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## 2 **Liberty ID-WSF 1.1 Interoperability Testing Procedures**

3 **Version 1.0**

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### 13 **Abstract:**

14 The conformance program is designed to validate core functionality via interoperability testing so that  
15 purchasers of Liberty-based technology can focus on other details specific to their market and/or deployment.  
16 This document describes the process and procedures for conducting interoperability testing for the Liberty  
17 Interoperable certification program. The goal of this document, combined with the SCR and the Liberty  
18 Conformance Process and Administration document is to unambiguously define the process and procedures  
19 that will be followed at conformance interoperability testing events. The procedures in this document are  
20 intended to streamline testing events, shorten testing times, and minimize disputes that could result in  
21 requests for arbitration.  
22

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39 **1. Introduction**

40 This document refers to ID-WSF 1.1 and the conformance profiles described in the ID-WSF 1.1 Static  
 41 Conformance Requirements (SCR) [[LibertyIDWSF11SCR](#)]. In addition, certain portions of the ID-WSF 1.0 SCR  
 42 [[LibertyIDWSF10SCR](#)] dealing with security mechanisms.

43 The conformance program is designed to validate core functionality via interoperability testing so that purchasers  
 44 of Liberty-based technology can focus on other details specific to their market and/or deployment. This document  
 45 describes the process and procedures for conducting interoperability testing for conformance.

46 The goal of this document, combined with the SCR and the Liberty Conformance Process and Administration  
 47 document is to unambiguously define the procedures that will be followed at conformance interoperability testing  
 48 events. The procedures in this document are intended to streamline testing events, shorten testing times, and  
 49 minimize disputes that could result in requests for arbitration.

50 The SCR describes a total of eight conformance profiles and the specific features that are required or optional for  
 51 each profile. The tables below summarizes the features that comprise the profiles. A vendor can participate in  
 52 conformance interoperability testing in the role of any one or more of these conformance profiles.

53 This document is maintained by the Conformance Expert Group (CEG). Testing events are organized and  
 54 managed by the CEG. The Liberty Conformance Review Team (LCRT) is a sub-team of the Liberty Alliance  
 55 management board and will arbitrate any claims arising from testing events and shall act as an official observer of  
 56 testing events.

Feature	ID-FF SP WSC	LUAD WSC	ID-FF SP WSP	LUAD WSP	ID-FF IdP	ID-WSF IdP	DS	IS
WSC Common	MUST	MUST						
WSP Common			MUST	MUST			MUST	MUST
ID-FF SP WSC SOAP Binding	MUST							
ID-FF SP WSC Security Security Mechanisms	MUST							
Interaction Redirect	MUST		OPT				OPT	
Interaction Service			OPT	OPT			OPT	MUST
ID-FF DS Bootstrap	MUST				MUST			
Authentication Service		MUST				MUST		
SSO Service		OPT				OPT		
Service Registration			OPT	OPT			MUST	OPT
Service Discovery	MUST	MUST					MUST	
Service Invocation	MUST	MUST	MUST	MUST				
PAOS	OPT			OPT			OPT	OPT
LUAD		MUST		MUST			OPT	OPT

Table 1 ID-WSF 1.1 SCR Profiles Matrix

57

58 **2. Overview of Conformance Process**

59 See [[LibConfProc](#)]

60 **3. Test Procedures**

61 Testing will follow a simple scenario based approach with multiple passes that test required features, and optional  
 62 features when support if indicated by the vendor in the registration form. The basic scenario is intended to  
 63 simulate the use of the full range of range of features available in the ID-WSF framework :

- 64 1. Authenticate
- 65 2. Invoke Discovery Service
- 66 3. Contact Service via WSC and WSP.
- 67 4. Optionally interact with user.
- 68 5. Return service results

69 It will be necessary to repeat this scenario through several passes in order test each of the profiles specified in the  
 70 SCR and the test process is designed avoid repeating unnecessary steps to the extent possible.

71 Note that these testing procedures integrate the testing of several profiles concurrently in a single test sequence.  
 72 Typically, one testing sequence will benefit all testing partners as they each try to achieve interoperability with the  
 73 required number of testing partners.

74 **3.1. Common Test Features**

75 This section describes test features or procedures that are common across some or all of the profiles defined in  
 76 subsequent sections.

77 **3.1.1. Asymmetry of Testing Requirements**

78 One of the fundamental aspects of interoperability testing is that two or more participants must work together in  
 79 complementary roles to achieve a testing result. In several cases, one role (e.g. WSC) is required to support a  
 80 feature that is optional for the complementary role (e.g. WSP). In these cases, the WSC (e.g.) is dependent on  
 81 the fact that enough partners will implement the optional features so that interoperability can be demonstrated.

82 Typically, a test participant will implement both roles (e.g., a WSC and WSP) and they have a vested interest in  
 83 making mutual interoperability possible. In this case, the sensible strategy is to build the optional features (i.e.,  
 84 observe the Golden Rule).

85 **3.1.2. Security Mechanisms**

86 The initial portion of each test sequence requires that the implementation demonstrate correct functioning of each  
 87 of the required security mechanisms for the profile under test. This is accomplished by repeating a sequence of  
 88 test steps, changing the security mechanism prior to each repetition.

89 Once all of the required security mechanisms are tested, the remainder of the testing is performed using a  
 90 security mechanism agreed to by all testing partners.

91 The table below lists the ID-WSF 1.1 security mechanisms that are required for the different profiles under test.  
 92 Note that the WSP, DS and IS profiles have three alternative subsets (ALT1, ALT2, ALT3) of the security  
 93 mechanisms, at least one of which must be demonstrated.

94

Test Step	Security Mechanism	ID-FF SP WSC	LUAD WSC	WSP, DS, IS
SEC-NN	urn:liberty:security:2003-08:null:null	<b>MUST</b>	<b>MUST</b>	<b>ALT1</b>
SEC-TN	urn:liberty:security:2003-08:TLS:null	<b>MUST</b>	<b>MUST</b>	<b>ALT1</b>
SEC-NB	urn:liberty:security:2005-02:null:Bearer	<b>MUST</b>	<b>MUST</b>	<b>ALT2</b>
SEC-TB	urn:liberty:security:2005-02:TLS:Bearer	<b>MUST</b>	<b>MUST</b>	<b>ALT2</b>
SEC-NX	urn:liberty:security:2005-02:null:X509	<b>MUST</b>		<b>ALT3</b>
SEC-NS	urn:liberty:security:2005-02:null:SAML	<b>MUST</b>		<b>ALT3</b>
SEC-TX	urn:liberty:security:2005-02:TLS:X509	<b>MUST</b>		<b>ALT3</b>
SEC-TS	urn:liberty:security:2005-02:TLS:SAML	<b>MUST</b>		<b>ALT3</b>

Table 2: ID-WSF 1.1 Security Mechanisms

95 In addition to the require ID-WSF 1.1 security mechanisms, there is an optional testing sequence designed to  
 96 validate interoperability with ID-WSF 1.0 implementations. This testing sequence uses the same repetition of test  
 97 steps described above, except that the security mechanisms used are only those that are specific to ID-WSF 1.0.  
 98 These security mechanisms and the requirements for the testing profiles are listed below.

Test Step	Security Mechanism	ID-FF SP WSC	LUAD WSC	WSP, DS, IS
SEC-NB	urn:liberty:security:2004-04:null:Bearer	MUST	MUST	ALT2
SEC-TB	urn:liberty:security:2004-04:TLS:Bearer	MUST	MUST	ALT2
SEC-NX	urn:liberty:security:2003-08:null:X509	MUST		ALT3
SEC-NS	urn:liberty:security:2003-08:null:SAML	MUST		ALT3
SEC-TX	urn:liberty:security:2003-08:TLS:X509	MUST		ALT3
SEC-TS	urn:liberty:security:2003-08:TLS:SAML	MUST		ALT3

Table 3: ID-WSF 1.0 Security Mechanisms subset for optional combined 1.1/1.0 interoperability

### 100 3.1.3. Service Invocation

101 Essentially every test sequence for WSC and WSP include a service invocation step. The ID-WSF 1.1  
 102 specifications do not normatively specify the nature of such services, and these testing procedure do not explicitly  
 103 define a service interface to be invoked. The requirements only state that conforming WSC and WSP  
 104 implementations must support the invocation of a discovered service.

105 However, many test participants have found it useful to agree upon a common service for demonstrating  
 106 interoperability. Historically, this has been a small subset of the Liberty ID-SIS Personal Profile service [LibIDPP].  
 107 Specifically, a useful set of attributes might be CommonName and/or InformalName. Thus the data pertaining to  
 108 such a service might be simply:

```

109     <PP>
110         <InformalName>theWanderer</InformalName>
111         <CommonName>
112             <CN>Zita Lopes</CN>
113         </CommonName>
114     </PP>
  
```

115 See the examples in [LibIDPPGuide].

### 116 3.1.4. Test Pairings

117 Test partners are assigned randomly and dynamically from amongst all participants with complementary  
 118 implemantations who are ready to test at a particular time. As noted above, the test procedures are designed so  
 119 that all testing partners in a particular test benefit from participating<sup>1</sup> ((i.e., the test “counts” for all participants). The  
 120 test pairings shown in the table below are typical:

	WSC	WSP	DS/IDP
Test 1	A	A	B
	A	B	A
	B	B	A
	B	A	B
Test 2	A	A	C
	A	C	A
	C	C	A
	C	A	C

<sup>1</sup>After a participant has met the minimum requirements, their participation no longer is strictly necessary and thus they don't benefit directly. However, it is sensible to test with as many partners as possible.

- 122 After these tests, Team A has tested with 2 partners in all roles, and is "done" for WSC, WSP, and DS. If Teams  
123 B and C test together (e.g. substituting C for A in Test 1) then B and C will also be done for all three profiles<sup>2</sup>.

---

<sup>2</sup>This procedure thus requires twelve separate tests to complete testing of three teams against three profiles. The same could be accomplished theoretically by six tests where each test involved all three teams, each in a different role. However, coordinating a three-way test has proven extremely difficult and time-consuming.

124 **3.2. Testing Steps**

Test Steps	Feature	ID-FF SP WSC	LUAD WSC	ID-FF SP WSP	LUAD WSP	ID-FF IdP	ID-WSF IdP	DS	IS
<b>WSP/WSC Common</b>									
<b>Basic SOAP</b>									
COM-SCH	Send Correlation Header	MUST	MUST	MUST	MUST			MUST	MUST
COM-PCH	Process Correlation Header	MUST	MUST	MUST	MUST			MUST	MUST
COM-SIUC	ServiceInstanceUpdate Credential change	MUST	MUST						
COM-SIUE	ServiceInstanceUpdate EndpointMoved retry	MUST	MUST						
<b>Basic Security</b>									
SEC-NN	null:null	MUST	MUST	ALT1	ALT1			ALT1	ALT1
SEC-TN	TLS:null	MUST	MUST	ALT1	ALT1			ALT1	ALT1
SEC-NB	null:Bearer	MUST	MUST	ALT2	ALT2			ALT2	ALT2
SEC-TB	TLS:Bearer	MUST	MUST	ALT2	ALT2			ALT2	ALT2
<b>ID-FF SP WSC Security Mechanisms</b>									
SEC-NX	null:X509	MUST		ALT3	ALT3			ALT3	ALT3
SEC-NS	null:SAML	MUST		ALT3	ALT3			ALT3	ALT3
SEC-TX	TLS:X509	MUST		ALT3	ALT3			ALT3	ALT3
SEC-TS	TLS:SAML	MUST		ALT3	ALT3			ALT3	ALT3
<b>Interaction Header</b>									
INT-PH	Process Interaction Header			MUST	MUST			MUST	MUST
<b>ID-FF SP WSC SOAP Binding</b>									
SP-SPH	Send Provider Header	MUST							
<b>Interaction Redirect</b>									
IR-1	1 - WSC sends Request with redirect=true	MUST							
IR-2	2 - WSP sends SOAP Fault with Redirect			OPT				OPT	
IR-3	3 - WSC HTTP 302 to RedirectURL at WSP	MUST							
IR-4	4 - WSP Validate URLs			OPT				OPT	
IR-CD	c,d - WSP Draw inquiry page, enter			OPT				OPT	
IR-E	e - WSP Process GET/POST answers			OPT				OPT	
IR-5	5,6 - WSP HTTP 302 to ReturnToURL			OPT				OPT	
IR-7	7 - WSC Resend	MUST							
IR-8	8 - WSP Response			OPT				OPT	
IR-V	Validate Result	MUST		OPT				OPT	
<b>Interaction Service</b>									
IS-WSC1	WSC sends UserInteraction redirect=false								
IS-WSP1	WSP sends InteractionRequest to IS (or LUAD WSC)			OPT	OPT			OPT	
IS-ISQ	IS Queries Principal								MUST
IS-ISR	IS Sends InteractionResponse to WSP								MUST
IS-WSP2	WSP responds to WSC			OPT	OPT			OPT	
IS-WSC2	WSC processes response								
<b>ID-FF DS Bootstrap</b>									
ID-DSBA	SAML Assertion with DiscoveryResourceOffering attribute					MUST			
ID-DSBP	Process Bootstrap to locate Disco	MUST							
<b>Authentication Service</b>									
<b>Authn Protocol</b>									
AS-WSCI	WSC Authn Invocation		MUST						
AS-WSPR	WSP SASLResponse						MUST		
AS-WSPPA	WSC SASL Request PLAIN or ANONYMOUS		MUST						
AS-WSPMD5	WSC SASL Request CRAM-MD5		MUST						
<b>Password Translation</b>									
AS-PWT	Truncation		MUST						
AS-PWL	Lowercase		MUST						
AS-PWU	Uppercase		MUST						
AS-PWS	Select		MUST						
<b>SSO Service</b>									
SSOS-WSCA	WSC authenticates at AS		OPT				OPT		
SSOS-WSCR	WSC sends AuthnRequest (already Federated)		OPT						
SSOS-WSPR	WSP sends AuthnResponse						OPT		
SSOS-SP	WSC accesses SP with Authn		OPT						
<b>Service Registration</b>									
DS-MODI	DS Modify InsertEntry			OPT	OPT			MUST	OPT
DS-MODR	DS Modify RemoveEntry			OPT	OPT			MUST	OPT
DS-MODE	DS Modify InsertEntry (EncryptResourceID dir)			OPT	OPT			MUST	OPT
DS-MODO	DS Modify (other directives)			OPT	OPT			OPT	OPT
<b>Service Discovery</b>									
DS-WSCQ1	WSC Query Plain	MUST	MUST					MUST	
DS-WSCQ2	WSC Query with Options								
DS-QR	DS QueryResponse	MUST	MUST					MUST	
DS-QRE	DS QueryResponse (EncryptedResourceID)	MUST	MUST					MUST	
WS-SI	Service Invocation	MUST	MUST	MUST	MUST				
<b>PAOS</b>									
PAOS-RR	Request-Response pattern	OPT			OPT			OPT	OPT
PAOS-R	Response pattern	OPT			OPT			OPT	OPT
<b>LUAD</b>									
LUAD-WSC	LUAD WSC		MUST						
LUAD-WSP	LUAD WSP				MUST				OPT
LUAD-DS	LUAD DS							OPT	

Table 4: Testing Steps

125 Table 4 lists all the testing steps and whether they are required (“MUST”), optional (“OPT”), or alternates (see  
 126 discussion of security mechanisms above). This list is an expansion of the requirements in [LibertyIDWSF11SCR]  
 127 derived from the referenced specifications. The testing sequences in the following sections are composed of the  
 128 steps defined in Table 4.

129 **3.2.1. ID-FF SP WSC/P, ID-FF IDP, DS Test Procedures**

130 Note that the initial sequence assumes that a service has been registered at the DS. The manner in which this is  
 131 accomplished is not specified, but typically it could be done by the WSP registering the service with the DS. As  
 132 that operation is optional for the WSP, however, some other method for registering the service at the DS should  
 133 be used.

No.	Test Step	Feature	ID-FF SP WSC	ID-FF SP WSP	ID-FF IdP	DS
1	SEC-TN	TLS:null (modify for each iteration)	MUST	ALT1		ALT1
2	ID-Login	Principal SSO via Artifact Profile (already Federated)			MUST	
3	ID-DSBA	SAML Assertion with DiscoveryResourceOffering attribute			MUST	
4	ID-DSBP	Process Bootstrap to locate Disco	MUST			
5	DS-WSCQ1	WSC Query Plain	MUST			MUST
6	DS-QR	DS QueryResponse	MUST			MUST
7	WS-SI	Service Invocation	MUST	MUST		
8	Repeat	Repeat 1-7 above for each secmec				
9	DS-MODE	DS Modify InsertEntry (EncryptResourceID dir)		OPT		MUST
10	DS-QRE	DS QueryResponse (EncryptedResourceID)	MUST			MUST
11	WS-SI	Service Invocation	MUST	MUST		
12	DS-WSCQ2	WSC Query with Options				
13	DS-QR	DS QueryResponse	MUST			MUST
14	WS-SI	Service Invocation	MUST	MUST		
15	DS-WSCQ1	WSC Query Plain	MUST			MUST
16	DS-QR	DS QueryResponse	MUST			MUST
17	IR-1	1 - WSC sends Request with redirect=true	MUST			
18	INT-PH	Process Interaction Header		MUST		MUST
19	IR-2	2 - WSP sends SOAP Fault with Redirect		OPT		OPT
20	IR-3	3 - WSC HTTP 302 to RedirectURL at WSP	MUST			
21	IR-4	4 - WSP Validate URLs		OPT		OPT
22	IR-CD	c,d - WSP Draw inquiry page, enter		OPT		OPT
23	IR-E	e - WSP Process GET/POST answers		OPT		OPT
24	IR-5	5,6 - WSP HTTP 302 to RedirectToURL		OPT		OPT
25	IR-7	7 - WSC Resend	MUST			
26	IR-8	8 - WSP Response		OPT		OPT
27	IR-V	Validate Result	MUST	OPT		OPT
28	SIU Setup	Setup for Service Instance Update Credential Change				
29	ID-Login	Principal SSO via Artifact Profile (already Federated)				
30	ID-DSBA	SAML Assertion with DiscoveryResourceOffering attribute			MUST	
31	ID-DSBP	Process Bootstrap to locate Disco	MUST			
32	DS-WSCQ1	WSC Query Plain	MUST			MUST
33	DS-QR	DS QueryResponse	MUST			MUST
34	WS-SI	Service Invocation	MUST	MUST		
35	COM-SIUC	ServiceInstanceUpdate Credential change	MUST			
36	WS-SI	Service Invocation	MUST	MUST		
37	SIU Setup	Setup for Service Instance Update EndpointMoved				
38	ID-Login	Principal SSO via Artifact Profile (already Federated)				
39	ID-DSBA	SAML Assertion with DiscoveryResourceOffering attribute			MUST	
40	ID-DSBP	Process Bootstrap to locate Disco	MUST			
41	DS-WSCQ1	WSC Query Plain	MUST			MUST
42	DS-QR	DS QueryResponse	MUST			MUST
43	WS-SI	Service Invocation	MUST	MUST		
44	COM-SIUE	ServiceInstanceUpdate EndpointMoved retry	MUST			
45	WS-SI	Service Invocation	MUST	MUST		
46	PAOS-RR	Request-Response pattern	OPT			OPT
47	PAOS-R	Response pattern	OPT			OPT

Table 5: ID-FF SP WSC/P, ID-FF IDP, DS Test Procedures

135 The optional PAOS test sequence at the end of the procedure will (typically) need to be performed in conjunction  
 136 with a LUAD WSP that supports PAOS.

137 **3.2.2. LUAD WSC/P, ID-WSF IDP, DS, IS Test Procedures**

- 138 Note: the interaction sequence (test steps in yellow) are optional, except for interaction service (IS) profile testing.  
139 Also, the PAOS sequence will require the participation of a PAOS-capable SP/WSP implementation.

No.	Test Steps	Feature	LUAD WSC	LUAD WSP	ID-WSF IdP	DS	IS
1	SEC-TN	TLS:null	MUST	ALT1		ALT1	ALT1
2	AS-WSCI	WSC Authn Invocation	MUST				
3	AS-WSPR	WSP SASLResponse			MUST		
4	AS-WSPPA	WSC SASL Request PLAIN or ANONYMOUS	MUST				
5	DS-WSCQ1	WSC Query Plain	MUST			MUST	
6	DS-QR	DS QueryResponse	MUST			MUST	
7	WS-SI	Service Invocation	MUST	MUST			
8	Repeat	Repeat above for each secmec					
9	SEC-ANY	Set secmec for rest of tests					
10	AS-WSCI	WSC Authn Invocation	MUST				
11	AS-WSPR	WSP SASLResponse			MUST		
12	AS-WSPMD5	WSC SASL Request CRAM-MD5	MUST				
13	COM-SCH	Send Correlation Header	MUST	MUST		MUST	MUST
14	COM-PCH	Process Correlation Header	MUST	MUST		MUST	MUST
15	AS-PWT	Truncation	MUST				
16	AS-WSPPA	WSC SASL Request PLAIN or ANONYMOUS	MUST				
17	AS-PWL	Lowercase	MUST				
18	AS-WSPPA	WSC SASL Request PLAIN or ANONYMOUS	MUST				
19	AS-PWU	Uppercase	MUST				
20	AS-WSPPA	WSC SASL Request PLAIN or ANONYMOUS	MUST				
21	AS-PWS	Select	MUST				
22	AS-WSPPA	WSC SASL Request PLAIN or ANONYMOUS	MUST				
23	DS-MODE	DS Modify InsertEntry (EncryptResourceID dir)		OPT		MUST	OPT
24	DS-QRE	DS QueryResponse (EncryptedResourceID)	MUST			MUST	
25	WS-SI	Service Invocation	MUST	MUST			
26	DS-WSCQ2	WSC Query with Options					
27	DS-QR	DS QueryResponse	MUST			MUST	
28	WS-SI	Service Invocation	MUST	MUST			
29	DS-WSCQ1	WSC Query Plain	MUST			MUST	
30	DS-QR	DS QueryResponse	MUST			MUST	
31	IS-WSC1	WSC sends UserInteraction redirect=false	OPT				
32	INT-PH	Process Interaction Header		MUST		MUST	MUST
33	IS-WSP1	WSP sends InteractionRequest to IS (or LUAD WSC)		OPT		OPT	
34	IS-ISQ	IS Queries Principal					MUST
35	IS-ISR	IS Sends InteractionResponse to WSP					MUST
36	IS-WSP2	WSP responds to WSC		OPT		OPT	
37	IS-WSC2	WSC processes response					
38	SIU Setup	Setup for Service Instance Update CredentialChange					
39	Authenticate	Authenticate with ID-WSF IdP (AS) any profile					
40	DS-WSCQ1	WSC Query Plain	MUST			MUST	
41	DS-QR	DS QueryResponse	MUST			MUST	
42	WS-SI	Service Invocation	MUST	MUST			
43	COM-SIUC	ServiceInstanceUpdate Credential change	MUST				
44	SIU Setup	Setup for Service Instance Update EndpointMoved					
45	Authenticate	Authenticate with ID-WSF IdP (AS) any profile					
46	DS-WSCQ1	WSC Query Plain	MUST			MUST	
47	DS-QR	DS QueryResponse	MUST			MUST	
48	WS-SI	Service Invocation	MUST	MUST			
49	COM-SIUE	ServiceInstanceUpdate EndpointMoved retry	MUST				
50	PAOS-RR	Request-Response pattern		OPT		OPT	OPT
51	PAOS-R	Response pattern		OPT		OPT	OPT

Table 6: LUAD WSC/P, ID-WSF IDP, DS, IS Test Procedures

140 **3.2.3. ID-WSF 1.0 Interoperability [Optional]**

141 An implementation may optionally test interoperability with ID-WSF 1.0 by performing the security mechanism  
 142 tests in the appropriate test sequence (3.2.1 or 3.2.2) but using the ID-WSF 1.0 Security Mechanisms from Table  
 143 3.

144 **4. Testing Checklist**

145 This form must be completed for each complete test run. Both parties to the test must agree to the indication of  
 146 pass/fail for each feature tested and sign each copy of the form. A copy of the form will go to each testing party  
 147 and the original will be kept on record by LCRT/ISTO.

148 The product name is simply an identifier; it does not have to be the public name of the product.

IDP Tester	
Product Name	
Version (major.minor)	
Implementation Type(s)	IDP IDP Extended
Company	
Contact Name	
Contact Phone	
Contact Email	
Signature (after testing)	

149

SP Tester		
Product Name		
Version (major.minor)		
Implementation Type(s)	SP Basic	SP Complete SP Extended
Company		
Contact Name		
Contact Phone		
Contact Email		
Signature (after testing)		

150

LECP Tester	
Product Name	
Version (major.minor)	
Company	
Contact Name	
Contact Phone	
Contact Email	
Signature (after testing)	

151

LCRT Representative	
Contact Name	
Signature (after testing)	

152

## 153 **5. References**

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