

**AMPSEAL 16 COAX Connector System**

A3	1P, Header Updates for Release to Market 4P Header Vibration Data Added	21SEP2021	DFS	JB
A2	1P, Cap Pin Assy, W2W Sealed Coaxial – Test details and test request number added.  4P, Cap Pin Assy, flange, Sealed COAX AS16 - Test request number added.	15SEP2021	HPS	JB
<b>Rev</b>	<b>Description</b>	<b>Date</b>	<b>Drawn</b>	<b>Approved</b>

**1. INTRODUCTION**

1.1. Purpose

Testing was performed on the TE Connectivity (TE) AMPSEAL 16 COAX connector series system to determine its conformance to the requirements of Product Specification 108-94799.

1.2. Scope

This report covers the mechanical, electrical, and environmental sealing performance of the AS16 COAX connector series system. The test file numbers, and test location can be found in Figure 3. This documentation is on file at, and available from the Global Automotive Division Product Reliability Center.

1.3. Conclusion

The COAX connector series listed in paragraph 1.4. conformed to the mechanical, electrical, and environmental sealing performance requirements given in Product Specification 108-94799.

1.4. Test Specimens

Test specimens were representative of normal production lots. Specimen part numbers listed in Figure 1 were used for test.

<b>PART NUMBER</b>	<b>DESCRIPTION</b>	<b>Status</b>
2355843-1	Plug Assy,1P, W2W Sealed Coax, Key A	Available
2355843-2	Plug Assy,1P, W2W Sealed Coax, Key B	Not released for production/Not tested
2355843-3	Plug Assy,1P, W2W Sealed Coax, Key C	Not released for production/Not tested
2355843-4	Plug Assy,1P, W2W Sealed Coax, Key D	Not released for production/Not tested
2355844-1	1P Pin Dia 2.5, HDR Assy, 180DEG AS16 Coax, Key A	Available
2355844-2	1P Pin Dia 2.5, HDR Assy, 180DEG AS16 Coax, Key B	Not released for production/Not tested
2355844-3	1P Pin Dia 2.5, HDR Assy, 180DEG AS16 Coax, Key C	Not released for production/Not tested
2355844-4	1P Pin Dia 2.5, HDR Assy, 180DEG AS16 Coax, Key D	Not released for production/Not tested
2338212-1	Plug Socket Assy, 4P, W2W, Sealed Coax, Key A	Available
2338212-2	Plug Socket Assy, 4P, W2W, Sealed Coax, Key B	Not released for production/Not tested
2338212-3	Plug Socket Assy, 4P, W2W, Sealed Coax, Key C	Not released for production/Not tested
2338212-4	Plug Socket Assy, 4P, W2W, Sealed Coax, Key D	Not released for production/Not tested
2338211-1	Cap Pin Assy,4P, W2W, Sealed Coax, Key A	Available
2338211-2	Cap Pin Assy,4P, W2W, Sealed Coax, Key B	Not released for production/Not tested
2338211-3	Cap Pin Assy,4P, W2W, Sealed Coax, Key C	Not released for production/Not tested
2338211-4	Cap Pin Assy,4P, W2W, Sealed Coax, Key D	Not released for production/Not tested
2356408-1	4P Vertical Coax Header Assy, Key A	Available
2356408-2	4P Vertical Coax Header Assy, Key B	Not released for production/Not tested
2356408-3	4P Vertical Coax Header Assy, Key C	Not released for production/Not tested
2356408-4	4P Vertical Coax Header Assy, Key D	Not released for production/Not tested
2298488	MATE-AX 180DEG Socket Contact. Assy Cable RTK031	Available

2298490	MATE-AX 180DEG Pin Contact. Assy Cable RTK031	Available
2298510	MATE-AX 180DEG Socket Contact, Assy Cable RG174	Available
2298511	MATE-AX 180DEG Pin Cont. Assy Cable RG174	Available
2356413-2	Coax Pin Assembly, Short AS16 Coax	Available
2374559-1	Cap Pin Assy, 1P, W2W Sealed Coaxial, Key A	Available
2374559-2	Cap Pin Assy, 1P, W2W Sealed Coaxial, Key B	Not released for production
2374559-3	Cap Pin Assy, 1P, W2W Sealed Coaxial, Key C	Not released for production
2374559-4	Cap Pin Assy, 1P, W2W Sealed Coaxial, Key D	Not released for production
2339729-1	Cap Pin Assy, 4P, flange, Sealed COAX AS16, Key A	Available
2339729-2	Cap Pin Assy, 4P, flange, Sealed COAX AS16, Key B	Not Released for Production
2339729-3	Cap Pin Assy, 4P, flange, Sealed COAX AS16, Key C	Not Released for Production
2339729-4	Cap Pin Assy, 4P, flange, Sealed COAX AS16, Key D	Not Released for Production

**Figure 1. Test Specimen Part Numbers and Description**

1.5. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15° to 35°C

Relative humidity (RH): 25 to 75%

1.6. Qualification Test Sequences

TEST OR EXAMINATION	Test Group (a)																	
	1(d)	2	3	4	5	6	7	8(d)(f)	9	10	11	12	13	14	15	16	17	18
	Test Sequence (b)																	
Visual inspection	1, 10(c)	1,4	1,7	1, 3(c)	1,3	1,3	1,5	1,7	1,3	1,3	1,7	1,7	1,7	1,6	1,3	1,3	1,3	1,3
Mating Force and Un-mating Force		3																
Terminal Insertion/Forward Stop					2						2,5							
TPA engagement Pre-Set to Lock w/ terminals				2								2,5						
Vibration	7																	
Insulation resistance			2,4,6															
Low Signal Termination Resistance	2,5,8																	
Voltage drop – SAEJ2030	3,6,9																	
Maximum Test Current Capability						2												
Water Immersion ISO 20653 IPX7			3											2,5				
Thermal Shock	4	2																
Dust Test ISO 20653 IP6KX			5															
GMSL2 Channel Test: Insertion Loss							2											
GMSL2 Channel Test: Insertion Loss to Return Loss Ratio (IRR)							3											
RF Channel Cross Talk							4											
Connector Cycling								2										
Dry Circuit Resistance								3,5										
Vibration/Mechanical Shock								4(e)										
Circuit Continuity Monitoring								4(e)										
Voltage Drop - USCAR2								6										
Header Terminal Solderability									2									
Header Terminal Wave Solderability										2								
Connector Mating & Un-mating Force (g)													2,5					
Connector Retention Force(g)													3,6					
Terminal Retention(g)											3,6							
TPA disengagement Lock to Pre-Set w/ terminals(g)												3,6						
Polarization Feature Effectiveness(g)															2			
Connector Drop Test(g)																2		
Cavity Damage Susceptibility(g)																	2	
Mounting Feature Strength(g)																		2
Dry Heat (LV214 B.19.3 105° for 120hrs) (g)											4	4	4	3				
Temperature shock (LV 214 B 19.1) (g)														4				

- (a) Sample quantities for each group further described in 108-94799.
- (b) Numbers indicate sequence in which tests were performed.
- (c) Final visual inspection of cap assemblies failed due to testing performed outside of this sequence.
- (d) Test specimens divided into two groups. The first group is used to measure low signal termination resistance. The second group is used to measure voltage drop and continuity monitoring.
- (e) Circuit Continuity Monitoring is performed during [simultaneously with] the scheduled conditioning per the Test Sequence step number.
- (f) Test results pending completion; refer to Figure 3 for detail regarding tested samples and quantities.
- (g) Tests only specific for 1P Coax Cap Pin Assy connector

**Figure 2. Test Sequences**

## **2. SUMMARY OF TESTING**

### **2.1. Visual inspection**

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance (C of C) was issued by Quality Engineering. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

### **2.2. Connector-connector mating force**

For connectors without mechanical assist, test the maximum required force to mate the Plug and Cap/Header pair and engage the latching mechanism. The force is not to exceed 135 N.

### **2.3. Connector-connector un-mating force.**

For connectors without mechanical assist, test the maximum force required to separate the Plug and Cap/Header with the latch mechanism fully disengaged. The force is not to exceed 135 N.

### **2.4. Terminal insertion/Forward stop**

All terminal-connector insertion measurements were less than 50 N for a single terminal. No terminals pushed through the connector housing when 50N was applied.

### **2.5. TPA Engagement Force Pre-Set to lock w/ terminals**

All force measurements to engage the TPA were below 60N. Refer to the AS16 COAX Application Specification for details regarding how to properly service the TPAs.

### **2.6. Insulation resistance**

All insulation resistance measurements were greater than 100 megaohms at 500 volts direct current.

Using a 500 V DC insulation resistance test measurement device or equivalent, check insulation resistance between each contact to each adjacent contact or housing edge. If the housing edge is plastic, then a metal foil may be applied around it, to create a grounding surface for the tester return. The insulation resistance shall be greater than 100 megohms.

### **2.7. Low Signal Termination Resistance**

All low signal termination resistance measurements were less than 15 milliohms after subtracting the bulk resistance of equal wire length. The test specimens were subjected to a 20 millivolt maximum open circuit voltage and current not exceeding 100 milliamperes.

### **2.8. Voltage Drop – SAEJ2030**

All voltage drop measurements were less than 100 millivolts for a maximum of 3A test current was applied depending on the cable. Averaged measurements done after 30 seconds, 15 minutes and 30 minutes of current being applied. The equivalent wire length was subtracted out of the reported data.

Wire	Test current	Voltage Drop
RG 174	1A	100 mV
RTK-031	3A	100 mV

2.9. Maximum Test Current Capability

Samples were energized at a current level and allowed to maintain thermal stability. Thermal stabilization is achieved when temperature rise of 3 consecutive readings taken at 5-minute intervals differ at most by 1 degree Celsius. Once the test sample is considered stable at that current level, the current is increased to the next level. This was repeated until a 45 -degree Celsius T-Rise was reached.

2.10. Impedance

Impedance within 50±10 ohm for t rise = 35ps have been recorded in all positions when alternating current was applied through a mated connector. Initial operation requirement is 6 GHz.

2.11. Crosstalk

Refer to 108-94515 Section 4.2.7 for RF performance requirements.

Refer to 109-18379 Section 7.3.3 for information regarding the test procedure.

2.12. Insertion Loss

Refer to 108-94515 Section 4.2.7 for RF performance requirements.

Refer to 109-18379 Section 7.3.3 for information regarding the test procedure.

2.13. Return Loss

Refer to 108-94515 Section 4.2.7 for RF performance requirements.

Refer to 109-18379 Section 7.3.3 for information regarding the test procedure.

2.14. GMSL2 Channel Test: Insertion Loss

Channel consisting of three 5m segments meets GMSL2 standard between 10MHz and 3.5GHz.

2.15. GMSL2 Channel Test: Insertion Loss to Return Loss Ratio (IRR)

Channel consisting of three 5m segments meets GMSL2 standard between 10MHz and 3.5GHz.

2.16. RF Channel Cross Talk

2.17. Water Immersion IPX7

No evidence of leakage or water ingress was detected as a result of submersion of mated connectors to a depth of 1.0 m for a duration 30 min. Water did not penetrate in a quantity causing harmful effects or impair performance when the enclosure was immersed in water temporarily under specified pressure and time conditions

2.18. Dust test IP6KX

Test dust A2 (Arizona dust) according to ISO 12103-1 was used. There was no evidence for dust penetration when tested as per ISO 20653.

2.19. Thermal shock

The cabled-mated connector was subjected to 10 cycles of thermal shock with no evidence of cracking, chipping, or other damage detrimental to the normal operation of the connector. One cycle consists of a soak time at -40 °C ambient, then a transition within 2 min to an ambient of 105 °C, with a soak time there and then a transition back to -40 °C ambient within 2 min. The soak times were established as the time necessary to bring the internal connector temperature on test to within 5 °C of each of the ambient temperatures.

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- 2.20. Vibration  
Vibration test was performed according to USCAR-2 Class V2.
- 2.21. Header Terminal Solderability  
All specimens met the requirement of a minimum of 95% solder wetting of the critical area of solderability.
- 2.22. Header Terminal Wave Solderability  
After the resistance to wave soldering test, there was no visual evidence of melting, cracking, delamination, or other damage from the exposure to a soldering bath set to 265°C.
- 2.23. Connector-connector mating force(g)  
For connectors without mechanical assist, test the maximum required force to mate the Plug and Cap/Header pair and engage the latching mechanism. The force is not to exceed 135 N.
- 2.24. Connector-connector un-mating force(g).  
For connectors without mechanical assist, test the maximum force required to separate the Plug and Cap/Header with the latch mechanism fully disengaged. The force does not exceed 75 N.
- 2.25. Connector-connector retention force(g).  
For connectors without mechanical assist, test the maximum force required to separate the Plug and Cap/Header with the latch mechanism fully engaged. The force exceeds 110 N.
- 2.26. Terminal-connector retention force(g).  
Test the maximum force required to pull the terminal straight back from the connector at uniform rate of 50mm/min, until pullout occurs. The force exceeds 60 N before aging and exceeds 50 N after aging.
- 2.27. TPA dis-engagement Force lock to Pre-Set w/ terminals(g)  
All force measurements to dis-engage the TPA were below 60N. Refer to the AS16 COAX Application Specification for details regarding how to properly service the TPAs.
- 2.28. Polarization Feature Effectiveness(g)  
Connector halves engaged a rate not to exceed 50mm/min. until a force of 3X the maximum value of a properly mated connector is applied. Held force for 3 seconds. No electrical contact made between the male/female terminals.
- 2.29. Connector Drop Test(g)  
Connectors dropped as one sample at a time onto a horizontal concrete surface from a height of at least 1 meter, orienting the samples in six groups corresponding to the six connector "faces" of a rectangular connector. Parts were visually inspected, there were no evidence of deterioration, cracks, deformities, etc. that could affect their functionality. Sub-components were not displaced from their intended shipping position.
- 2.30. Cavity Damage Susceptibility(g)  
Terminals were partially inserted into cavity until it is just short of locking into position at uniform rate of 50mm/min. While holding the terminal in this position, TPA inserted with force(max force to insert TPA + 40N). TPA position was recorded. Removed the force and terminal seated in its normal position. Push the TPA to secondary lock position. TPA was not seated in its final position and terminal retention met the forces 50N Min.
- 2.31. Mounting Feature Strength(g)  
Connector secured with the designed-in mounting feature to a bracket with a fixture simulating the coordinating mounting feature. Forces applied in all six directions. The minimum force required to break the mounting feature or separate the connector from the mounting feature in direction F1 to F5 is > 50 N & F6 is >110 N.
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### 3. TEST SEQUENCE-TO-TEST NUMBER CROSS-REFERENCE

TEST NUMBER			
Test Group(a)	Test Request Number	Product Configuration	Test Group (In given report)
1	WE-20200496	4P Plug/Receptacle	4A, 4B
	WE-20200696	4P Plug/Header	4A, 4B
	WE-20210821		4A, 4B
2	WE-20200495	4P Plug/Receptacle	1, 2
	WE-20200698	4P Plug/Header	1, 2
	WE-20211129	1P Plug/Header	1
3	WE-20201075	4P Plug/Receptacle	6B, 6C
	WE-20210154	4P Plug/Header	1
	WE-20211035	1P Plug/Header	1
	WE-20210786	4P Bulkhead	10
	WE-20211183	1P Plug/Receptacle	1
4	WE-20200608	4P Plug/Receptacle	7
	WE-20200587	1P Plug	7
5	WE-20200608	4P Plug/Receptacle	8A, 8B, 8C, 8D
	WE-20200587	1P Plug	8A, 8B
6	WE-20200609	4P Plug/Receptacle	13A, 13B
	WE-20200695	4P Plug/Header	13A, 13B
	WE-20200588	Header Terminal	13C, 13D
	WE-20200588	1P Plug/Header	13A, 13B
7	WE-20210699	4P Plug/Header/Inline Cap	1
8	WE-20211051	1P Plug/Header	Pending Test Completion
	WE-20210784	4P Bulkhead	12
9	EA20200288T	Header Terminal	12B
10	EA20200288T	Header Terminal	12A
11	AOR20/0711	1P Cap Pin Assy	1
12	AOR21/0379	1P Cap Pin Assy	2
13	AOR21/0383	1P Cap Pin Assy	3
14	AOR21/0384	1P Cap Pin Assy	4
15	AOR21/0385	1P Cap Pin Assy	5
16	AOR21/0386	1P Cap Pin Assy	6
17	AOR21/0390	1P Cap Pin Assy	7
18	AOR21/0391	1P Cap Pin Assy	8

Figure 3. Test Number Cross-Reference