Harwin Test Report Summary

HT06602

Environmental & Mechanical Testing of Shield Clips (S0911-46R, S0921-46R)

harwin.com

1. Introduction.

1.1. Description and Purpose.

The purpose of this test program is to confirm the environmental, mechanical and electrical performance of Shield Clips S0911-46R and S0921-46R. This report is a summary of the testing documented in Test Reports 1710, 1761, 1852, 1855 and 1857.

1.2. Conclusion.

S0911-46R – under the specified conditions the requirements for environmental, mechanical and electrical testing were met. Following results from the exploratory sweep, vibration tests were scaled back to 15g instead of 40g. It is recommended that if the clip is being used in harsh environments where there is likely to be high shock, vibration and bump requirements, 6 or more clips are used (although Harwin recommend independent testing is carried out as each application can vary).

S0921-46R – under the specified conditions the requirements for environmental, mechanical and electrical testing were met. It is possible, that this clip is suitable for use in environments where harsh vibration, shock and bump requirements would be experienced (although Harwin recommend independent testing is carried out as each application can vary).

2. Test Method and Requirements.

2.1. List of Test Samples.

The two clips under test were S0911-46R Compact Shield Clip and S0921-46R Corner Shield Clip. For all these tests the clips were SMT soldered to test boards, in the following configurations:

a) Test board: 4 x S0911-46R Shield Clips, with Shield Can S02-30200250 assembled
b) Test board: 4 x S0911-46R Shield Clips, with Shield Can S02-20150300 assembled
c) Test board: 6 x S0911-46R Shield Clips, with Shield Can S02-20150300 assembled
d) Test board: 6 x S0911-46R Shield Clips, with Shield Can S02-30200250 assembled
e) Test board: 4 x S0921-46R Shield Clips, with Shield Can S01-30300500 assembled
f) Test board: 4 x S0921-46R Shield Clips, with Shield Can S01-50250500 assembled

2.2. Specification Parameters.

The testing performed included:

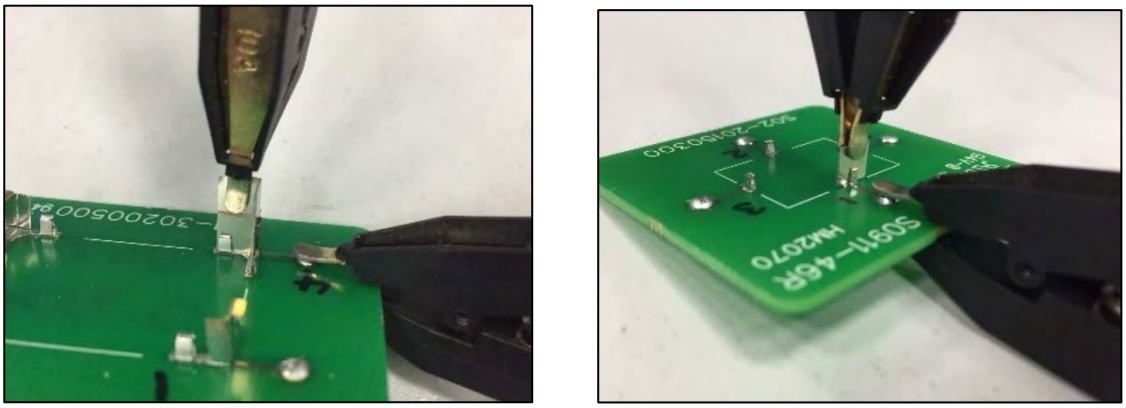
3. Test Results.

3.1. Contact Resistance to EIA-36406C: 1999

Methodology: The cans from test boards containing S0911-46R & S0921-46R were removed. The clips were mated to a cutting of blank shield can from S01-806005KIT (1x1 & 2x2 size cuttings used, respectively). The contact resistance of the clip mated with the shield can was measured prior to any electrical, mechanical or environmental testing (listed as INITIAL in the table). Samples were also tested post-conditioning (after tests 3.2, 3.6, 3.7, 3.8).

Results and Test Photos:

Contact Resistance					
Component	Test		Contact Resistance (mΩ)		
			Maximum	Minimum	Average
S0911-46R	Initial		5.00	4.30	4.60
	Durability		5.70	4.50	5.10
	Humidity		5.50	4.70	5.20
	Thermal Shock		5.40	4.80	5.20
	Salt Spray		19.70	13.90	15.70
	Temperature Life	96hrs	6.30	3.90	4.90
		250 hrs	5.80	3.80	4.80
		1000 hrs	5.80	4.80	5.10
S0921-46R	Initial		2.85	2.31	2.67
	Durability		2.86	2.48	2.71
	Humidity		2.87	2.73	2.81
	Thermal Shock		2.89	2.73	2.81
	Salt Spray		6.03	4.22	5.27
	Temperature Life	96hrs	3.51	2.79	3.05
		250 hrs	3.22	2.77	3.01
		1000 hrs	3.11	2.85	2.99



Contact Resistance Test Setup

3.2. Durability to EIA-364-09C: 1999.

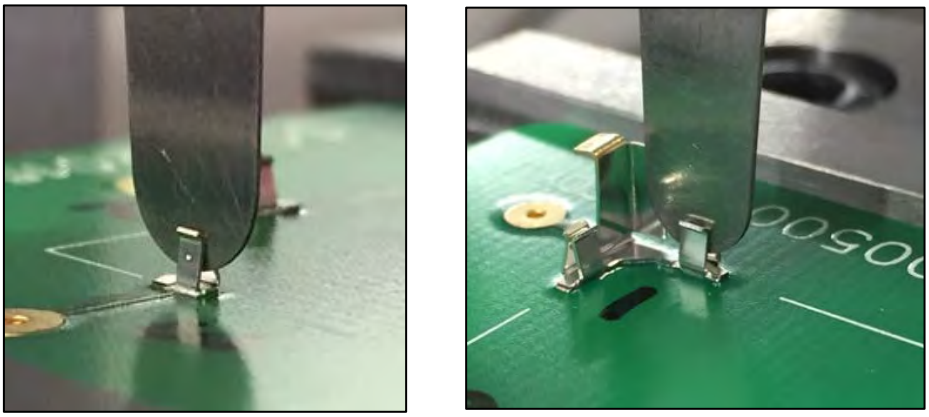
Methodology: S0911-46R clips assembled to test boards were mated with 0.15 & 0.20mm thickness gauges. S0921-46R clips assembled to test boards were mated with 0.30 & 0.40mm thickness gauges. The test was performed at a speed of 25mm/min for 30 cycles. Insertion and withdrawal forces were measured. Samples were also tested post-conditioning (after tests 3.5, 3.6, 3.7, 3.8).

Results and Test Photos:

Durability – Insertion Forces						
Part Number	Gauge (mm)	Condition	Maximum (N)	Minimum (N)	Average (N)	Calculated Average Force to Mate Shield Can to 4 Shield Clips (N)
S0911-46R	0.15	Initial Force	1.552	1.030	1.246	4.807
		Cycling Force	1.552	1.030	1.262	
		Final Force	1.369	0.843	1.097	
S0911-46R	0.20	Initial Force	2.086	1.358	1.705	6.360
		Cycling Force	2.086	1.358	1.711	
		Final Force	1.597	1.116	1.354	
S0921-46R	0.30	Initial Force	6.219	4.104	4.958	28.792
		Cycling Force	6.219	4.104	4.958	
		Final Force	3.018	2.201	2.717	
S0921-46R	0.40	Initial Force	7.040	4.100	5.789	42.037
		Cycling Force	7.040	4.708	5.850	
		Final Force	5.555	3.194	4.125	
Durability – Withdrawal Forces						
Part Number	Gauge (mm)	Condition	Maximum (N)	Minimum (N)	Average (N)	Calculated Average Force to Un-mate Shield Can from 4 Shield Clips (N)
S0911-46R	0.15	Initial Force	0.772	0.534	0.677	3.027
		Cycling Force	1.138	0.704	0.876	
		Final Force	0.862	0.582	0.717	
S0911-46R	0.20	Initial Force	0.821	0.575	0.685	2.861
		Cycling Force	0.895	0.705	0.792	
		Final Force	0.750	0.589	0.669	
S0921-46R	0.30	Initial Force	6.316	1.545	3.429	9.544
		Cycling Force	6.316	1.776	3.536	
		Final Force	2.641	1.496	1.919	
S0921-46R	0.40	Initial Force	1.813	1.541	1.684	15.651
		Cycling Force	4.731	1.776	2.266	
		Final Force	2.641	1.496	1.919	

Durability – Post Conditioning Insertion Forces						
Part Number	Gauge (mm)	Test		Maximum (N)	Minimum (N)	Average (N)
S0911-46R	0.20	Initial		2.086	1.116	1.590
		Salt Spray		1.962	0.705	1.499
		Humidity		1.593	0.179	0.836
		Thermal Shock		2.022	0.623	1.189
		Temperature	96 hrs	1.933	0.168	0.691
			250 hrs	1.365	0.369	0.862
			1000 hrs	1.839	0.716	1.046
S0921-46R	0.30	Initial		6.219	2.201	4.211
		Salt Spray		6.704	2.929	5.121
		Humidity		3.936	1.227	2.559
		Thermal Shock		3.582	0.948	2.807
		Temperature	96 hrs	4.380	0.705	2.905
			250 hrs	4.719	1.533	3.379
			1000 hrs	3.149	1.399	2.224

Durability – Post Conditioning Withdrawal Forces						
Part Number	Gauge (mm)	Test		Maximum (N)	Minimum (N)	Average (N)
S0911-46R	0.20	Initial		0.895	0.575	0.715
		Salt Spray		1.474	0.425	0.969
		Humidity		0.877	0.164	0.482
		Thermal Shock		1.571	0.317	0.702
		Temperature	96 hrs	0.966	0.175	0.413
			250 hrs	1.056	0.358	0.630
			1000 hrs	1.074	0.347	0.650
S0921-46R	0.30	Initial		1.705	1.007	1.327
		Salt Spray		2.119	1.149	1.775
		Humidity		1.634	0.515	0.949
		Thermal Shock		1.369	0.429	0.828
		Temperature	96 hrs	1.194	0.399	0.770
			250 hrs	2.100	0.631	1.378
			1000 hrs	1.977	0.418	1.181



Durability Test Setup

3.3. SMT Retention to Board

Methodology: Components S0911-46R & S0921-46R were assembled on to test boards. A lateral force was applied to the wings of the components until they broke or peeled away from the board, this force was recorded.

Results and Test Photos:

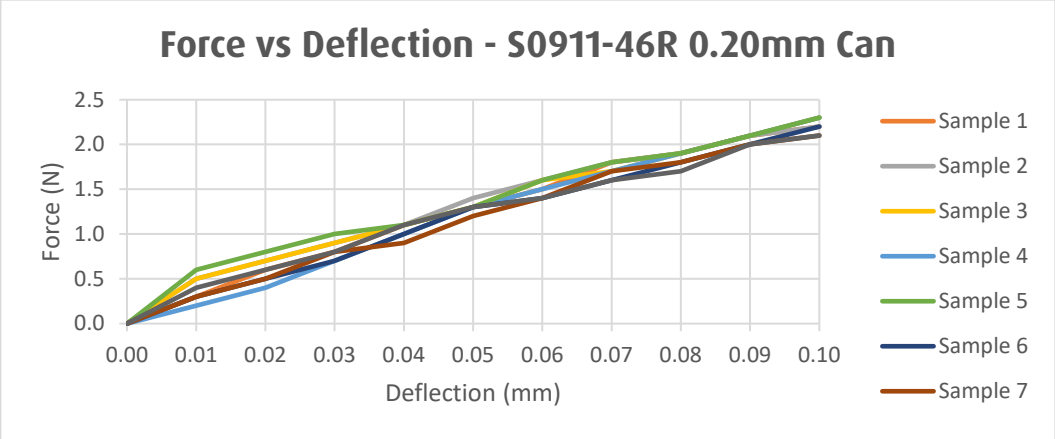
Retention to Board			
Part Number	Maximum (N)	Minimum (N)	Average (N)
S0911-46R	81.7	47.8	58.3
S0921-46R	62.0	48.9	58.2

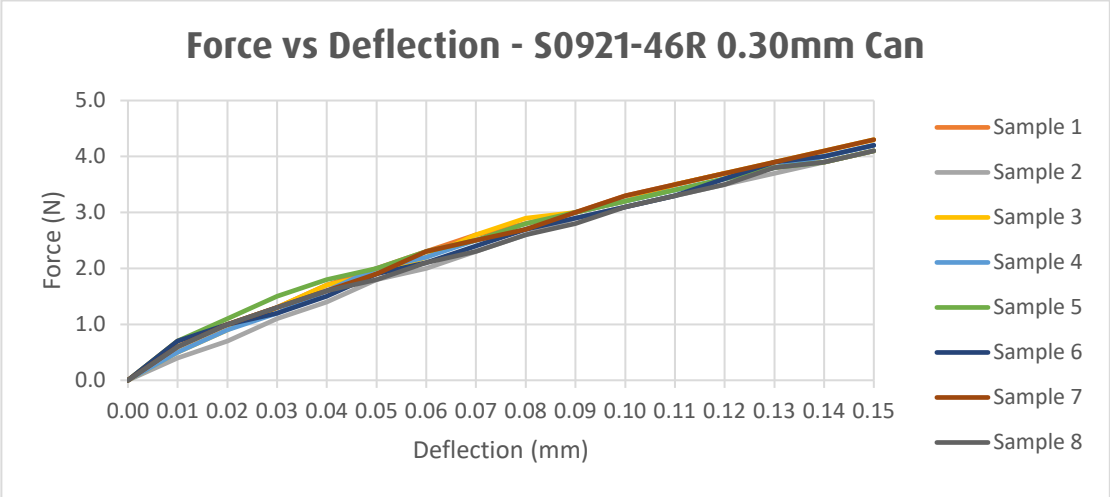
Retention to Board Test Setup

3.4. Force vs Deflection

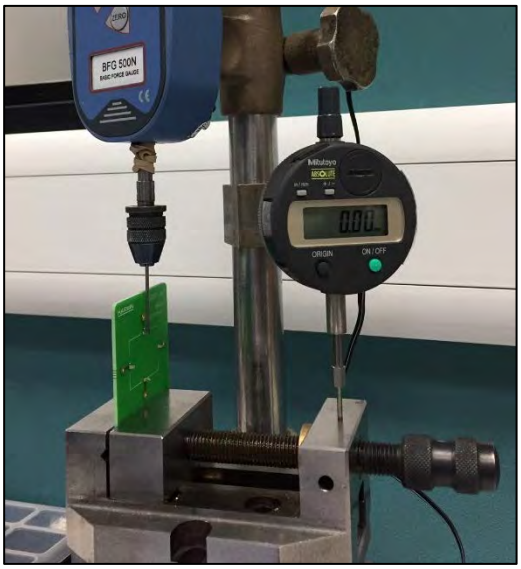
Methodology: Components S0911-46R & S0921-46R were assembled on to test boards. A lateral force was applied to one contact side (wing) at deflection increments of 0.01mm – the force at each step was noted. Deflection was continued up to 0.10mm deflection for S0911-46R, and 0.15mm deflection for S0921-46R. The distance of permanent set after maximum deflection was measured.

Results and Test Photos:





Permanent Set – After Deflection (mm)			
Part Number	Maximum	Minimum	Average
S0911-46R	0.02	0.01	0.02
S0921-46R	0.04	0.03	0.03



Force vs Deflection Test Setup

3.5. Temperature life (Without Load) to EIA-364-17B:1999

Methodology: Testing was performed to EIA-364-17B, condition 5, method A. Clips assembled to test boards were subjected to 96 hours, 250 hours and 1000 hours at 105±2°C. The samples were measured for contact resistance and durability, as well as a visual inspection after testing.

Results:

Part Number	Duration in Temperature Testing Oven		
	96 hours @ +105°C	250 hours @ +105°C	1000 hours @ +105°C
S0911-46R	Pass	Pass	Pass
S0921-46R	Pass	Pass	Pass

No obvious visual changes were noted.

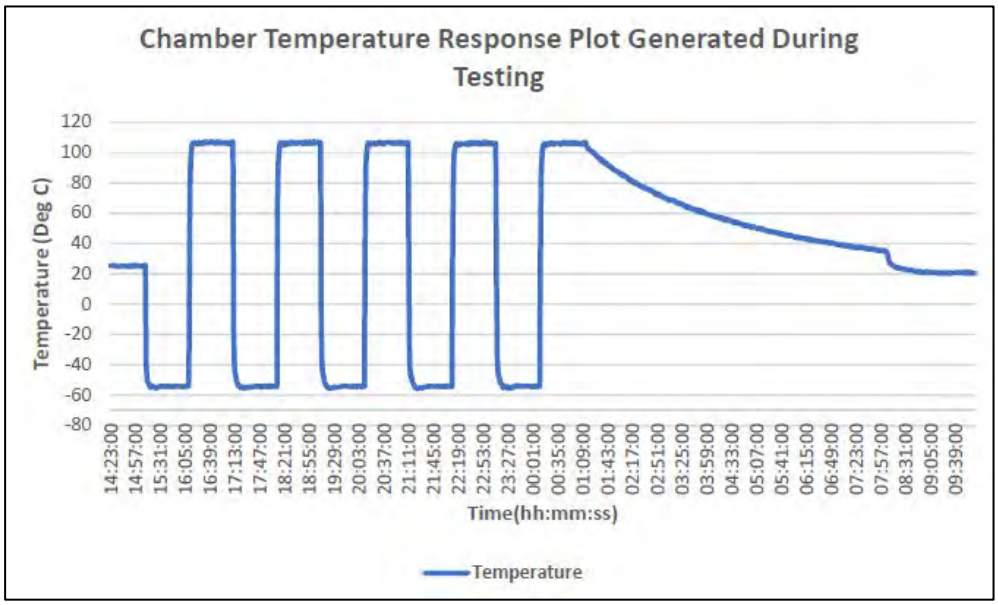
3.6. Thermal Shock to EIA-364-32C: 2000

Methodology: Thermal Shock Testing was performed to the shield clips assembled to the test boards in accordance with BS EN 60068-2-14:2009 Test Na and EIA364-32C Test Condition 7, using the following conditions:

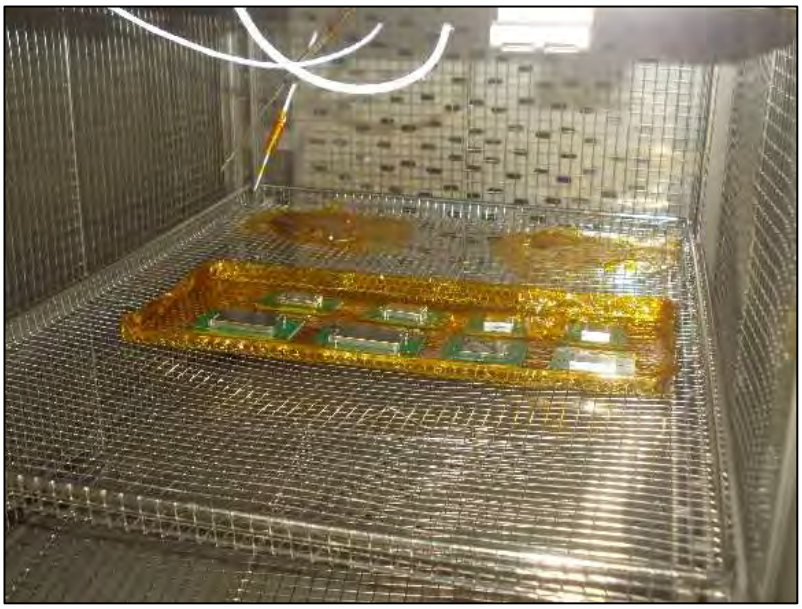
- Temperature Extremes -55°C and +105°C
- Dwell times 1 hr at each temperature extreme
- 5 cycles

The samples were measured for contact resistance and durability, as well as a visual inspection after testing. There were no obvious changes as a result.

Results and Test Photos:



No obvious visual changes were noted.



Samples in Thermal Shock Chamber

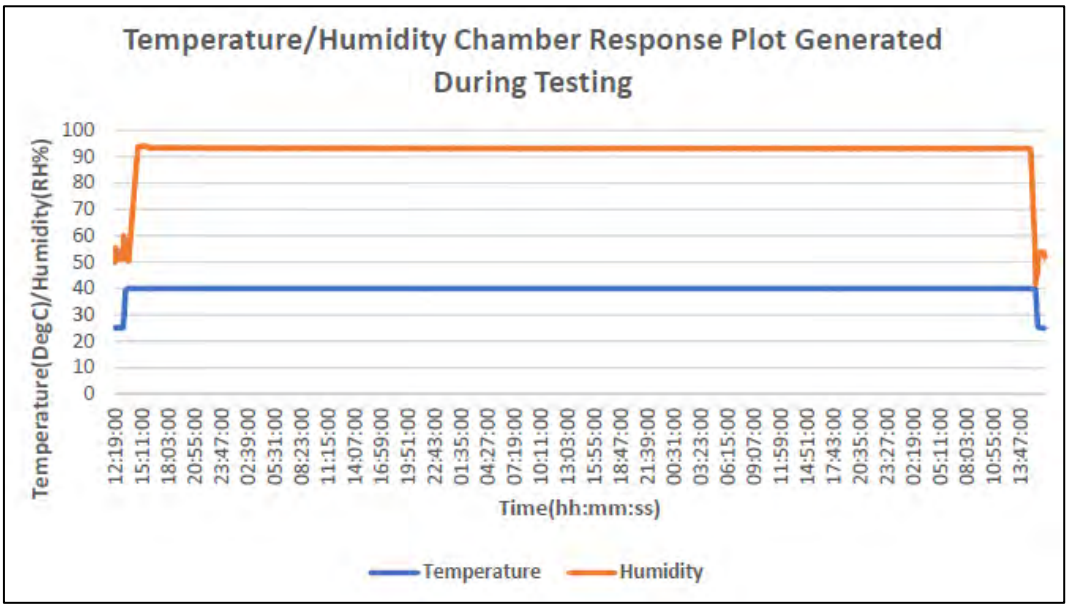
3.7. Humidity Steady State to EIA-364-31B: 1999

Methodology: A Steady State Humidity test was performed on the two clips assembled to test boards, in accordance with BS EN 60068-2-78-2013 Test Cab and EIA-364-31B Method 2 Test Condition A, using the following conditions:

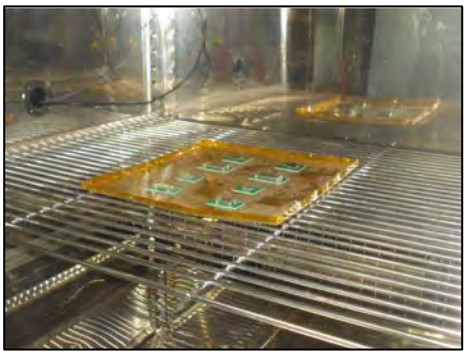
- Ambient Temperature +40°C
- Steady state humidity at 90% to 95% Rh
- Duration 96hrs

The samples were measured for contact resistance and durability, as well as a visual inspection after testing.

Results and Test Photos:



No obvious visual changes were noted.



Samples in Humidity Chamber

3.8. Salt Spray to EIA-364-26B: 1999

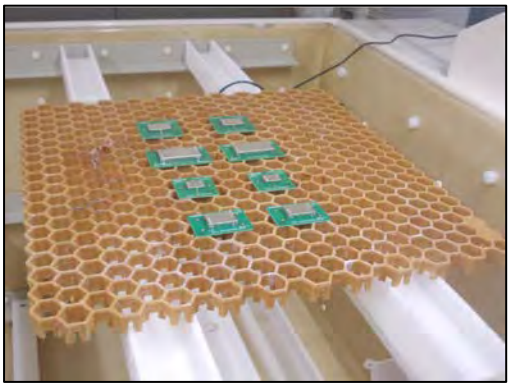
Methodology: A salt mist test was performed on test boards including the two clips, in accordance with BS EN 60068-2-11:1999 Test Ka, using the following conditions:

- Salt solution 5% NaCl
- Salt Mist chamber temperature +35°C
- 96hrs continuous salt spray
- Fallout rates: 0.5-3ml per hr
- Ph level: 6.5 to 7.2

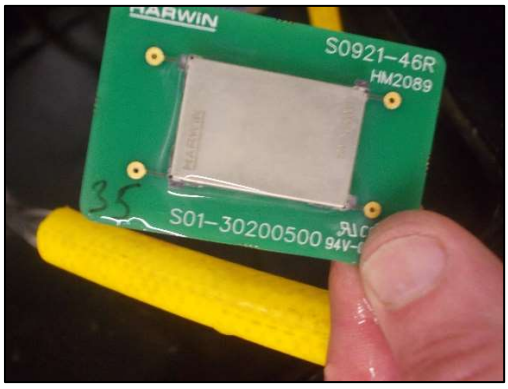
On completion of the salt mist duration, the samples were dipped in running water and placed into a temperature chamber at +38°C for 16hrs. The samples were measured for contact resistance and durability, as well as a visual inspection after testing.

Results and Test Photos:

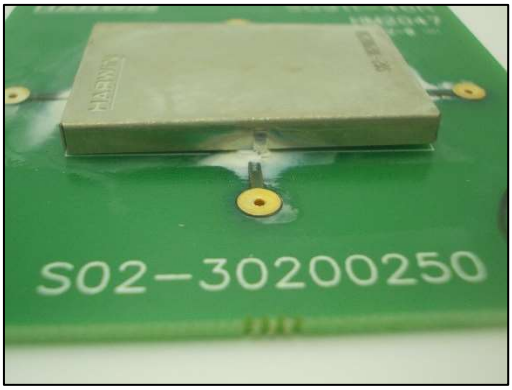
No obvious visual changes were noted.



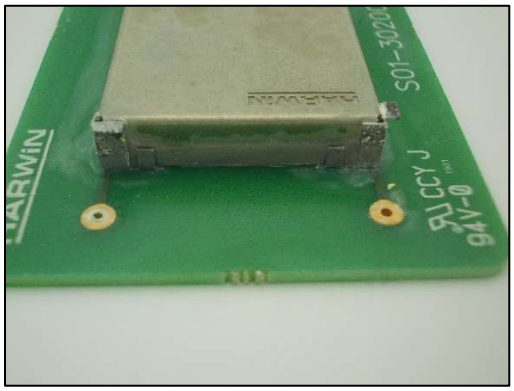
Samples in Salt Mist Chamber



Samples being washed



Samples after washing



Samples after washing

3.9. Vibration to EIA-364-28D: 1999

Methodology: One of each assembled test board were placed onto a shaker table and subjected to a sine vibration test, performed in accordance with BS EN 60068-2-6:2008 Test Fc and EIA-364-28D Test Condition 4, using the following conditions:

- Vertical sine sweep investigation only: 10Hz to 2000Hz with increasing incremental acceleration steps of: 10g, 15g, 20g, 23g, 26g, 29g, 32g, 35g, 38g & 40g.
- If discontinuity was noted at any particular acceleration, a dwell of 4 hours at -5g of that set-point was performed.
- If at 40g no discontinuity was noted, a sine sweep at 40g for a duration of 4 hours per axis was performed.

The following profiles were then applied for the sine endurance vibration on all samples, on completion of the investigational sweeps:

- 10 Hz to 2,000 Hz and return to 10 Hz traversed in 20 minutes.
- This cycle performed 12 times in each of three mutually perpendicular directions (total of 36 times).

Results and Test Pictures from Endurance Vibration:

Test boards (a) and (b) – S9011-46R with 4 clips, two different size Cans:
Following the exploratory sweep at an endurance level of 15g:

- 10-70Hz @ 1.52mm amplitude
- 70-2000Hz @ 15g

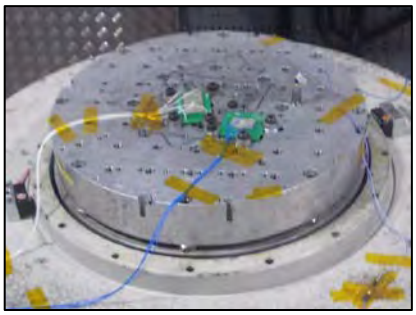
Test samples triggered multiple times during the 4 hour endurance tests in each axis. In some cases, the corner of the shield can lifted slightly from the clips, but never fully removed from the board.

Test boards (e) and (f) – S9021-46R with 4 clips, two different size Cans:
Following the exploratory sweep at an endurance level of 40g:

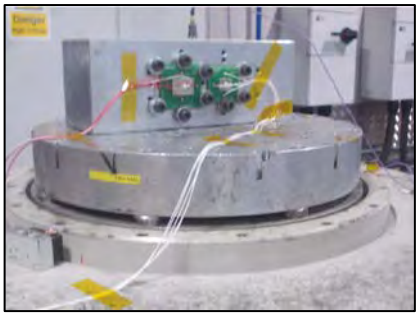
- 10-114.3 @ 1.52mm amplitude
- 114.3-2000Hz @ 40g

No discontinuities were noted during the 4hour endurance tests, in each axis.

Typical Test Setup:



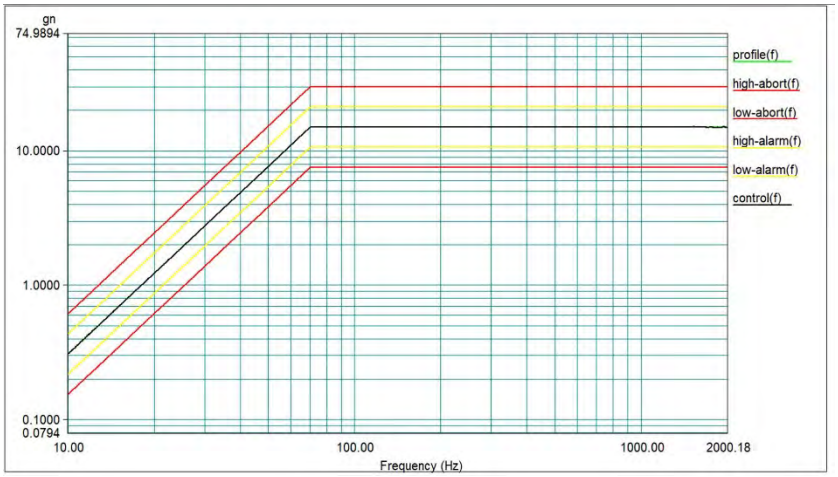
Typical test setup vertical



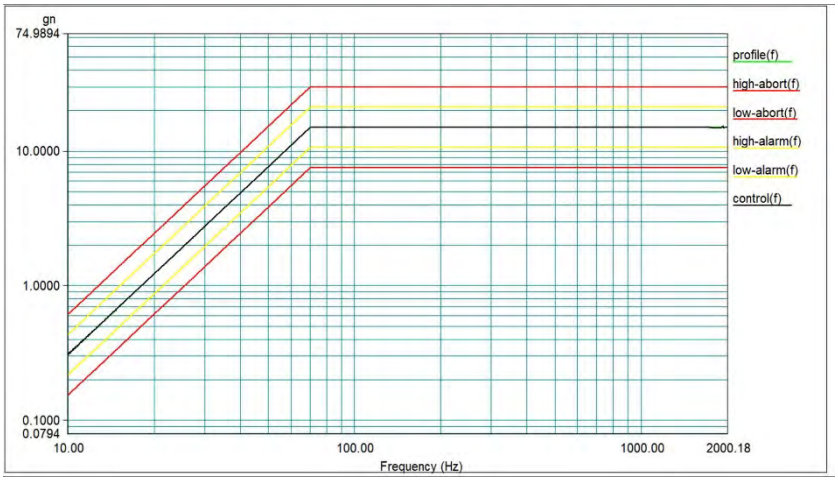
Typical test setup transverse

Typical test setup

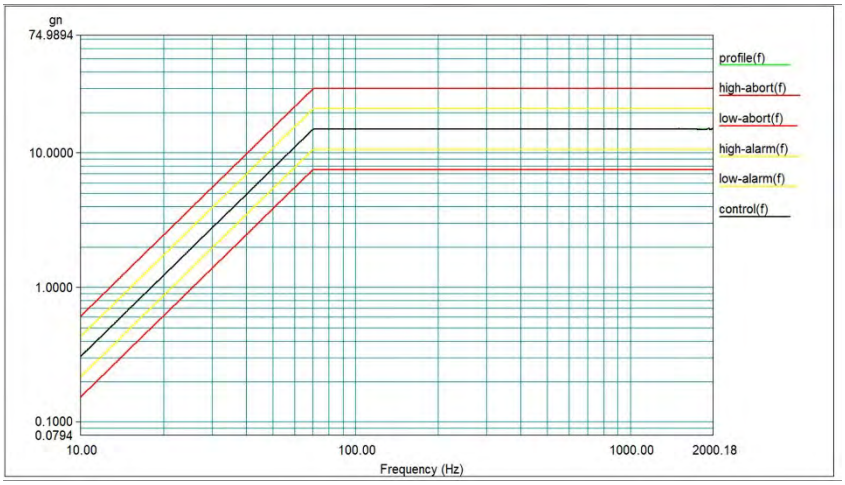
Vertical Axis – S0911-46R, 4 clip configuration



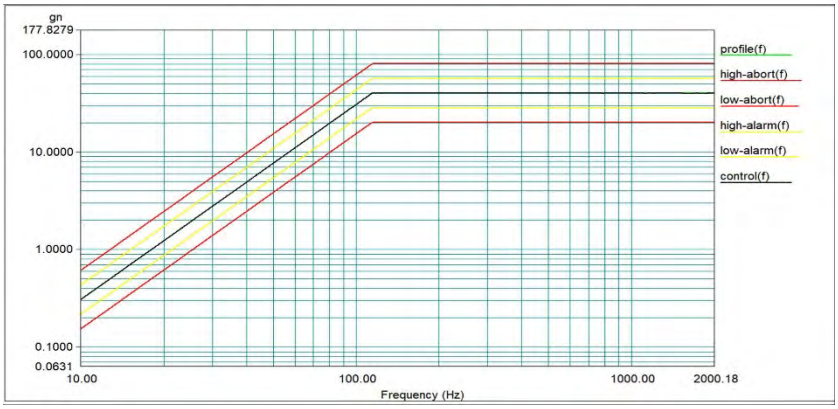
Transverse Axis – S0911-46R, 4 clip configuration



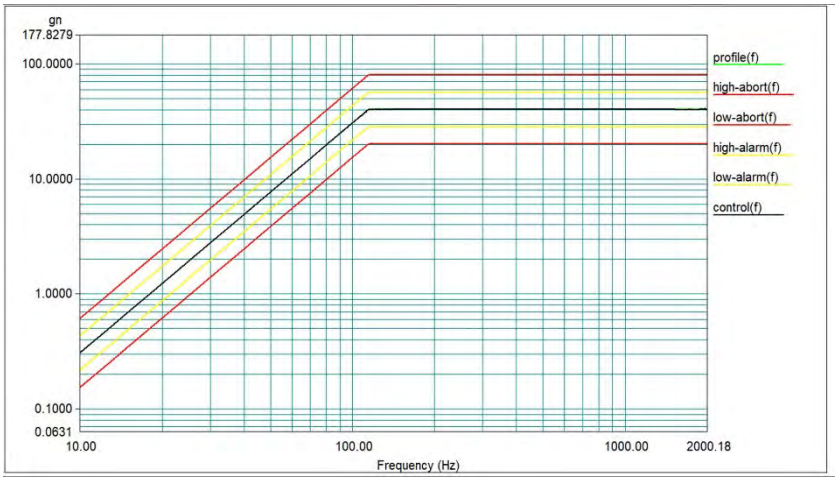
Longitudinal Axis – S0911-46R, 4 clip configuration



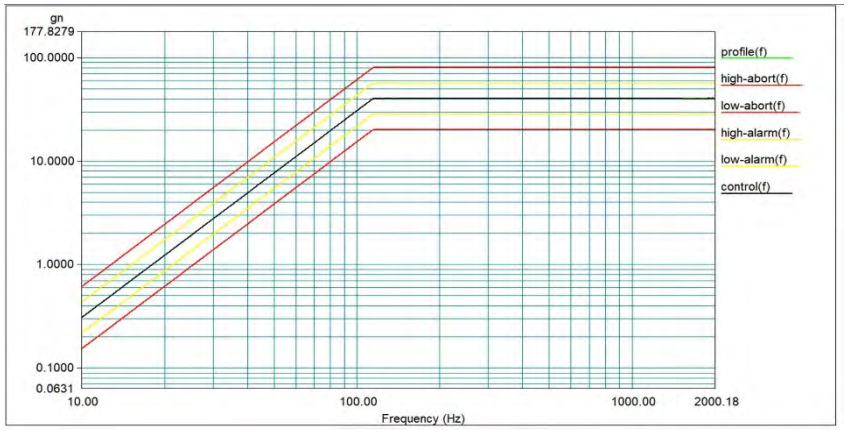
Vertical Axis – S0921-46R, 4 clip configuration

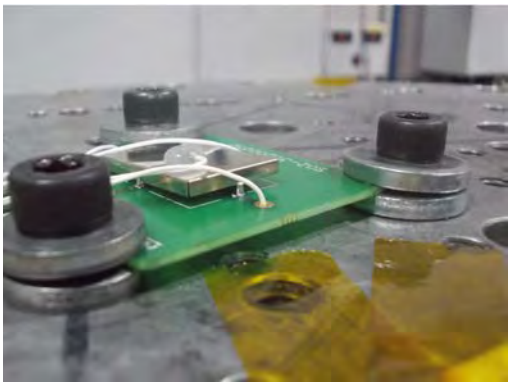


Transverse Axis – S0921-46R, 4 clip configuration



Longitudinal Axis – S0921-46R, 4 clip configuration





Example of lifted shield can post vibration testing

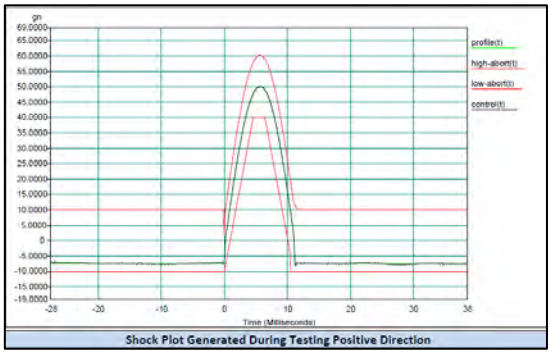
3.10. Shock to EIA-364-27B:1996

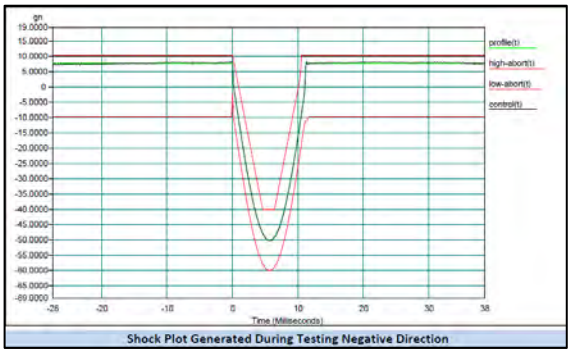
Methodology: The samples were placed onto the shaker and subjected to a Shock Test performed in accordance with BS EN 60068-2-27:2009 Test Ea and EIA-364-27B test conditions A & C, using the following conditions:

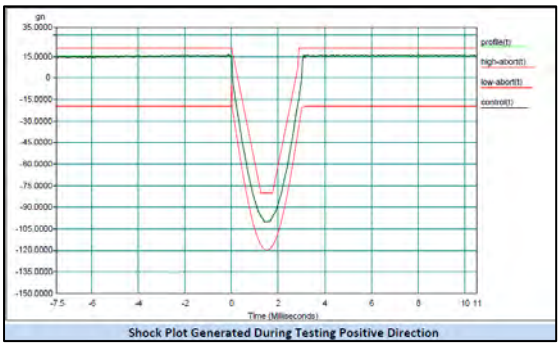
- Acceleration 50g, Shock duration 11ms, Shock shape Half sine pulse, 3 shocks in each case, vertical axis only, monitor for discontinuity throughout testing to 1 microsecond.
- Acceleration 100g, Shock duration 3ms, Shock shape half sine pulse, 3 shocks in each case, vertical axis only, monitor for discontinuity throughout testing to 1 microsecond.

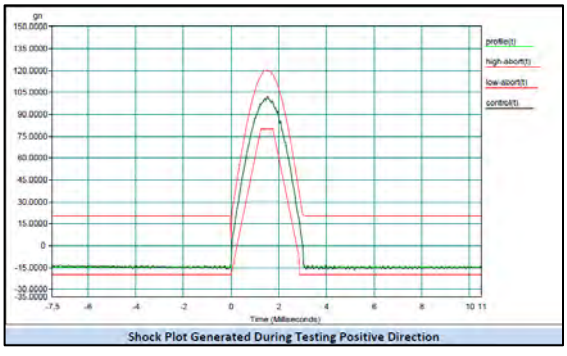
Results and Test Photos:

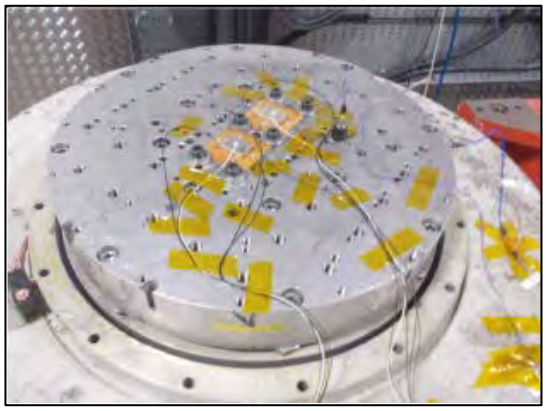
- **Test Boards (e), (f), (b) and (c) – S0921-46R, and S0911-46R with the smaller Shield Can (4 and 6 clips):**
  No discontinuities were noted during the 50gn and 100gn tests.
- **Test Boards (a) and (d) – S0911-46R with the larger Shield Can (4 and 6 clips)**
  No discontinuities were noted during the 50gn test. Discontinuities were noted during the 100gn tests. Shield cans had lifted slightly, but never fully removed from clips.









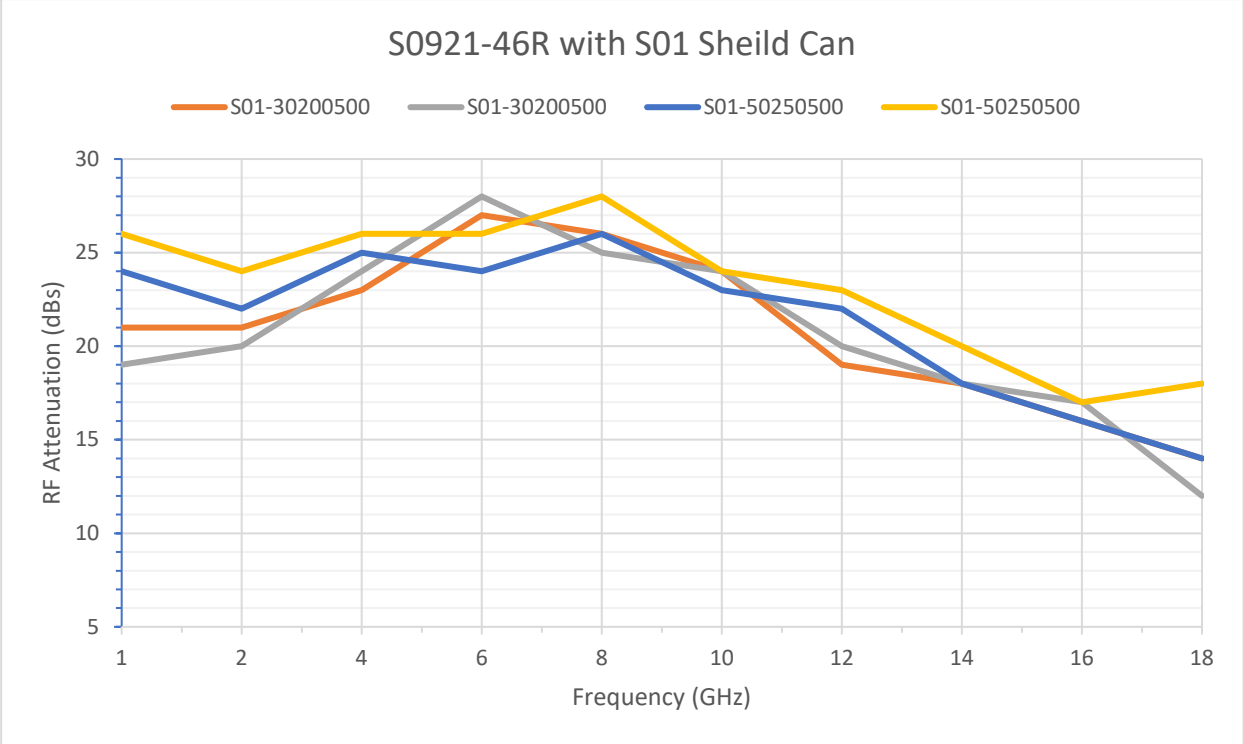


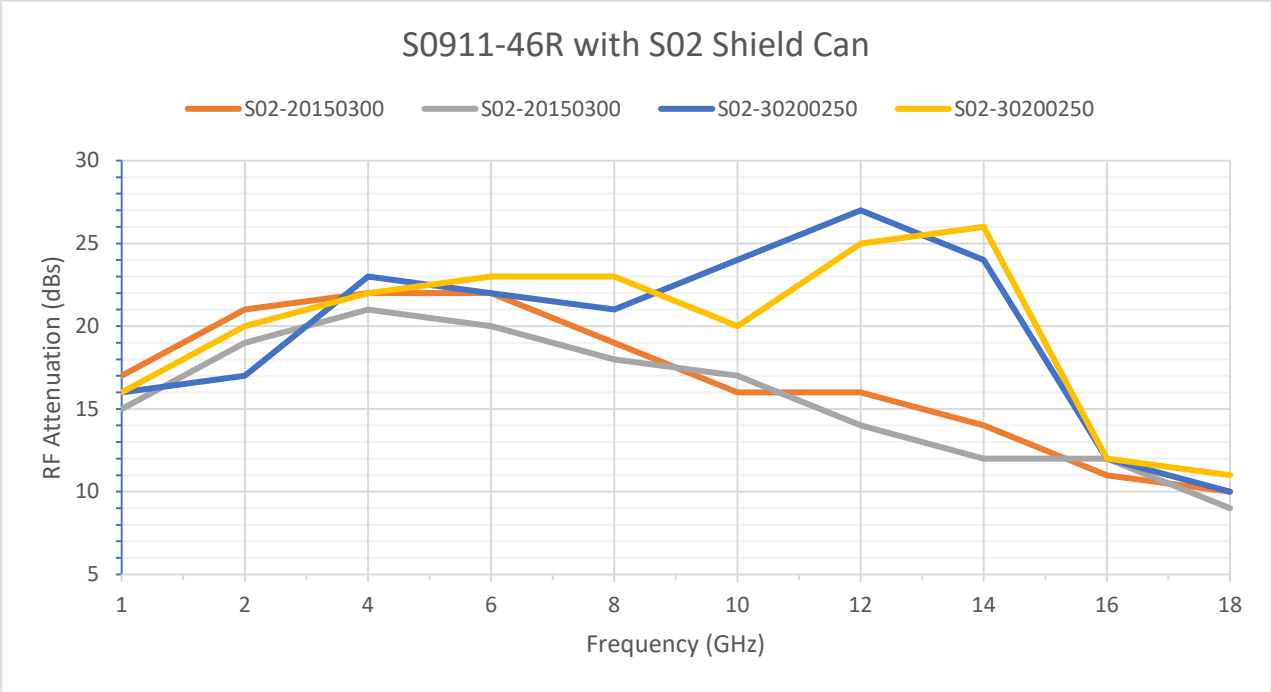
Typical Test Setup Vertical Axis

3.11. RF Attenuation to MIL STD 285

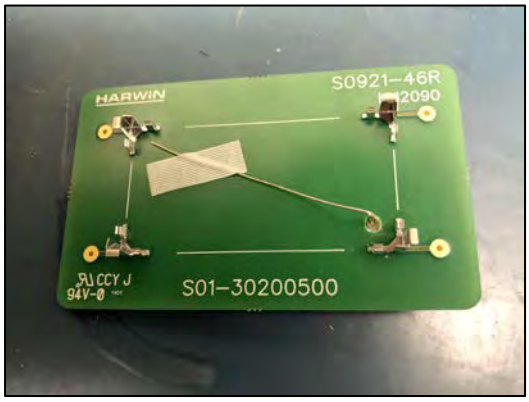
Methodology: Measurements were made in general accordance with MIL STD 285. Each test sample in turn was mounted (without the shield can fitted) on a fixed jig within a screened test chamber and a stepped measurement made between 1GHz and 18GHz. This test was subsequently repeated with the shield can fitted (without any other changes in the test system) the difference in levels recorded between the two runs is the RF Attenuation offered by the shield can and this is directly expressed in dBs in the results presented below.

Results and Test Photos:





RF Attenuation Test Setup



RF Attenuation Test Board (Calibration Configuration)

RF Attenuation Test Board (Measurement Configuration)