Amphenol Aerospace (AAO) in Sidney, NY has decades of experience developing rugged board level products intended for military and aerospace applications. AAO teamed up with sister division Amphenol TCS to develop the VITA 46 R-VPX connector. The Amphenol Aerospace R-VPX connector meets or exceeds all of the requirements called out in VITA 46 and Telecordia GR-1217-CORE-i02 test specifications. Amphenol has also proven the R-VPX connector is fully intermateable and intermountable with TE Connectivity's Multigig RT2 and RT2-R connectors. This was achieved by: characterizing the TE Multigig VITA 46 connector during the initial development of Amphenol Aerospace's R-VPX connector; , full qualification testing of both the Amphenol Aerospace and TE connectors, with a focus on intermateability; and an expanded mating interface analysis of the TE connector after development of the Amphenol Aerospace connector.

Design and Construction of the VPX Connector

The anatomy of the VPX connector is made up of features, components, and materials that are well known in the connector industry. Manufacturing methods of the moldings, stamped-formed-plated parts, & FR4 wafers are all well established and adhere to tightly controlled processes and tolerances. In general, the connector is a combination of two card edge connectors (Figure 1 - #1 and #2) mating to either side of a small printed circuit board (Figure 1 - #3). The plated FR4 wafers contained in the module connector are held in place with a liquid crystal thermoplastic material (Figure 1 - #4) which is commonly used throughout the connector industry. There is a generous chamfered gathering/lead-in (Figure 1 - #5) which makes for a robust mating engagement for both Amphenol and TE connectors. The backplane contact is a cantilever beam and compliant tail termination, another common feature in backplane connectors (Figure 1 - #6).

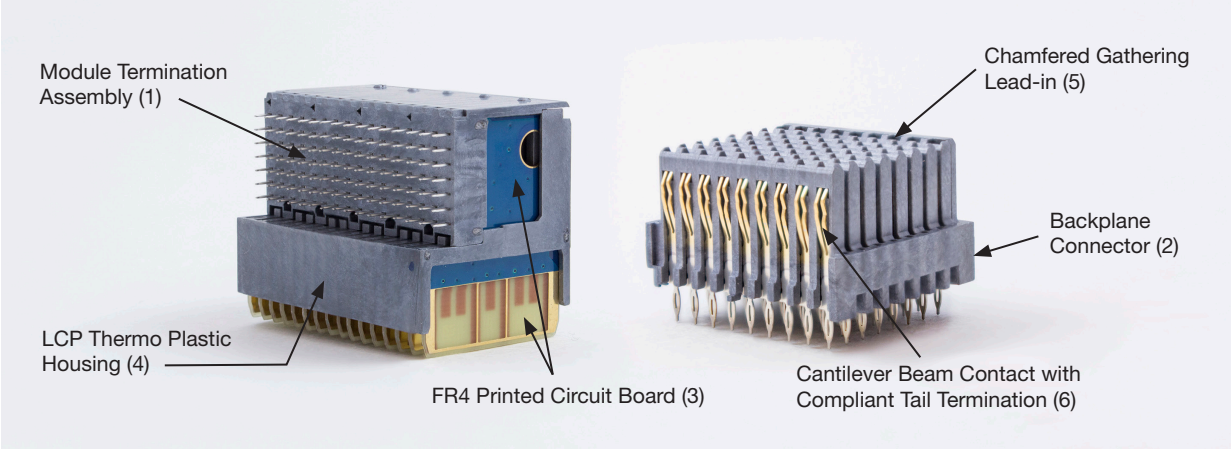

Figure 1

Amphenol's Initial Development of the R-VPX Connector

Amphenol Aerospace used the VITA 46 specification and TE's connector product drawings, which provided the size, shape, mated height, mounting, and termination descriptions, to develop the R-VPX connector. These resources provided a large percentage of the known connector design.

The main design variable was the characterization of the mating interface geometry. To understand this, Amphenol Aerospace performed in-house analysis via CT (Computerized Tomography) scanning, physical measurements, and other metrology methods. This data, along with our internal stack-up analyses and module contact/trace locations which based on our extensive knowledge of backplane contact patterns, provided a strong base for Amphenol Aerospace's intermateable and intermountable connector design.

Qualification of AAO, TE, and Intermated Pairs

Amphenol Aerospace's R-VPX connector passed connector qualification per the VITA 46 and Telecordia GR-1217-CORE-i02 test specifications. Testing was conducted by Contech Research of Rumford, RI. Amphenol Aerospace and TE connectors were intermated through relevant tests in both the VITA 46 and Telecordia GR-1217-CORE-i02 testing. In Tables 1 & 2 on page 3, intermated testing is denoted in the header "Group" boxes. "R-VPX" indicates the Amphenol Aerospace connector, "RT2" indicates the TE connector. See Appendix 1 for engineering summary report. More detailed reports can be provided upon request.

In Table 1 on page 3, connectors listed in the Group 1 through Group 4 boxes are:

- 3X R-VPX / R-VPX – AAO Backplane connector to AAO Module connector
- R-VPX / RT2 – AAO Backplane connector to TE Module connector
- RT2 / R-VPX – TE Backplane connector to AAO Module connector

In Table 2 on page 4, connectors listed in the Group A1, Group A2, Group B boxes are:

- R-VPX / R-VPX – AAO Backplane connector to AAO Module connector
- R-VPX / RT2 – AAO Backplane connector to TE Module connector
- RT2 / R-VPX – TE Backplane connector to AAO Module connector

Telecordia Testing per GR-1217-CORE-i02, Table 1

Group 1 3X R-VPX/R-VPX R-VPX/RT2* RT2/R-VPX*	**Group 2** 3X R-VPX/R-VPX R-VPX/RT2* RT2/R-VPX*	**Group 3** 3X R-VPX/R-VPX R-VPX/RT2* RT2/R-VPX*	**Group 4** 3X R-VPX/R-VPX R-VPX/RT2* RT2/R-VPX*	**Group 5** R-VPX/R-VPX	**Group 6** R-VPX/R-VPX
Visual Exam	Visual Exam	Visual Exam	Visual Exam	Visual Exam	Visual Exam
Mate/Unmate Force	Mate/Unmate Force	Separation Force	Pre-Condition 300 Hrs 105° C	Plating Thickness	Insertion Force 1st Pin
LLCR	LLCR	Mate/Unmate Force	Durability 100 Cycles	Plating Porosity	24 Hrs
Durability 100 Cycles	IR	LLCR	Mate/Unmate Force		Compliant Pin Interface Resistance (CPIR)
Mechanical Shock X, Y, Z	DWV	Temperature Life	LLCR		Push Out Force 1st Pin
LLCR X, Y, Z	LLCR	LLCR	Mixed Flowing Gas (MFG) Unmated		Insertion Force 2nd Pin
Dust	Thermal Shock	Mate/Unmate Force	5th Day LLCR 10th Day LLCR		Push our Force 2nd Pin
Vibration X, Y, Z	IR	Separation Force	MFG Mated		Insertion Force 3rd Pin
LLCR X, Y, Z	DWV	LLCR	15th Day LLCR 20th Day LLCR		CPIR
Durability 100 Cycles	Durability 250 Cycles		Durability 250 Cycles		Temperature Life 500 hrs 105°C
Mate/Unmate Force	LLCR		Disturbance		Push Out Force 3rd Pin
LLCR	Dust		LLCR		CPIR
	LLCR		Durability 100 Cycles		
	Humidity		LLCR		
	LLCR				
	IR				
	Mate/Unmate Force				
	DWV				

* Intermateability testing completed in subgroups 1, 2, 3, & 4

VITA 46 Testing, Table 2

Group A1 R-VPX/R-VPX R-VPX/RT2* RT2/R-VPX*	Group A2 R-VPX/R-VPX R-VPX/RT2* RT2/R-VPX*	Group B R-VPX/R-VPX	Group C R-VPX/R-VPX	Group D R-VPX/R-VPX	Group E R-VPX/R-VPX	Group F R-VPX/R-VPX	Group G R-VPX/R-VPX
Visual Exam	Visual Exam	Visual Exam	Visual Exam	Visual Exam	Visual Exam	Visual Exam	Visual Exam
LLCR	LLCR	LLCR	LLCR	LLCR	LLCR	ESD	LLCR
Safety Ground	Safety Ground	DWV	DWV	DWV	Safety Ground	LLCR	DWV
Sine Vibration	Sine Vibration	Safety Ground	Safety Ground	Safety Ground	Dust	DWV	Safety Ground
LLCR	LLCR	Bench Handling	Thermal Cycle with Humidity	Salt Fog W/ SO2	LLCR	Safety Ground	Current Overload
DWV	DWV	LLCR	LLCR	LLCR	DWV	Mate/Unmate Force	LLCR
Safety Ground	Safety Ground	DWV	DWV	DWV	Safety Ground	Durability	DWV
Mechanical Shock	Mechanical Shock	Safety Ground	Safety Ground	Safety Ground	Sand	Mate/Unmate Force	Safety Ground
LLCR	LLCR	Vibration at Temperature		Salt Fog W/ SO2	LLCR	LLCR	
DWV	DWV	LLCR		LLCR	DWV	DWV	
Safety Ground	Safety Ground	DWV		DWV	Safety Ground	Safety Ground	
Random Vibration	HALT Vibration	Safety Ground		Safety Ground		Durability	
LLCR	LLCR					Mate/Unmate Force	
DWV	DWV					LLCR	
Safety Ground	Safety Ground					DWV	
						Safety Ground	
						ESD	

* Intermateability testing completed in subgroups A1, A2, & B

Expanded Mating Interface Analysis

Amphenol Aerospace contracted with 3D Engineering Solutions of Cincinnati, Ohio after development of the R-VPX connector to verify intermateability with TE's connector. 3D Engineering Solutions have a well-known reputation in reverse engineering expertise and multiple scanning technologies. Extensive work was put into the accuracy, detail, and verification of scanning results of TE's connector.

In this study, key interface dimensions of the TE connector were measured via CT (Computerized Tomography) scanning to obtain the location and sizes of critical mating interface features. Samples (see Figure 2) scanned are as followed; 21 samples of TE P/N 1410140-1, 21 samples of TE P/N 1410187-3, 11 samples of TE P/N 14101189-3, and 11 samples of TE P/N 1410186-1. None of the data from the CT scanning, as well subsequent physical verification measurements, resulted in any interference, alignment, or mating issues. The scanning results displayed mating interfaces that were virtually identical between the Amphenol Aerospace R-VPX and the TE Multigig RT2 connectors.

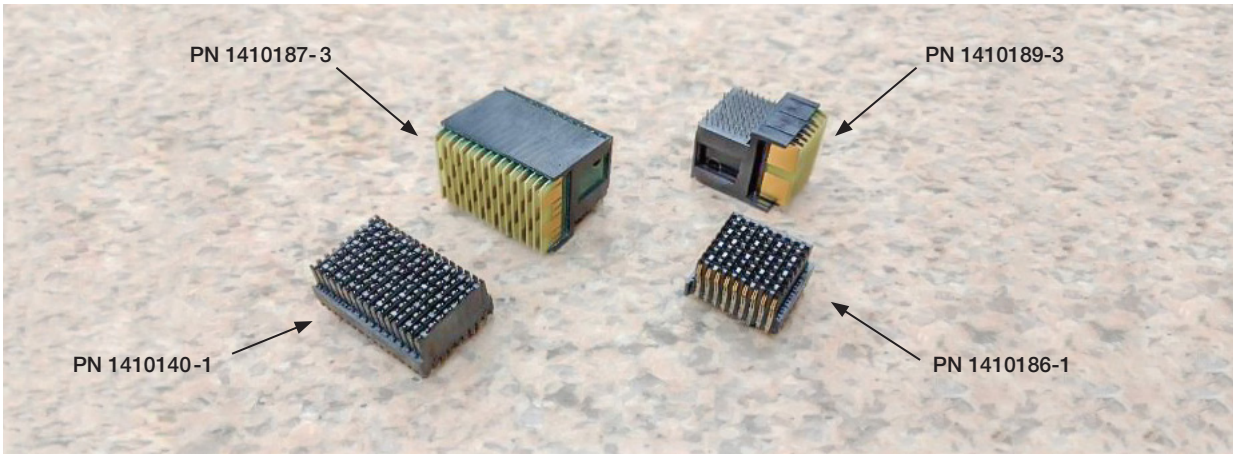

Figure 2