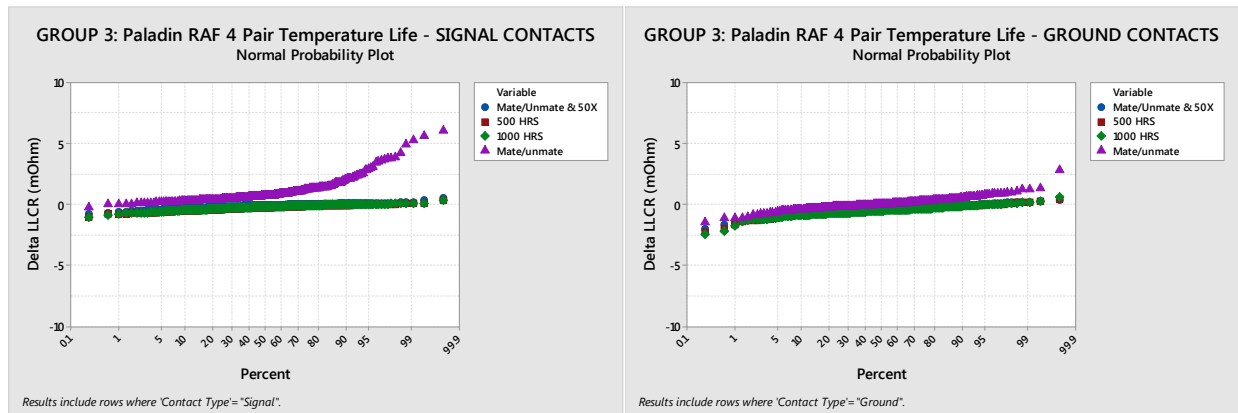


Figure 4: Delta LLCR results for all Group 3 samples - signal and ground contacts.

4.4 Group 4: Mixed flowing gas

4.4.1 Four test samples were exposed to a mixed flowing gas (MFG) test per Telcordia GR-1217-CORE Central Office requirements, and a total of 288 signal and 288 ground contacts were monitored for LLCR. See Figure 5 for test results.

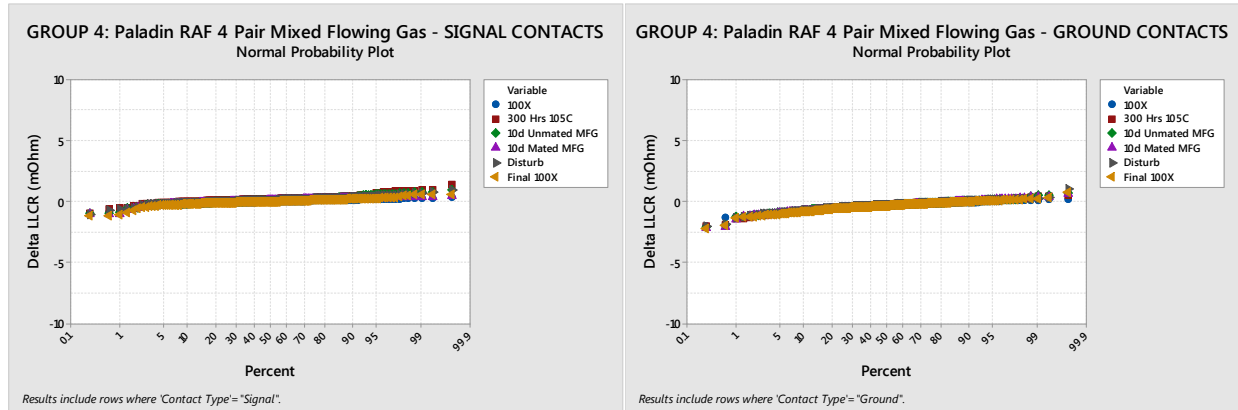


Figure 5: Delta LLCR results for all Group 4 samples - signal and ground contacts.

5.0 Test results summary and discussion

5.1 Group 1: Mechanical shock and random vibration

5.1.1 The Paladin RAF test samples passed the Telcordia GR-1217-CORE C.O. requirements for mechanical shock and random vibration. The maximum signal contact delta low level contact resistance measured 6.08 milli-ohms and occurred after the final 100 durability cycles and mate/unmate force. The maximum ground contact delta LLCR measured 0.52 milli-ohms and occurred after the first 100 durability cycles. The mechanical shock and random vibration results summary for signals and grounds are shown in Table 2 and Table 3, respectively.

GROUP 1 SIGNALS								
	Initial	Mate/Unmate	100X	72 Hrs @ 105C	Dust	VIB	SHOCK	100X & Mate/Unmate
AVE	27.86	-0.11	-0.19	-0.27	0.31	0.05	-0.03	-0.26
MIN	22.06	-0.80	-1.43	-1.49	-0.86	-1.06	-1.12	-5.77
MAX	35.51	0.13	1.82	0.27	2.09	1.48	1.26	6.08
STDEV	4.280	0.133	0.300	0.240	0.435	0.366	0.351	0.803

Table 2: Mechanical shock and vibration test results summary – Signals (all units in milli-ohms)

GROUP 1 GROUNDS								
	Initial	Mate/Unmate	100X	72 HRS @ 105C	Dust	VIB	Shock	100X & Mate/Unmate
AVE	12.69	-0.26	-0.54	-0.59	-0.52	-0.63	-0.64	-0.64
MIN	10.57	-1.37	-1.77	-1.84	-1.71	-1.93	-1.97	-1.97
MAX	15.61	0.35	0.52	0.04	0.07	0.10	0.24	0.24
STDEV	1.194	0.22	0.30	0.30	0.30	0.31	0.32	0.32

Table 3: Mechanical shock and vibration test results summary – Grounds (all units in milli-ohms)

5.2 Group 2: Thermal shock, durability, dust, and humidity cycling (dielectric withstanding voltage and insulation resistance are also included in this group)

5.2.1 The Paladin RAF test samples passed the Telcordia GR-1217-CORE C.O. requirements for thermal shock, durability, dust, and humidity cycling. The maximum signal contact delta LLCR measured 1.98 milli-ohms and occurred after the final mate/unmate test. The maximum ground contact delta LLCR measured 2.94 milli-ohms and occurred after humidity testing. The thermal shock, durability, dust, and humidity cycling test results summary for signals and grounds are shown in Table 4 and Table 5, respectively.

GROUP 2 SIGNALS							
	Initial	Mate/Unmate	250X	Dust	T.S.	Humidity	Final Mate/Unmate
AVE	27.71	-0.07	-0.05	-0.22	-0.18	-0.29	-0.17
MIN	22.68	-0.77	-2.28	-2.98	-3.32	-3.25	-3.03
MAX	35.23	0.37	0.44	1.61	1.02	0.81	1.98
STDEV	4.288	0.138	0.241	0.332	0.334	0.317	0.356

Table 4: Thermal shock and humidity cycling test results summary – Signals (all units in milli-ohms)

GROUP 2 GROUNDS							
	Initial	Mate/Unmate	250X	Dust	T.S.	Humidity	Final Mate/Unmate
AVE	12.79	-0.33	-0.55	-0.77	-0.87	-0.69	-0.55
MIN	10.90	-1.96	-2.12	-2.13	-2.45	-2.91	-2.83
MAX	15.95	0.16	0.26	0.33	0.09	2.94	0.62
STDEV	1.306	0.273	0.355	0.371	0.364	0.678	0.565

Table 5: Thermal shock and humidity cycling test results summary – Grounds (all units in milli-ohms)

5.3 Group 3: Temperature life

5.3.1 The Paladin RAF test samples passed the Telcordia GR-1217-CORE C.O. requirements for temperature life. The samples were exposed to 105°C for 1000 hours which exceeds the Telcordia requirement of 85°C for 500 hours for Central Office environments. The maximum signal contact delta LLCR was 6.00 milli-ohms and occurred after the final mate/unmate force test. The maximum ground contact delta LLCR was 2.73 milli-ohms and occurred after the final mate/unmate force test. The temperature life test results summary for signals and grounds are shown in Table 6 and Table 7, respectively.

GROUP 3 SIGNALS					
	Initial	Mate/Unmate & 50X	500 HRS	1000 HRS	Mate/Unmate
AVE	27.68	-0.15	-0.31	-0.25	0.93
MIN	22.99	-0.81	-1.06	-1.07	-0.30
MAX	35.14	0.45	0.31	0.31	6.00
STDEV	4.28	0.15	0.19	0.19	0.93

Table 6: Temperature life test results summary – Signals (all units in milli-ohms)

GROUP 3 GROUNDS					
	Initial	Mate/Unmate & 50X	500 HRS	1000 HRS	Mate/Unmate
AVE	12.72	-0.44	-0.53	-0.56	-0.01
MIN	10.83	-2.08	-2.34	-2.48	-1.51
MAX	16.92	0.34	0.43	0.59	2.73
STDEV	1.24	0.31	0.33	0.34	0.43

Table 7: Temperature life test results summary – Grounds (all units in milli-ohms)

5.4 Group 4: Mixed flowing gas

5.4.1 The Paladin RAF test samples passed the Telcordia GR-1217-CORE CO requirements for the mixed flowing gas test. The maximum signal contact delta LLCR measured 1.35 milli-ohms and occurred after the 300 hours at 105°C. The maximum ground contact delta LLCR measured 0.98 milli-ohms after disturbance. The mixed flowing gas test results summary for signals and grounds are shown in Table 8 and Table 9, respectively.

GROUP 4 SIGNALS							
	Initial	100X	300 HRS 105C	10d Unmated MFG	10d Mated MFG	Disturb	100x
AVE	27.72	-0.08	0.17	0.07	-0.01	0.07	-0.02
MIN	22.91	-1.10	-1.03	-1.02	-1.13	-1.13	-1.19
MAX	35.35	0.27	1.35	0.92	0.40	0.94	0.55
STDEV	4.29	0.16	0.24	0.24	0.20	0.21	0.22

Table 8: Mixed flowing gas test results summary – Signals (all units in milli-ohms)

GROUP 4 GROUNDS							
	Initial	100X	300 HRS 105C	10d Unmated MFG	10d Mated MFG	Disturb	100X
AVE	12.71	-0.41	-0.35	-0.34	-0.43	-0.34	-0.38
MIN	10.62	-2.03	-2.05	-2.11	-2.26	-2.03	-2.24
MAX	16.58	0.13	0.51	0.64	0.54	0.98	0.75
STDEV	1.30	0.29	0.35	0.34	0.35	0.34	0.35

Table 9: Mixed flowing gas test results summary – Grounds (all units in milli-ohms)

6.0 Conclusions

- 6.1 The Telcordia qualification test results for the Paladin P1 4 Pair RAF connector plated with the standard nickel sulfamate plating system show that it passed all the Telcordia GR-1217-CORE CO qualification requirements.
- 6.2 All the test results showed less than a 10 milli-ohm change in low level contact resistance, indicating that the product is robust and reliable enough for the central office requirements.