TB-2166

Summary Report:
Amphenol TCS Airmax VS® Connector Inter-mating with FCI Airmax VS ® Connector
Qualification to Telcordia Specification GR-1217-CORE, "Generic Requirements for Separable Electrical Connectors Used in Telecommunications Hardware"

Revision "A"

Specification Revision Status

Revision	SCR No.	Description	Initial	Date
"-"	S0550	New Release	KDL	4/30/07
"A"	S0802	Updated Copyright Information	C.Palmer	2/25/08

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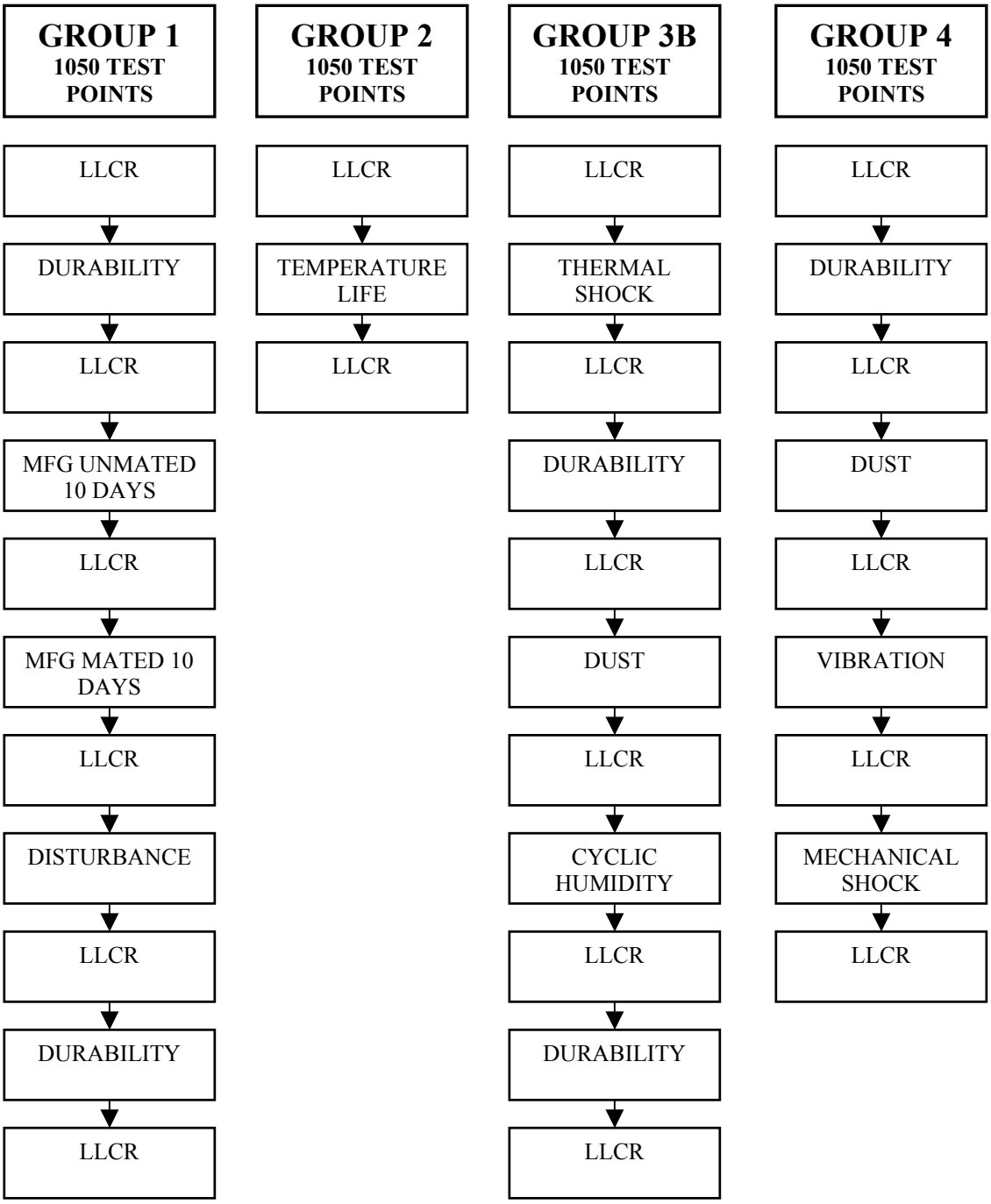
The Airmax VS ® separable electrical connector was submitted for qualification testing to Telcordia specification GR-1217-CORE. The intent of the qualification was to simulate, through accelerated life testing, the extreme worst-case environmental and mechanical conditions a connector will encounter over a 20-year field service life.

The Airmax VS® connector was submitted to the Telcordia central office controlled environmental test conditions in September of 2006 per the following test plan and as outlined in FCI specification GS-12-239.



Test Results:

The results of the tests concluded the Amphenol-tcs Airmax VS® connector system experienced zero failures in accelerated life testing of a 20-year life expectancy on 1050 data points through each of the 4 separate test groups.

Test Groups:

Test group 1 – Mixed Flowing Gases:

Test group 1 is a sequence of accelerated life tests designed to evaluate separable interface under simulated worst-case environmental conditions the connector would be exposed to during a twenty year field life period.

The failure mechanism for the test is a change in mating interface low level contact resistance (LLCR) of > 10mΩ.

450 mating interface points (150 points per connector sample) were subjected to the test with no points exceeding the 10mΩ specification, resulting in no failures recorded. The table is the final LLCR readings after the completion of group 1 testing. Data is change from initial to final readings.

Change in LLCR mΩ

Amphenol Header – FCI Receptacle

	Durability 99X		10 Days Unmated		20 Days Mated		Disturbance 0.004"		Durability 99X	
	Avg.	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**
	-0.4	+5.7	-0.3	+6.1	-0.3	+5.9	-0.2	+6.0	-0.3	+5.7
# Data Points	450	450	450	450	450	450	450	450	450	450

Change in LLCR mΩ

FCI Header – Amphenol Receptacle

	Durability 99X		10 Days Unmated		20 Days Mated		Disturbance 0.004"		Durability 99X	
	Avg.	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**
	-0.3	+5.7	+0.9	+6.8	+2.7	+15.4	+3.8	+147.1*	+0.4	+7.0
# Data Points	450	450	450	450	450	450	450	450	450	450

* Contact damage external to the test assignable cause of readings.

Group 1 Mating / Un-mating Forces (Newtons) Amphenol Header – FCI Receptacle			
Mating Force		**Un-Mating Force**	
Req. (MAX)	**Actual**	**Req. (Min)**	**Actual**
67.5	45.2	15.0	31.1

Group 1 Mating / Un-mating Forces (Newtons) FCI Header – Amphenol Receptacle			
Mating Force		**Un-Mating Force**	
Req. (MAX)	**Actual**	**Req. (Min)**	**Actual**
67.5	48.6	15.0	39.4

Test group 2 – Temperature Life:
Test group 2 is a sequence of accelerated life tests designed to evaluate separable interface under simulated worst-case material stress relaxation conditions the connector would be exposed to during a twenty year field life period.
The failure mechanism for the test is a change in mating interface low level contact resistance (LLCR) of > 10mΩ.
450 mating interface points (150 points per connector sample) were subjected to the test with no points exceeding the 10mΩ specification, resulting in no failures recorded. The table is the final LLCR readings after the completion of group 2 testing. Data is change from initial to final readings.

Change in LLCR mΩ **Amphenol Header – FCI Receptacle**		
	Avg.	**Max.**
	-0.4	+6.6
# Data Points	450	450

Change in LLCR mΩ **FCI Header – Amphenol Receptacle**		
	Avg.	**Max.**
	-0.2	+3.7
# Data Points	450	450

Test group 3B – Thermal Shock, Temperature, and Humidity:
Test group 2 is a sequence of accelerated life tests designed to evaluate separable interface under simulated worst-case temperature and humidity conditions the connector would be exposed to during a twenty year field life period.
The failure mechanism for the test is a change in mating interface low level contact resistance (LLCR) of > 10mΩ.
450 mating interface points (150 points per connector sample) were subjected to the test with no points exceeding the 10mΩ specification, resulting in no failures recorded. The table is the final LLCR readings after the completion of group 3B testing. Data is change from initial to final readings.

Change in LLCR mΩ **Amphenol Header – FCI Receptacle**										
	Thermal Shock		**Durability 99X**		**Dust**		**Humidity**		**Durability 99X**	
	Avg.	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**
	+0.0	+3.2	-0.4	+1.6	-0.2	+7.3	-0.4	+6.8	-0.8	+2.1
# Data Points	450	450	450	450	450	450	450	450	450	450

Change in LLCR mΩ **FCI Header – Amphenol Receptacle**										
	Thermal Shock		**Durability 99X**		**Dust**		**Humidity**		**Durability 99X**	
	Avg.	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**
	+0.1	+1.9	+0.1	+2.4	+0.2	+2.8	-0.2	+3.3	-0.3	+2.7
# Data Points	450	450	450	450	450	450	450	450	450	450

Group 3B Mating / Un-mating Forces (Newtons) Amphenol Header – FCI Receptacle			
Mating Force		**Un-Mating Force**	
Req. (MAX)	**Actual**	**Req. (Min)**	**Actual**
67.5	45.3	15.0	28.1

Group 3B Mating / Un-mating Forces (Newtons) FCI Header – Amphenol Receptacle			
Mating Force		**Un-Mating Force**	
Req. (MAX)	**Actual**	**Req. (Min)**	**Actual**
67.5	50.0	15.0	37.4

Test group 4 – Dust, Vibration, and Mechanical Shock:
Test group 2 is a sequence of accelerated life tests designed to evaluate separable interface under simulated worst-case dust, vibration, and shock conditions the connector would be exposed to during a twenty year field life period.
The failure mechanism for the test is a change in mating interface low level contact resistance (LLCR) of > 10mΩ.
450 mating interface points (150 points per connector sample) were subjected to the test with no points exceeding the 10mΩ specification, resulting in no failures recorded. The table is the final LLCR readings after the completion of group 4 testing. Data is change from initial to final readings.

Dust and Vibration

Change in LLCR mΩ **Amphenol Header – FCI Receptacle**						
	Durability 99X		**Dust**		**Vibration**	
	Avg.	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**
	-0.4	+2.9	-0.2	+7.5	-0.4	+6.3
# Data Points	450	450	450	450	450	450

Change in LLCR mΩ **FCI Header – Amphenol Receptacle**						
	Durability 99X		**Dust**		**Vibration**	
	Avg.	**Max.**	**Avg.**	**Max.**	**Avg.**	**Max.**
	-0.2	+0.8	-0.2	+7.3	-0.4	+5.7
# Data Points	450	450	450	450	450	450

Mechanical Shock – 3 Axis

Change in LLCR mΩ Amphenol Header – FCI Receptacle						
	Shock Axis #1		Shock Axis #2		Shock Axis #3	
	Avg.	Max.	Avg.	Max.	Avg.	Max.
	-0.6	+7.0	-0.6	+7.1	-0.6	+7.1
# Data Points	450	450	450	450	450	450

Change in LLCR mΩ FCI Header – Amphenol Receptacle						
	Shock Axis #1		Shock Axis #2		Shock Axis #3	
	Avg.	Max.	Avg.	Max.	Avg.	Max.
	-0.3	+5.7	-0.3	+6.7	-0.3	+6.7
# Data Points	450	450	450	450	450	450

Group 4 Mating / Un-mating Forces (Newtons) Amphenol Header – FCI Receptacle			
Mating Force		Un-Mating Force	
Req. (MAX)	Actual	Req. (Min)	Actual
67.5	48.7	15.0	28.6

Group 4 Mating / Un-mating Forces (Newtons) FCI Header – Amphenol Receptacle			
Mating Force		Un-Mating Force	
Req. (MAX)	Actual	Req. (Min)	Actual
67.5	53.5	15.0	35.6

Test Descriptions

The following section describes the tests conditions and requirements for the outlined in Telcordia GR-1217-CORE.

LLCR:

The test requires the plug and receptacle to be mounted onto test boards that allow a four-wire measurement to the backplane and daughtercard module mating interface through the test PWB.

Test Method – EIA 364 TP-23A
The measurement energy shall be restricted to no more than 20 mV and 100 mA.

Requirements – GR-1217-CORE, Section 6.2.1 Low Level Contact Resistance (LLCR)
The change in LLCR shall not exceed 10 mΩ.

Durability:

Plug and receptacle connectors are to be mounted onto test boards allowing for systematic mating and un-mating of cards to simulate normal usage in the field.

Test Method – EIA 364 TP-09A
The number of cycles in each durability test shall be 99 cycles.

Requirements – GR-1217-CORE, Section 9.1.1
The change in LLCR shall not exceed 10 mΩ.

Mixed Flowing Gases:

Modules mounted to the four-wire test boards shall be exposed to 10 days of MFG in the unmated condition and 10 days in the mated condition to evaluate the risk to the significant number of telecommunications connectors, including backplane contacts, which can be unmated for some years prior to being put into service.

Test Method – The recommended MFG procedure, gas analysis procedure, and monitoring procedure is defined in the ASTM B827-92 and ASTM B810-91. The test temperature shall be 30°C and relative humidity 70%. The LLCR is measured initially and every 5 days during the test sequence. Samples shall be stabilized at room temperature for at least 1 hour before the final observations and measurements are made.

Requirements – GR-1217-CORE, Section 9.1.3
The change in LLCR shall not exceed 10 mΩ.

The four-gas mixture for the MFG test is as follows:

Gas	Concentration
NO_2	200 ppb
Cl_2	10 ppb
H_2S	10 ppb
SO_2	100 ppb

Temperature Life:
Mated plug and receptacle modules shall be elevated to and exposed to 85°C for a minimum of 500 hours.

Test Method – EIA 364 TP-17A

Requirements – GR-1217-CORE, Section 6.3.2
The change in LLCR shall not exceed 10 mΩ.

Vibration, Random:
The test requires the plug and receptacle to be mounted onto test boards that allow a four-wire measurement to the backplane and daughtercard module mating interface through the test PWB.
Test Method – EIA 364 TP-28A
The measurement energy shall be restricted to no more than 20 mV and 100 mA.

Requirements – GR-1217-CORE, Section 9.1.2.1
The change in LLCR shall not exceed 10 mΩ.

Mechanical Shock:
Plug and receptacle connectors are to be mounted onto test boards and subjected to three shocks in each direction along each of the three mutually perpendicular axes of the sample. The total number of shocks shall be 18. LLCR readings are taken after each shock.

Test Method – EIA 364 TP-27 test condition 1, 30g, saw tooth excitation.

Requirements – GR-1217-CORE, Section 9.1.2.1
The change in LLCR shall not exceed 10 mΩ.

Thermal Shock:
Plug and receptacle connectors are to be mounted onto test boards and subjected to 100 thermal shock cycles from -55°C to + 85°C.

Test Method – EIA 364 TP-32 test condition 1.

Requirements – GR-1217-CORE, Section 6.3.3
The change in LLCR shall not exceed 10 mΩ.

Humidity and Temperature Cycling:
Plug and receptacle connectors are to be mounted onto test boards and subjected to 600 hours steady state 90 – 95% RH while temperature cycling from 25°C to + 65°C.

Test Method – EIA 364 TP-31.

Requirements – GR-1217-CORE, Section 6.3.4
The change in LLCR shall not exceed 10 mΩ.

Dust:
Plug and receptacle connectors are to be mounted onto test boards. In an unmated condition, the connector samples shall be exposed to dust, mated once, and LLCR reading shall be recorded.

Test Method – EIA 364 TP-50

Requirements – GR-1217-CORE, Section 9.1.1.1
The change in LLCR shall not exceed 10 mΩ.