FAKRA-Compliant Next Generation Sealed Right Angle Connector

1. SCOPE

1.1. Contents

This specification covers performance, tests and quality requirements of TE FAKRA Next Generation sealed right angle connectors.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Sections 3.4, 3.5 and 3.6 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line has not yet been completed. The Product Validation Report will be provided upon request.

2. APPLICABLE DOCUMENTS AND FORMS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

2.1. TE Documents

- 114-162005: Application Specification

2.2. Industry Documents

- SAE/USCAR-2 Rev 6 Automotive testing specification
- SAE/USCAR-17 Rev 5 FAKRA testing specification
- SAE/USCAR-21 Rev 3 Performance Specification for Cable-to-Terminal Electrical Crimps

2.3. Reference Document

- N/A

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

3.2. Ratings

Voltage	Current	Temperature
800VAC	1 amp maximum	Connector: -40 to 125°C Max temp is cable dependent

3.3. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Visual Inspection	Meets requirements of product drawing and Application Specification	SAE/USCAR-2 Rev 6
Final examination of product	Meets visual requirements	SAE/USCAR-2 Rev 6
Crimp/Weld Integrity	Crimp heights meet application spec 114-162005	SAE/USCAR-21 Rev 3
ELECTRICAL		
Contact Resistance (CR)	24mΩ maximum for signal 5mΩ before / 6mΩ after environment maximum for ground contacts	SAE/USCAR-17 Rev 5
Circuit Continuity Monitoring	No loss of electrical continuity for > 1µs	SAE/USCAR-2 Rev 6
Dielectric Withstanding Voltage	≥800VAC	SAE/USCAR-17 Rev 5
Voltage Standing Wave Ratio (VSWR)	VSWR ≤ 1.40 0 to 2GHZ VSWR ≤ 1.50 2 to 3GHz VSWR ≤ 1.60 3 to 6GHz	SAE/USCAR-17 Rev 5
Insertion Loss (IL)	IL ≤ 0.3 0 to 3GHZ IL ≤ 0.45 3 to 6GHz	SAE/USCAR-17 Rev 5
Insulation Resistance	≥100MΩ	SAE/USCAR-17 Rev 5
RF Leakage	Leakage ≤ - 45dB 0 to 3GHZ Leakage ≤ - 40dB 3 to 6GHz	SAE/USCAR-17 Rev 5
Capacitance	≤ 6.0 pF for in-line connectors	SAE/USCAR-17 Rev 5
MECHANICAL		
Terminal Bend Resistance (Center Contacts)	No tear or crack at 3N	SAE/USCAR-2 Rev 6
Terminal to Connector Engage/Disengage	Engage w/o TPA ≤ 30N Disengage w/o TPA ≥ 45N Disengage w/ TPA ≥ 110N Disengage w/ TPA after conditioning ≥ 80N Disengage w/ TPA after vibration ≥ 70N Disengage w/ TPA after temp/humidity ≥ 70N Disengage w/ TPA after heat age ≥ 70N	SAE/USCAR-2 Rev 6
Connector to Connector Mating/Unmating	Mating force ≤ 25N (1 Position) Connector disengage with lock ≥ 110N Force to disengage lock ≥6N and ≤ 51N Unmating force with lock disengaged ≤ 75N	SAE/USCAR-2 Rev 6
Polarization Effectiveness	Force to achieve center contact continuity ≥ 80N	SAE/USCAR-2 Rev 6
TPA Forces	TPA engage force w/ Terminals: 15N ≤ X ≤ 60N TPA engage force w/o Terminals: ≥15N TPA disengage force: 15N ≤ X ≤ 60N TPA removal force: ≥ 25N	SAE/USCAR-2 Rev 6

CPA Forces	CPA locking force mated: ≤ 25N CPA unlocking force mated: 10N ≤ X ≤ 30N CPA closing force unmated: ≥ 80N CPA removal force: ≥ 60N	SAE/USCAR-2 Rev 6
Connector to Connector Audible Click	Information only	SAE/USCAR-17 Rev 5
Connector Drop Test	No physical damage	SAE/USCAR-2 Rev 6
Cavity Damage	TPA must not seat with an applied 60N force	SAE/USCAR-2 Rev 6
Mechanical Pull	75N Side load, 5 second hold, no loss of continuity IL and VSWR, before and after, see Electrical section	SAE/USCAR-17 Rev 5
Cable Resistance to Applied Torque	75% braid coverage in Ferrule crimp region, 45° angular displacement, min pull force (cable dependent)	SAE/USCAR-17 Rev 5
ENVIRONMENTAL		
Vibration/Mechanical Shock	No loss of electrical continuity VSWR/IL/CR check before and after	SAE/USCAR-2 Rev 6
Thermal Shock	No loss of electrical continuity VSWR/IL/CR check before and after	SAE/USCAR-17 Rev 5 Cycle from -40°C to Max, cable dependent
Temperature/Humidity Cycling	VSWR/IL/CR check before and after	SAE/USCAR-2 Rev 6 Cycle from -40°C to +85°C
High Temperature Exposure	VSWR/IL/CR check before and after	SAE/USCAR-2 Rev 6 Max temperature is cable dependent
SEALING		
Fluid Resistance	Meets visual requirements	SAE/USCAR-2 Rev 6 9 different fluids
Submersion	No leakage current <5µA or water inside	SAE/USCAR-2 Rev 6
Pressure/Vacuum Leak	No bubbles present at 7psi before or 4psi after	SAE/USCAR-2 Rev 6
High Pressure Spray	No leakage current <5µA or water inside	SAE/USCAR-2 Rev 6

3.4. Product Qualification and Requalification Test Sequence – Mechanical

TEST OR EXAMINATION	Sequence ID (Per USCAR-17 rev 5)										
	A	B	G	H	IA	IB	J	K	L	N	V
Initial examination of product/ Conditioning	1	1	1	1	1	1	1	1	1	1	1
Circuit Continuity Monitoring										3	
Voltage Standing Wave Ratio (VSWR)										2,4	
Insertion Loss (IL)										2,4	
Terminal Bend Resistance	2										
Terminal to Connector Engage (w/o TPA)		2a									
Terminal to Connector Disengage (w/o TPA)		2b									
Terminal to Connector Disengage (w/ TPA)		2c									
Terminal to Connector Disengage after Conditioning (w/ TPA)		2d									
Connector Engagement Force			2								
Connector Disengage with Lock Enabled			3a								
Force to Disengage Lock			3b								
Connector Disengage Force with Lock Disabled			3c								
Polarization Effectiveness				2							
TPA Lock (Pre-lock to Lock)					2a						
TPA Unlock (Lock to Pre-lock)					2b						
TPA Removal (Pre-lock to Off)					2c						
CPA Lock Mated						2a					
CPA Unlock Mated						2b					
CPA Lock Unmated						2c					
CPA Removal						2d					
Connector to Connector Audible Click							2				
Connector Drop Test								2			
Cavity Damage									2		
Mechanical Pull and Sideload										3	
Cable Resistance to Applied Torque											2
Final examination of product	3	3	4	3	3	3	3	3	3	5	3

Note: Numbers indicate sequence in which tests are performed.

3.5. Product Qualification and Requalification Test Sequence – Environmental

TEST OR EXAMINATION	Sequence ID (Per USCAR-17 rev 5)					
	O	P	Q	R	S	U
Initial examination of product/ Conditioning	1	1	1	1	1	1
Contact Resistance (CR)	2,4		2,4	2,4	2,4	
Circuit Continuity Monitoring	3		3			
Dielectric Withstanding Voltage	5		5	5	5	
Voltage Standing Wave Ratio (VSWR)	2,4		2,4	2,4	2,4	
Insertion Loss (IL)	2,4		2,4	2,4	2,4	
Vibration/Mechanical Shock	3					
RF Leakage		2				
Thermal Shock			3			
Temperature/Humidity Cycling				3		
High Temperature Exposure					3	
Capacitance						2
Terminal to Connector Disengage (w/ TPA)	6			6		
Final examination of product	7	3	6	7	6	3

Note: Numbers indicate sequence in which tests are performed.

3.6. Product Qualification and Requalification Test Sequence – Sealing

TEST OR EXAMINATION	Sequence ID (Per USCAR-17 rev 5)										
	SA1	SB1	SB2	SB3	SC1	SC2	SC3	SD1	SD2	SD3	SE1
Initial examination of product/ Conditioning	1,3	1,7	1,8	1,7	1,7	1,8	1,7	1,7	1,8	1,7	1,6
Connector Cycling		2	2	2	2	2	2	2	2	2	2
Terminal to Connector Disengage (w/ TPA)		8	9	8	8	9	8	8	9	8	
Isolation Resistance		3,5	3,6	3,5	3,5	3,6	3,5	3,5	3,6	3,5	3,5
Thermal Shock		4	5	4							
Temperature / Humidity Cycling					4	5	4				
High Temperature Exposure								4	5	4	
Fluid Resistance	2										
Submersion		6			6			6			
Pressure / Vacuum Leak			4,7			4,7			4,7		4
High Pressure Spray				6			6			6	

Note: Numbers indicate sequence in which tests are performed.

Revision	Description	Author	Date
A	Initial release	C Brandt	28Jun2021
B	Removed “Draft” watermark	C Brandt	01Aug2023