OpenSG Edge/Enterprise Conformance Task Group

Certification Process Reference Manual

V0.9

December 11, 2010

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Disclaimer

This document should be considered as a living document. It is anticipated that there will be updates resulting from further work within OpenSG and the work of the NIST SGIP Test and Certification committee (SGTCC).

Change History

Date	Rev	Change	By
August 25, 2010	R9: work in progress	Added this Change History Table	Phil Beecher
		Generalized references to “products” (previously devices and systems	
		Added Context for OpenSG Conformance Program	
		Reorganized acronyms and definitions	
		Inserted system component overview diagram	
		Merged sections describing Approved Device Certification Lab and Approved System Certification Lab	
December 11, 2010	V0.9	Added line numbers, Revised version number ready for comment and voting	Phil Beecher

1. Introduction

The electric energy utility industry has sponsored the work of the Open Smart Grid (OpenSG) Conformity Working Group organization, Edge Conformance Task Group (OpenSG Edge TG), under the auspices of the Utility Common Architecture Group (UCA Group). This OpenSG Edge TG is tasked with the job of defining the necessary requirements for assuring conformance and interoperability of various devices, systems and technologies in Enterprise Systems, OpenHAN, OpenADR, and OpenADE specifications.

The GridWise Council, sponsored by NIST, also address issues of interoperability and testing. This document aims to be inclusive of the GridWise Council work products, while maintaining a clear focus on utility infrastructure and industry requirements.

1.1. Purpose

This document describes the Interoperability and Conformance Program (ICP) required by OpenSG. The purpose of this document is to promote industry-centered robust product and system certification programs to test for the stringent requirements from AMI-Enterprise, OpenHAN, OpenADR, and OpenADE. It is the intent of this document to become the basic foundation of standards organization testing and certification programs that would be deemed acceptable to the utility industry and the smart grid industry community at large.

1.2. Scope

This document covers the entire framework description of the ICP. The ICP follows the OpenSG Edge Conformity WG Guiding Principles. This document is issued by the OpenSG Edge and Enterprise Conformance Task Groups, and implements the following key policy factors:

- Testing and certification experiences of communication protocol stacks following Best Practice for testing as described in the Guiding Principles document.
- The importance of accumulated experience of testing institutions is recognized. Of particular importance are: coexistence with interferers, interoperability at application layers but with various physical layers and interconnections thereof, and enforcement of standards based interoperability.
- Systems represented in the OpenSG community are covered, including AMI-Enterprise Systems, OpenHAN, OpenADE and OpenADR interoperability and conformance.

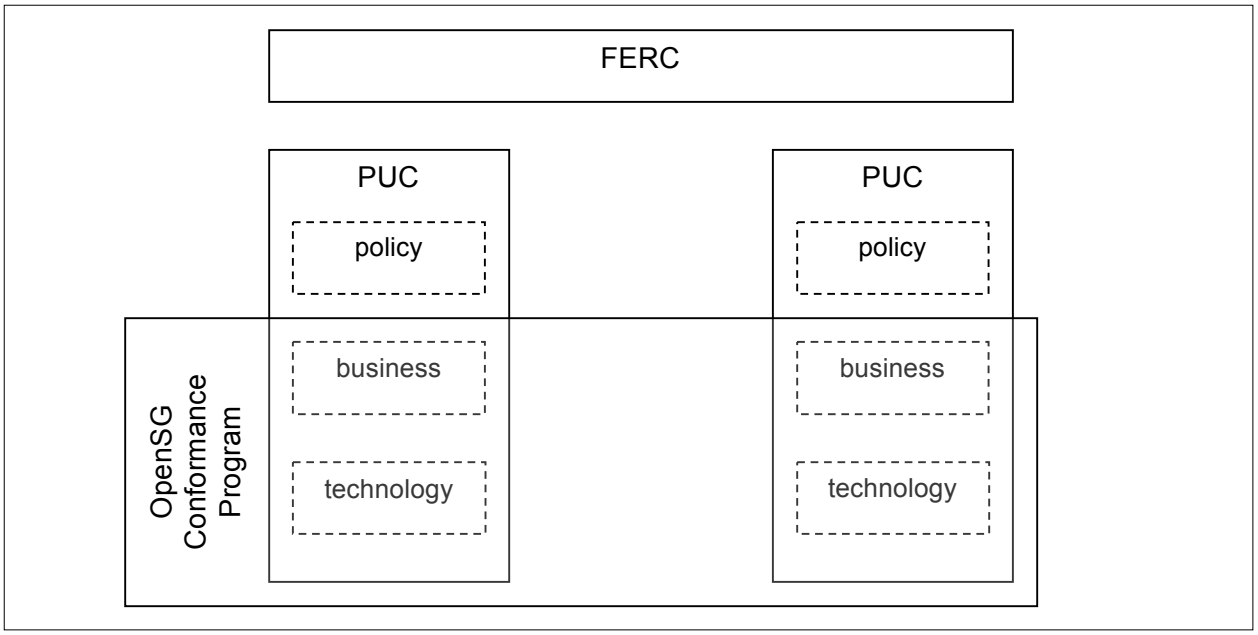

Figure 1 Context for OpenSG Conformance Program

Figure 1 shows the context for the OpenSG Conformance and Interoperability program. Each electric utility operates their smart grid within a technical, informational, and business environment different for every PUC and interested party jurisdiction. As such, the smart grid technologies will be installed in different regulatory and infrastructure environments. The CPRM shares a common purpose with NIST SGIP TCC Interoperability Process Reference Manual, which should be read as a companion document. However, this CPRM specifically describes the model implementation for informational and technical layers of the GWAC stack.

In general, the ICP framework shall consist of a basic two parts, with one part being the ICP Program Operations and Administration, while the other is the ICP Requirements & Policy. An Interoperability Program Management Organization (IPMO) shall oversee the entire program and liaise with OpenSG on the suitability of the specific ICP Program.

Figure 2: Organization

1.3. Acronyms and Abbreviations

APCB: Approved Product Certification Body- Qualified person responsible to manage a certification process for a particular device, and independent from test laboratory or manufacturer.

APCL: Approved Device Certification Laboratory- Testing organization tasked to evaluate device for compliance and interoperability. The product may be either a device or module incorporating hardware and software, or a software only system / sub-system

APCB: Approved Product Certification Body- Qualified organisation responsible to manage a certification process for a particular product, and independent from test laboratory. The product may be either a device or module incorporating hardware and software, or a software only system / sub-system

CA: Certificate Authority-Body responsible for digital certificate issuance of certified products and systems. This includes embedded devices, as well as browsers conforming to ZigBee SE Security (ECC) and X.509 security schemes.

CPM: Certification Program Manager - Person tasked by the SSO/SDO to administer the test and certification program

CRSL: Certification Reference Status List - List of test cases that are draft, active, deprecated, and planned in the certification program.

IUT: Implementation Under Test

ICP: Interoperability and Conformance Program

IPMO: Interoperability Program Management Organization - An administrative organization vested with the responsibility of operating and maintaining a testing and certification program for smart grid technology, and responsible to maintain its efficacy per the OpenSG requirements.

LL: Lead Lab - Central technical authority for testing and testing technology

PICS: Protocol implementation comformance statement

PIXIT: Protocol Implementation Extra Information for Testing

SSO: Standards Setting Organisation – An organisation which sets standards

SUT: System Under Test

TAB: Technical Advisory Board - a working group consisting of representatives of test labs, certification bodies, and SSO/SDO administration; facilitates in the operation of the testing and certification program, and discuss timely and critical issues facing the whole process.

1.4. Terminology

Compliance: A system is said to be "complying" when it is subjectively judged to be functioning according to specifications. The judgment is subjective by nature, as it is not evaluated by third party. Hence compliance is a weaker adherence to specification when compared with conformance

Conformance: A system "conforms" with a specification when it is objectively judged to be functioning according to specifications. The judgment is both rigorous/objective, based on technical and qualitative measures..

Conformance Testing: Determines whether an implementation conforms to the standard as written, usually by exercising the implementation with a test environment.

Compliant Portion: is defined as the part of a specific hardware and firmware/software configuration which behaves consistently according to the spec. The compliant portion may be compromised of individual hardware or firmware/software components, which when combined, become the compliant portion

Device: A device is a product which incorporates hardware, typically including communications hardware which is included as part of the compliant portion. A device will usually be deployed at the edge of the utility network.

Equivalence: An evaluation of a system against another system instantiation, whereby features/functions are compared and contrasted; when all such features/functions are identical, the system is judged to be in "equivalence".

Instantiation: An implementation of a system, either compliant or conforming. --- Example: compiling, etc.

Reference System: A system created as a complying instantiation.

Prototype System: A system created as a conforming instantiation.

Primary Test Categories: Canonical Baseline Test Types - tests categories that are deemed to be minimum required for an acceptable and effective testing program.

Signed Certification Mark License Agreement – [defn required]

System: Part or whole instance of product functionality, usually associated with software portion of product

Product: Hardware and/or software implementation to be tested for compliance / interoperability

Module: Hardware and software implementation that incorporates a compliant portion

Component: piece of software that together with another piece of software or hardware form a Compliant Portion

Interoperability: Communication and functionality achieved by multiple conforming systems. A correspondance of interfaces between two abstract functional units.

Interoperability Testing: connects two or more implementations together and determines whether they can successfully communicate. Significantly different from conformance testing because it is often possible for two systems that conform to the standard to be unable to communicate. If they can communicate, it is possible that they cannot perform any useful applications. These situations can arise because the implementations have conflicting interpretations of the specification or because they have chosen conflicting options within the standard. A particular form of interoperability testing is application testing in which there is a specification for the particular use of a standard that can be tested

Security Testing: Analyzes whether the implementation correctly makes use of any security features from the standard or other security features available in the device or computer system housing the implementation. This is the most difficult type of testing program because it must evaluate whether the system has vulnerabilities, which are not always obvious.

1.5. Other Considerations and References

It is the intention of this group to work with other organisations to reduce duplication of effort and leverage other activities and expertise. The OpenSG Conformity Task Forces will interface with the following organizations such as:

- NIST
- SGIP TCC
- ZigBee Alliance
- HomePlug Alliance
- Wi-Fi Alliance

- CIMug
- Others

Formal liaisons will be established as required. This will dependent on level of accreditation. It may also be dependent on use of a logo.

Requirements and contributions from Utilities, Vendors and others will be captured through the contributors' participation in OpenSG.

1.6. Overview

The scope of the design of the program described in this document is to certify products and systems to

- relevant mandatory and optional conformance feature sets of the communication stack physical layer
- relevant mandatory and optional conformance feature set of the communication protocol stack
- interoperability of devices within the device class, and service level and application interfaces relevant to the application profiles
- interoperability with applications and service level interfaces from other network domains within the smart grid communication infrastructure
- conformance to metrics for product and system performance as specified by business, regulatory, and user requirements per the GWAC stack framework

The relevant PICS documents are required to incorporate the SRS documents from AMI-Enterprise System, OpenHAN, OpenADR, and OpenADE as appropriate. Product and System Certification shall require applicants to sign a Declaration of Conformity (DoC) document prior to a Certification by the relevant organization.

The product certification process applies to deployable end products and reference designs such as, but not limited to, Smart Meters, Energy Service Interfaces and openHAN compliant Smart Energy 2.0 device implementations (PCT, IHD, LCD, etc.). The certification process also addresses complete radio, PLC, wireline, and/or radio-PLC-wireline modules and reference designs which may be integrated into other end products, typically without further modification, and therefore without further certification (See section Inheritance). Re-certification of certified device versions (evolving devices) and variants (adaptations) are also addressed (Section: Revisions). The certification program does not certify incomplete implementations (SW/HW components, subcomponents, subunits) of devices and applications, for example an implementation of part of the protocol stack.

The certification process is also applied to application software and systems consuming services at interfaces with AMI and smart grid communication infrastructure, to define the system certification process. These may include OpenADR and OpenADE client / server services, including Demand Response Automated Server (DRAS), Demand Response Client, portal services and AMI-Enterprise services. Re-certification of certified application software and system versions and variants are also addressed (Section: Revision). The certification

program does not certify incomplete implementations that do not implement mandatory set of features.

In the event of discrepancies or errors in the Requirements, Standard, Specifications or Certification testing of products or systems, an industry Lead Laboratory (LL) will notify all affected parties regarding needed remediation activities. In the event of an invalid test specification or requirement, an industry WG shall review the test result and procedures followed. If corrective action is needed the industry WG in cooperation with the LL will determine the course of action and notify all affected companies of its determination.

If a product or system is certified and later the registered company is no longer a viable entity, the certificate remains active but use of relevant logo stops and the listing is removed.

Figure 3 shows an Overview of the System Components to be considered by OpenSG Edge /Enterprise Conformity Task Groups. The service interfaces are shown as .

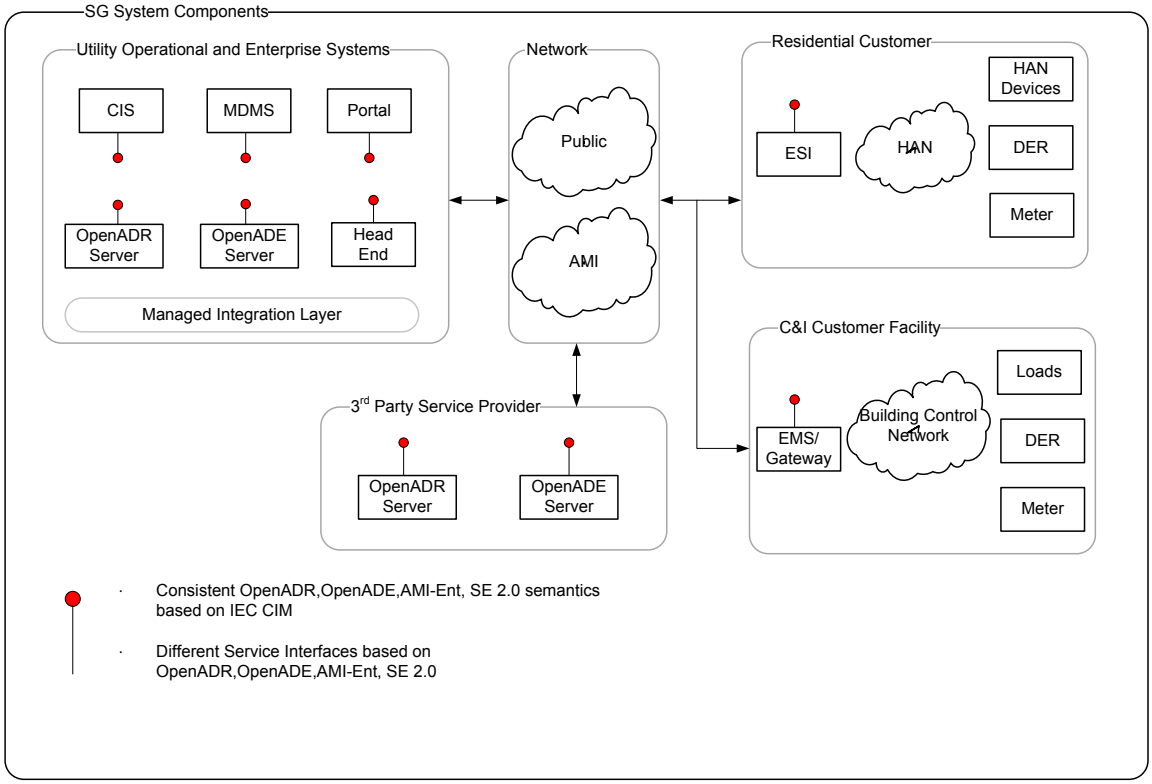

Figure 3: System Component Overview

2. Overall Description

2.1. Guiding Principles

The SG Conformity Task Forces shall define Policy, Process and Procedures required to implement testing and certification programs.

For both systems and devices that incorporate a hardware portion, existing Best Practice Structure shall be utilized. The importance of accumulated experience of testing institutions is also recognized. The following points must be considered in the IPMO when creating and maintaining a testing and certification program.

2.1.1. Open standards based

A public specification that is maintained by an open, public consensus process to accommodate new technology over time and that is consistent with standards. Open standards lower total cost of ownership and provide an open platform that encourages innovation.

2.1.2. Robust and comprehensive certification process

Robust certification processes are needed to guarantee a seamless user experience that minimizes support calls and builds confidence in the maturity of the smart grid technologies.

2.1.3. Clean, layered architecture

Adherence to industry best practices for software and systems development is a guiding principle. Specifically, the system designs shall follow a clean, layered OSI architecture model. This allows standardization of the higher levels of the stack to provide modularity and use of multiple transport layers.

2.1.4. Focus

The focus for devices and systems should be on the application programming interfaces and not specific applications. Identifying the interfaces between applications and the core information sets available provides a minimum set of attributes to enable the required functionality. This enables a platform for innovation upon which a wide range of applications can be designed and built to suit users' requirements and preferences while maintaining adherence to the open standard.

2.2. End to End System Interoperability

The Smart Grid communication infrastructure can be described by the OSI-7 layer model, but with added description of multiple domains of network (Edge and AMI). Conformance tests evaluate a unit or system under test for its adherence to a specification, whereas an interoperability test verifies the ability of a device to intercommunicate within its domain with peer layers of the OSI-stack. Further, the performance tests evaluate a unit or system under test for its fitness of use in deployment scenarios under business requirements. Figure 4 shows how individual test suites relate to the complete system. In the Edge Domain, products may incorporate hardware portions, e.g. radio devices or PLC. In this case, Physical Performance

and Physical Conformance Test Suites as well as Protocol Conformance Test suites for the Data Link Layers are required.

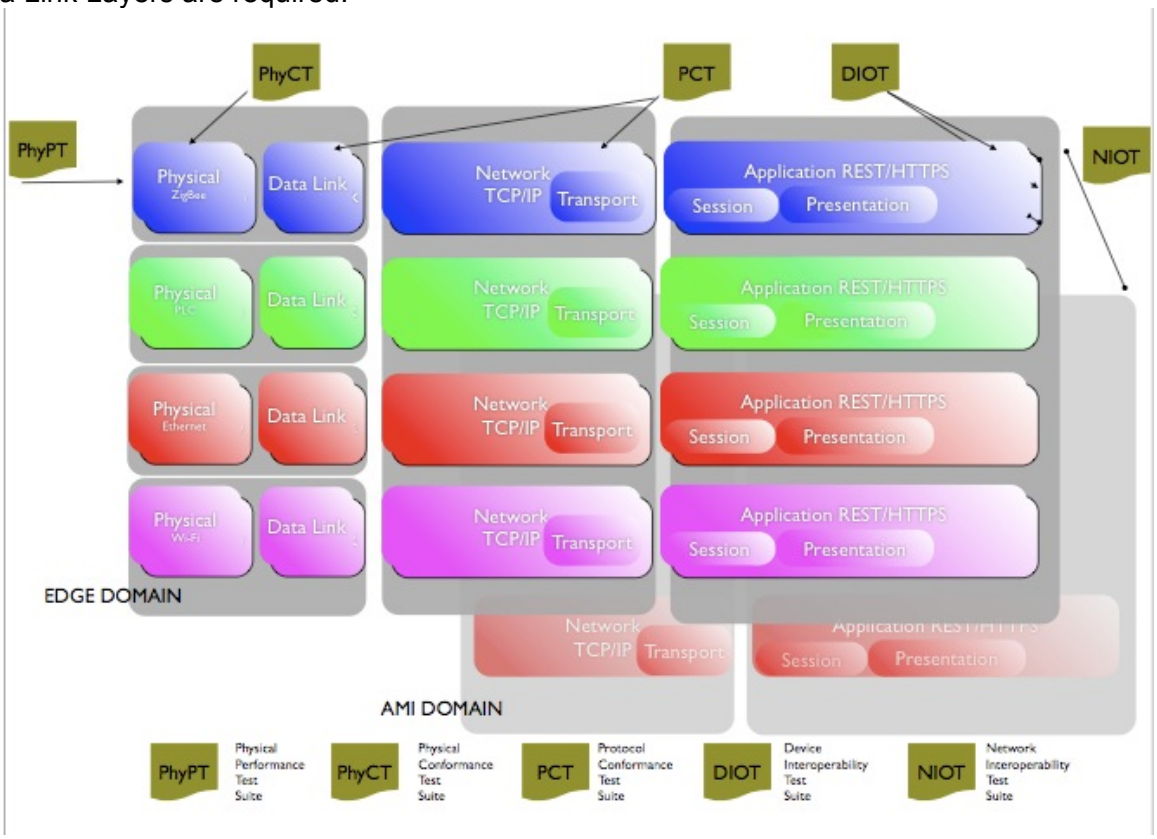

Figure 4: Context of individual test suites related to the total system

Figure 5: ZigBee SE2.0 Certification Scheme shows an example certification scheme as proposed for ZigBee Alliance Smart Energy Profile 2.0. The Certification Test Cases has been divided in 4 main sets: IEEE 802.15.4-2006, Stack, Platform and Device Type Certification. The coverage of each set of tests is shown in the figure.

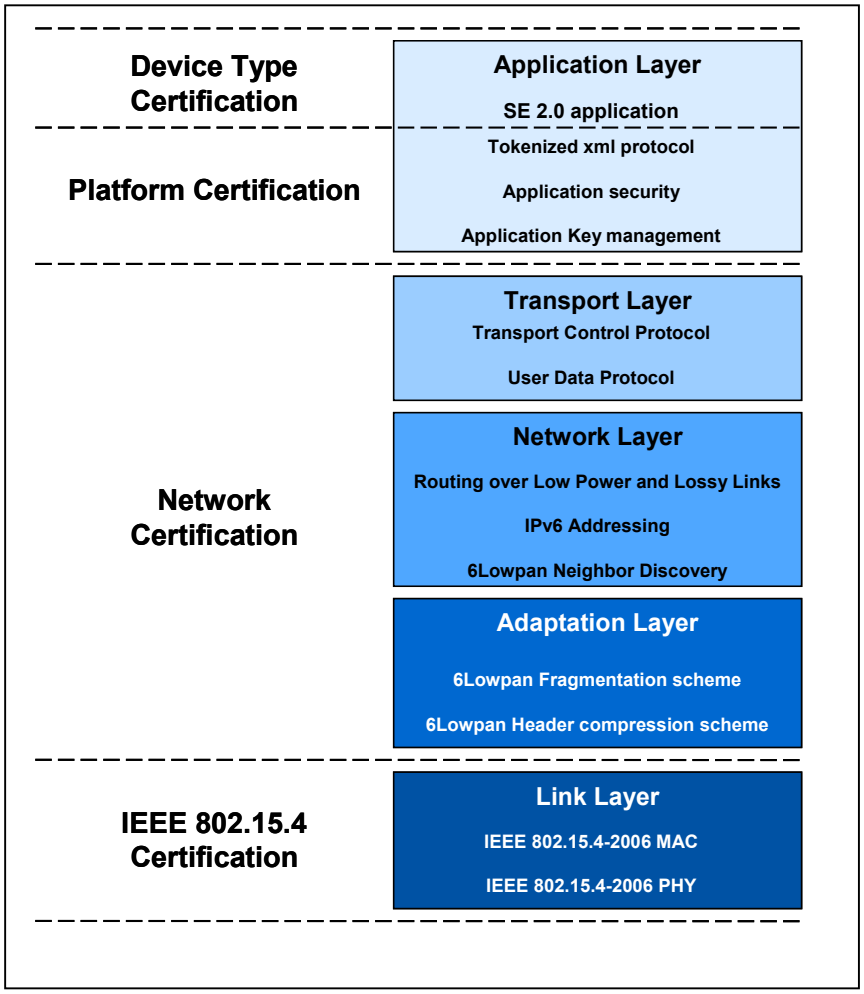

Figure 5: ZigBee SE2.0 Certification Scheme

2.3. Economic Viability

The IPMO shall design a testing and certification program that is economically viable for industry participants, including utilities, device and software vendors, and test laboratories.

2.4. Minimize Test Organization

The following statements describes the foundation of the testing program to establish rapidly maturing interoperable products and interfaces between products based on designated specifications relevant to the Edge.

2.5. Coexistence

A mass, scalable deployment of communication technology requires “robustness”, and in particular, coexistence with other technologies already in the field. These technologies may be wireline, such as DSL, or non-standard PLC technologies, or wireless, such as Bluetooth and Wi-Fi. Previously, the newer of installed technologies may or may not have impacted legacy

devices; however, with SE 2.0, wireline and wireless technologies may have mutual interference effects that need to be mitigated for successful deployment.

2.6. Interoperability

Certified products should interoperate at all layers. For mature technologies with proven certification programs, adoption should be straightforward. In recognition of various physical communication and protocol layers (OSI layers 1-4) that may be deployed at any time by the adopters of SEP, applications need to interoperate independent of the physical, MAC, link, and transport layer selection.

2.7. Standardization Efforts

Industry, nation and worldwide efforts are underway to define specifications not only of technology but also of interoperability itself. As such the Edge/Enterprise product testing and certification program shall continually monitor these standard developments (such as IEEE-SA P2030) and maintain compatibility with specified standards.

2.8. Architectural Considerations

The Gridwise Architecture Stack (GWAC) stack is shown below in Figure 5. The stack adequately describes the scope of the interoperability topic at hand, and serves as a starting point for the discussion on architectural considerations for the testing and certification program required from IPMOs.

Briefly, the three domains of Technical, Informational, and Organization blocks of the GWAC stack cover distinct by very relevant end-to-end system and cross business interoperability requirements.

It is recognized here that IPMOs may scope activities that are subsets of the GWAC stack, and may concentrate its efforts mostly on the *Technical block*. The OpenSG Edge Conformity requires that the IPMO bring into consideration the interdependencies of the other GWAC stack blocks that are not specifically addressed by the IPMO itself, and to maintain sufficient mechanism to address characteristics and limitations of the IPMO's portion of the total end-to-end system architectural issues.

As such, the IPMO shall take steps to establish needed formal liaison relationship with customer and SSO, to assure that end-to-end system requirements are adequately included in the IPMO established program.

As a general requirement for a qualified IPMO following this OpenSG document, that IPMO shall implement a formalized market and technical requirements derivation process, and include end-to-end system needs through utilization of SRS from OpenSG.

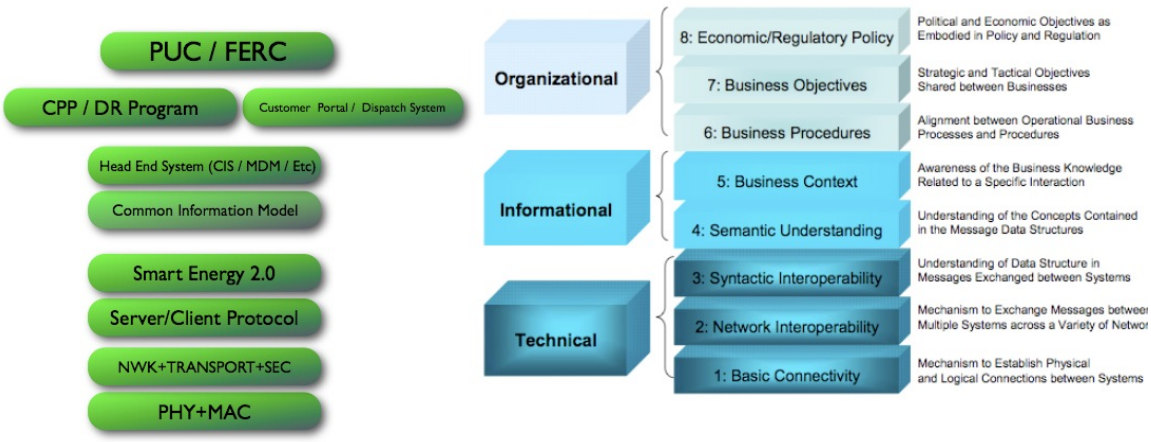

Figure 6: GWAC Stack

3. Organizational Requirements

3.1. Governance

The IPMO shall structure the testing and certification program with the following specific elements; to ensure that industry best practices are installed.

3.1.1. Certification Program Manager (CPM)

CPM is an individual appointed by the industry program to act as the administrator of the Logo Certification Program. His/her task is to oversee the day-to-day operations and needs of the certification program, and act as the interface between the industry and the program. His/her tasks involve:

3.1.1.1. Chairing the Technical Advisory Board (TAB)

Coordinating problem resolution in the Logo Certification Program
Communicating important items to the industry
Signing off on the Logo Certifications

3.1.1.2. Administering the Testing and Certification Program

t.b.d.

3.1.1.3. Administering the Interoperability Test Events

t.b.d.

3.1.2. Approved Product Certification Body (APCB)

The APCB is an organisation of qualified personnel installed by the logo program, and part of the Approved Product Certification Program. Each appointed APCB is entrusted with the authority to submit products as Certified, without further review. This special trust depends upon both the competence and the integrity of each APCB. The APCB appointment is renewed yearly by the APCB contingent upon the following yearly recognition maintenance requirements and any additional requirements the logo program deems necessary. The APCB may seek monetary compensation to clients for services rendered to clients and organizations as part of sanctioned APCB function.

3.1.2.1. Definition

The APCB comprises individuals appointed by the logo program to certify that an End Product or module satisfies all certification criteria to be a Certified Product. An APCB member is an individual who is typically, but not necessarily, affiliated with an APCL(s). APCB shall not be both a) responsible for performing tests, generating and/or signing off on a test report for a specific certification project, and b) responsible for assessing and certifying the results for submittal as a Certified Product, for the same specific certification project. In other words, APCB may test for projects he/she is not responsible for certifying.

3.1.2.2. Sanctioned Activities and Responsibilities

APCB submits product listings through the Certification Tool to the Certification Program Manager for listing Certified Products, after a review of the Compliance Folder and other documents by checking completeness, correctness, and consistency of the materials. APCB may assist the Member to determine tests required through the use of the Test Plan Generator, preparing documentation, and completing all requirements for the listing. At the time of completion of the certification assessment, the APCB shall deliver a Certified Product Notice certifying that product has satisfied all Certification Criteria and is ready for listing. This notification will be generated by the Cert system when the APCB updates the status of the corresponding certification project.

The APCB is knowledgeable about the application profile and its certification criteria. The APCB notifies the industry WG Program manager when all listing requirements are met, and gives a certification date and a member defined listing date of the product with the express permission of the Member. The APCB enters the product information on the Certified Products List when authorized by the Member for a specific listing date.

Confidentiality is a key part of the APCB activity. For this reason, the APCB will operated under the NDA. The APCB is responsible for verifying the authenticity of documents submitted and used in Product Certification.

With respect to the Certification program, the APCB serves under priviledge granted by the logo program, and hence answers foremost to the Program Manager above any immediate management authority the APCB may be operating under. Any deviation is grounds for withdrawal of APCB status.

3.1.2.3. Qualifications: Recognition Process for APCB

The APCB holds a position of high trust. Recognition as APCB is therefore both subjective and revocable. APCB recognition is based upon an applicant's compliance with criteria listed on this CPRM as well as additional information gained by logo program throughout the applicant evaluation process.

Applications for APCB recognition shall be submitted to the Certification Program Manager. The applicants shall directly address each requirement listed below in a manner that allows the responses to be easily compared with each requirement. The Certification Program Manager will forward completed APCB applications to the logo program consideration. The logo program will determine whether additional evidence or interview(s) are needed and will instruct the Certification Program Manager to so notify the applicant.

3.1.2.4. APCB Requirements

The APCB shall have the following minimum qualifications

- at least 3 years relevant professional work experience
- at least 2 years of relevant engineering related work experience in at least one of the following areas

    - product planning and project management
    - product design in physical, protocol, or application layers

- product evaluation and testing
- product regulatory testing
- product regulatory certification

- where APCB is part of a larger organization, the organizational arrangements should be such that departments having conflicting interests, such as production, commerical marketing, or financing do not adversely influence APCB compliance with the requirements of the Certification Program
- APCB shall have arrangements that ensure that APCB is free from any internal or external commerical, financial, or other pressures and influences that may adversely affect the quality of work
- authority to reject test resulsts based on non-conformance
- capable of maintaining confidential information
- at least 1 year of active participation in a related technical or qualification working group
- relevant degree in engineering or sciences, or equivalent
- ability to speak, read, write English at college level
- ability to compose a logical non-technical position and argument based on technical issues
- be available for participation in industry WG participation
- complete a Certification Program / APCB introductory course session held by CPM
- complete, with satisfactory results, the application and questionnaire for APCB recognition
- complete an interview with the CPM and logo program, or proxy thereof, for APCB recognition
- participate in Technical Advisory Board (TAB) once recognized as APCB

Furthermore, each APCB applicant acknowledges that continued recognition is contingent upon the applicant's maintaining both the complete trust of the program and the original APCB requirements met by the applicant. The logo program reserves the right to suspend any APCB recognition at any time, without warning. This includes, but is not limited to, changes in employment status and failure to maintain competence in the applicable specifications, test specifications, and certification policies. It is not necessary for the program to provide any specific reason for withdrawal of APCB priviledges.

The APCB shall annually declare in writing to the program:

- that no changes in the APCB's conformance with the recognition requirements have occurred,
- how the APCB continues as an active participant in the certification program, and
- how the APCB maintains competence in the SE specifications, and SE certification policies

Note that APCB appointment does not guarantee the validity of APCB's action (logo program cannot be held liable for any claims against a APCB).

3.1.3. Technical Advisory Board (TAB)

3.1.3.1. Definition

The TAB consists of Certification Program Manager, APCBs, APCL representatives, Lead Laboratory representative, in additional to other relevant technical experts from manufacturers. The TAB exists as an ongoing operations entity separate from the industry WG such as OpenHAN, OpenADR, OpenADE, Enterprise System. The TAB provides specific informational and operational recommendations to the program. Its function is advisory for feedback and improvements of the process of Certification program through the Program Manager. TAB shall seek to enhance the expertise and technical competence of its members in matters relating to edge product and system certification and testing.

3.1.3.2. Activities

The typical purposes of the TAB include:

- to address technical issues relating to conformance and interoperability testing of End Products and modules; including issues relating to test specificaitons, test requirements, test procedures, validated test equipment and validated test cases.
- to produce advisory notes for use by APCBs covering aspects related to test cases, guidance on test configurations, applicablility of test cases especially during transitional periods, and new testing techiques in order to iprove the practical implementations of the certification process.
- to review and decide on Test Case Waiver submissions, subject to review by the Lead Laboratory
- to provide a forum for free discusion of new ideas, developments, and advanced testing techniques relating to test requirements, methods, and equipment
- to provide an environment that will improve the practical and theoretical knowledge of members relating to the testing of End products and modules.

The primary function of the TAB is to advise and counsel the logo program in matters relating to product certification requirements and testing, including prolmes relating to test specifications, procedures, and equipment. A secondary function is the free exchange of knowledge among members. To help these functions the TAB will act as the input and source of knowledge on problems to the testing of End products and modules and on the certification process for the benefit of the entire Certification Program and the Lead Laboratory.

3.1.4. Lead Laboratory (LL)

3.1.4.1. Definition

The Lead Laboratory is appointed by the ICP as the operational arm of technical development, resolution, and ongoing repository of competence for the entire Certification Program. The LL is a test laboratory charged with the investigation of test methods, test equipment, and inputs from the TAB. The purpose of the LL is to maintain a center of core competence to uphold a robust Certification Program, and to normalize the trustworthiness of test results from the various APCLs.

3.1.4.2. Activities

The following activities are included in the LL scope of activities:

- Evaluation of test procedures, test cases, and test suites proposed by the industry SSO/ WG before final approval
- Coordinating and managing interoperability events for development, and certification readiness of upcoming specifications and products
- Evaluation and development of test systems (e.g. reference systems) used by the APCL and industry at large
- Proxy as technical operations arm of the Certification Program manager and program
- Evaluation of APCL for continued competence in testing for End Products and modules
- Coordinating and facilitating the output of TAB and resulting requests and requirements from the Certification Program Manager and/or program
- Serve as the operational arm of technical issues resolution, as necessary, for issues forwarded by TAB, and WG.
- In general to functional as center of excellence in technical matters related to the Certification Program, and to deploy that competence to the APCL
- The LL shall not commerically compete with existing APCL for testing and certification services.
- The LL shalll be capable of performing all tests required of ICP

3.1.4.3. Selection

The LL is selected and appointments renewed or revoked at the discretion of the SSO/SDO.

3.1.5. Approved Product Certified Laboratory (APCL)

3.1.5.1. Definition

The Approved Product Certified Laboratory (APCL) is a commercial or non-commercial testing laboratory focussed on delivering testing services as part of the Logo Certification Program. The APCL is charged with the responsibility of serving the logo program companies, to provide a clear and concise pass / fail result for Logo Testing based on the CRSL and the applicable test and technical specifications. The APCL status is granted by the logo program based on recommendation from the SSO/SDO. The APCL designation is a privilege which can be

revoked at any time by the logo program based on defined process of removal. Appointments are subject to evaluation and renewed biannually.

3.1.5.2. Activities

The following activities are included in the APCL scope of activities:

- timely implementation and maintenance of test procedures and test systems used in logo testing program
- participation and active contribution to industry WG and TAB
- provide testing services in accordance with the CRSL to the logo program member companies
- promptly address any issues identified by member companies, LL, TAB, WG, or logo program
- maintain competent personnel
- abide by the Service Level Agreement (SLA) defined with the logo program, and in force between the APCL, member companies, and the logo program

3.1.5.3. Selection

It is the intent of the WG to make selection recommendations based on the following:

- Overall result of both evaluation and audits of candidate APCL
- Geographic diversity of APCL locations in the Certification Program
- Fostering competition for service and technical excellence
- Basic organizational and technical strength
- Good management practices
- Recognized accreditations, including ISO Guide 17025 from an internationally recognized accreditation body under the ISO/IEC standarization structure
- Facilitating baseline business viability
- Commitment and ability to add value to the logo program organization through technical participation in working groups and advisory boards
- Experience in similar services
- Competent personnel
- Value brought to the logo program in general
- Work with APCB and submit to the APCB the results for review
- Capability or readiness to implement the following, both technically and budgetarily
  - product physical layer conformance testing (if applicable)
  - product protocol layer conformance testing
  - product interoperability testing
  - product network testing
  - product physical layer performance testing (if applicable)
  - network interoperability testing (if applicable)
  - product functional testing (if applicable)

The industry SSO/SDO will develop a complete evaluation procedure and documentation to assist APCL selection according to the above set of criteria.

3.1.6. Certificate Authority (CA)

3.1.6.1. Definition

The Certificate Authority (CA) is a commercial or non-commercial organization focussing on issuing the digital certificates for the Logo Certified Products. The CA is charged with the responsibility of serving the program member companies, to provide digital certificates to be embedded in to edge products. The CA status is granted by the logo program. The CA designation is a privilege which can be revoked at any time by the logo program based on defined process of removal. Appointments are subject to evaluation and renewed biannually.

3.1.6.2. Activities

The following activities are included in the CA scope of activities:

- timely issuance of digital certificates to Logo certified products
- management and control of digital certificate issuance system
- ensuring that the digital certificates issued are current and valid
- maintain competent personnel
- abide by the Service Level Agreement (SLA) defined with the ICP, and in force between the CA, member companies, and ICP.

3.2. Qualification of Laboratories

Laboratory Qualification is expected to be compatible with SGIP TCC guidelines / requirements.

3.3. Design of ICP

3.3.1. Process

An device or system industry manufacturer seeking an OpenSG compliant test and certification, such as ZigBee Smart Energy 2.x (ZEP2.x)/OpenADE/OpenADR, etc , of a new solution first completes an application for Certification (see Annex for details; a new device may be an End Product or a Module). This member selects an Approved Device Certification Laboratory (APCL) or Approved System Certification Laboratory (ASCL). The member seeking certification for a product, module or software system shall contract with the APCL as appropriate and when required, an Appointed Product Certification Body (APCB) for evaluation, testing, and certification services. The application process is the first step in the booking process. **It shall not possible to test and obtain a certification at the LL.**

The instance of the OpenHAN technology, such as ZEP2.x, provides a PICS proforma including all the features (Mandatory and optional) that certified product or module may support.

3.3.1.1. Products and Devices

The applicant supplies:

- Two product or module samples with supporting components (i.e. batteries, cables, chargers, notebook computers and associate hardware/software, etc. as needed to facilitate the evaluation)

- Signed and dated Laboratory Nondisclosure Agreement and Information Pack (soft copies preferred)
- User documentation
- Completed PICS proforma
- Completed PIXIT proforma. The PIXIT proforma will be provided by APCL at the beginning of the testing project
- Completed Declaration of Conformity - this must be finalized prior to certification but after testing is completed.
- Test reports for category C tests - supplied as available prior to certification
- A completed Signed Certification Mark License Agreement to permit use of the logo upon successful completion of Certification - to be completed prior to certification.

Where applicant seeks to certify more than one bill of material, product/module samples for each bill of material shall be provided. Based on a review of the differences between bill of materials, the APCL may waive this requirement.

The APCL with the APCB reviews the application, and determines test requirements based on the supplied PICS according to the current Certification Requirements Status List (CRSL).

The Compliant Portion of the proposed Certified Device shall be described precisely so that subsequent product change applications can determine whether a product/module change is Class I (outside Compliant Portion) or Class II (within Compliant Portion). When feasible, product model number, hardware version number and software version number shall be associated with the Compliant Portion rather than a higher level assembly. If the Compliant Portion is to be integrated into another end product, or if other Class I change is envisioned, the application shall describe the applicable hardware and software environment of the Compliant Portion sufficiently so that compliance can be ensured.

Certification Testing ensures that a IUT meets all Certification Criteria according to the vendors submitted PICS which determines through a mapping table which specific test cases in the currently applicable CRSL form the test plan that must be passed in accordance with the categories defined in the Certification Requirements Status List (CRSL - 3.1.10). The whole process shall be guided by a APCL. Tests include the following “Primary Test Categories” as shown in Figure 2:

PhyCT- Physical Conformance Testing
PCT-Protocol Conformance Testing
DIOT-Device Interoperability Testing
NIOT-Network InteroperabilityTesting
PhyPT-Physical Device Performance Testing

Testing requirements for a particular device are determined by the PICS and the applicable CRSL which identifies the current status of each applicable test and certification requirement. A PIXIT proforma is used to configure the implementation under test (IUT) in the test bed properly in order to run the test plan. Applicable tests shall be performed and results documented as required by their category. Test categories are defined in section 3.1.10. During the testing process each vendor has restricted access to the APCL’s web site for tracking and monitoring the progress of the testing of their equipment.

The APCL shall ensure that all testing requirements are satisfied by the particular hardware and software version certified. In general, no product change is permitted during certificaiton, except as expressly required by a Test Procedure within an appliable test case. The APCL may permit certain limited change if the APCL (a) has high confidence that such a change will not compromise the integrity of prior test results, or (b) repeats all test cases which might be impacted. Any product/module change introduced during certificaiton shall be documented and strictly managed by APCL. See section 4.1.6 guidelines on determining required retesting based on product changes.

When a product successfully completes all the required testing, test reports are assembled into a Compliance Folder. See section 4.1.2 for Compliance Folder details.

The APCB shall review the application and relevant certification documentation, including PICS, to determine that

- the vendor supplied product satisfies all current certification requirements;
- all mandatory PICS items are supported;
- the entire Compliant Portion is contained within the elements described;
- the hardware and software environment containing the Compliant Portion is sufficiently described to ensure compliance is maintained in that environment; and
- the Declaration of Conformity is complete and accurate.

After the APCB has determined that all necessary certification requirements are satisfied and the certification listing fee is paid, the APCB shall submit the Compliant Portion to the Certified Product/Module List along with necessary supporitng information (section 4.1.2) and shall add the product/module in which the Compliant Portion was evaluated to the End Product List.

Any deviation of the Compliant Portion thereof represents a Class I or Class II change. For example, a Device Module may be an Compliant Portion, as well as a particular microcontroller model with a specific firmware build.

Once the product or module is certified, the Certificate Authority (CA) issues a digital certificate to be programmed into the devices, for use in joining a utility smart grid network.

3.3.1.2. Software Products/Systems

The Product Certification Program aims to achieve compliance and interoperability of all instances of OpenADR and OpenADE systems. The Product Certification Program is sponsored by a SSO, and accredited by the OpenSG.

An OpenADR and OpenADE instantiations seeking Certification from the Program sponsor shall submit an application and an instance for evaluation by the Appointed Product Certification Laboratory (APCL) for compliance and interoperability.

The Compliant Portion of the proposed software product / system shall be described precisely so that system can state supported feature set. All changes shall undergo regression testing.

Certification Testing ensures that the System meets all Certification Criteria according to submitted PICS, which determines through a mapping table the specific test cases in the

currently applicable CRSL that form the test plan the system must pass. The whole process shall be done through an APCL. The Tests include the following Primary Test Categories:

A/E : Authentication and Encryption
PCT : Protocol Conformance
NIOT: Network Interoperability
FUNC: Functional Testing

Testing requirements for a particular system is determined by the PICS and the applicable CRSL. A PIXIT is used to configure the test set-up in order to run the test plan. Applicable tests shall be performed and results documented as required by their category. During the testing process each vendor has restricted access to the ASCL's web site for tracking and monitoring the progress of the testing.

When a system successfully completes all the required testing, test reports are assembled into a Compliance Folder.

The qualified person from the sponsoring SSO/SDO shall review the application and relevant certification documentation, including PICS, to determine that the system supplier satisfies all current certification requirements;

All mandatory PICS items are supported;
Compliant Portion is clearly defined;
the Declaration of Conformity is complete and accurate

3.3.2. Program and Program Version

The Testing and Certification Program set up by the SSO/SDO shall have a well defined release version number, to designate the policy and procedures in effect at any time during the program implementation.

3.3.2.1. Product and Module

A. General

A product or module shall have a certified Compliant Portion. The listing member company may intend to apply the certified Compliant Portion to a family of similar end product models or modules, either initially or subsequent to the initial listing.

Furthermore, the member company is allowed to sell the Compliant Portion for integration, resulting in end products offered by another member company if the Compliant Portion is listed as a Certified Module (See section 4.1.7).

Performance may be impacted by integration of a Compliant Portion into a different end product, and testing will typically be required when the end product differs or when the end product manfuacturer (integrator) is different from the Compliant Portion manufacturer according to Class I, Class II, or Class III change rules by a APCB.

Every End Product shall be listed on the End Product List.

Integration of a Compliant Portion into an end product different from the end product in which it was certified, may impact the performance, for example if the antenna placement or environment changes, or if the host environment is otherwise different. Such integration shall be considered within the Class I, Class II change rules by a APCB.

A member seeking to list a End Product shall complete an online application for Certification. An End Product application shall reference the Module or Compliant Portion of a Certified Product integrated into the End Product if the member wishes to claim abbreviated certification process.

When integrating a Module, an application for End Product certification shall declare that the hardware and firmware/software environment containing the module complies fully with that required by the Module, and provide supporting documentation as needed. Such integration shall be considered within the Class I, Class II change rules by a APCB.

When integrating a Compliant Portion that is not a Module, an application for End Product certificaiton shall describe any variation form the specific End Product in which the applicable Complant Portion was certified. Such integration shall be considered within the Class I, Class II, and Class III change rules by a APCB.

An End Product application may cover a family of end product models, provided the compliant portion is identical, and the applcation shall describe the end product family in a sufficientl detail to permit evaluation of potential impact of product family variations on performance including radiated performance.

A End Product application is reviewed by APCB to determine testing requirements with reference to CSRL and section 4.1.6, “Certification Program Class I/II/III Change Guidelines”. Indicated testing shall be performed and documented in the End Product Compliance Folder. After the APCB has determined that all necessary certification requirements have been met and the logo fee is paid, the APCB shall submit the end product into the End Product List along with necessary supporting documentation.

It is allowed to start certification testing for an end product before the initial product completes its certification, on condition that the end product does not complete certification before the inital product completes and obtains its certificate. In all cases the end product must follow the rules and policies as defined in section 3.1.1.3.

A certificate is issued for each End Product and Module Listing.

B. Change to End Product or Module

A change to an End Product or Module shall be reviewed by a APCB. When a listed product is changed, the member responsible for the listing shall complete an application for Certification Change online.

A Change application shall include the following:

- identify pertinent End Product or Module record,

- amended Compliant Portion or End Product / Module description as applicable
- amended PICS if applicable
- product change description, and
- executed revised Declaration of Conformity

The product/module change description shall be sufficient to determine the scope of testing required to determine that the change device is compliant.

The APCB may request additional information as needed to complete the review. The APCB shall determine additional testing as deemed required.

C. Device Certification Requirements

Product/module certification is associated with (a) a category (such as a device class as defined by the SSO/SDO), (b) a particular System Profile Release number and version and (c) one or more Certification Profile(s). To certify a product/module, a vendor completes the applicable PICS forms.

In the PICS, the vendor states the functions supported by the product/module to be certified. The completed PICS is used to generate a list of applicable Test Cases based on the test case mapping table (contact the APCB for a copy) within the online certification system.

The list of applicable test cases is used in conjunction with the current CRSL to determine which test cases shall be performed. See section 3.1.10 for detailed information on the CRSL.

3.3.2.2. Software Systems

A certified system for OpenADR or OpenADE consists of a Compliant Portion that implements features according to requirements for their server and/or client system.

A vendor system is evaluated and judged to be a Certified System when found to be in compliance by an ASCL; evaluation is performed against Reference System for interoperability, when available, and test suites derived from abstract test suites from OpenADR and OpenADE as relevant. It is not necessary to attain an equivalence with the reference system, i.e. all feature sets are functionally identical, but that those features sets represented in the vendor system be evaluated to be equivalent to the reference system implementation.

An instantiation of the reference system itself is not considered to inherit any Compliant Portion; that instantiation must be evaluated and judged as any vendor system for equivalent portions.

Reference Systems

Reference system(s) is(are) defined to be compliant implementation of the specification either by evaluation or by definition by the sponsoring SSO. The reference system, as a rule, need to be subject to direct implementation by instantiation by participants of the SSO. Therefore, an implementation cannot be a “reference system” if it is an “equivalent” system.

Candidate Reference Systems

Candidate reference system(s) is(are) defined to be a conforming implementation of the specification. Candidate reference systems are by definition not reference systems, though they may be evaluated for equivalence to reference systems, and compliance to requirements of OpenADR or OpenADE.

Changes to Certified System

Any change to the System shall be reviewed by ASCB. When a listed system is changed, the vendor responsible for the listing shall complete an application for Certification Change online.

A Change application shall include the following:

- Identify pertinent System record
- amended Compliant Portion description as applicable
- system change description
- amended PICS as applicable
- executed revised Declaration of Conformity

Unless member is willing to perform code review with the ASCL, changes to System shall require complete regression testing of the certification tests cases.

System Certification Requirements

System certification is associated with a server or a client implementation of OpenADR or OpenADE or AMI-ENT requirement.

In the PICS, the vendor stipulates the functions supported by the system to be certified. The completed PICS is used to generate a list of applicable Test Cases based on the test case mapping table within the online Certification System. The list of applicable test cases is used in conjunction with the current CRSL to determine which test cases shall be performed.

3.3.3. Self Testing and Certification

To be determined once the third party testing and certification system is sufficiently mature and products and systems objectively show an acceptable degree of interoperability throughout the program over extended periods of time.

3.3.4. Device Compliant Portion Testing

The End Product or Module is subject to testing for its proposed compliant portion. The testing involves layers, from the physical all the way to the network interfaces.

3.3.4.1. Physical Conformance (PhyCT): Radio, PLC, wireline

Physical Conformance Testing assesses the compliance of the physical layers of an implementation seeking certification to the applicable base or core specification of the mandatory and optional features of the physical transport layer PHY (IEEE 802.15.4, IEEE 802.11, etc), as applicable to the type of End Product or module.

Typically, Physical (RF, wireline, or PLC) Conformance Testing is not concerned with and does not cover assessment of performance, reliability or robustness of the entity under test, unless explicitly stated as a conformance requirement in the conformance testing specification.

Physical Conformance Testing does not add constraints to those stated in the core specifications and consists of a series of tests against the physical conformance requirments stated in the applicable radio/plc/wireline conformance testing specification.
A radio/plc conformance requirement is an elementary piece of the core specification stating what a SE implementation seeking certification is reqiured to do or not to do.

An implementation is found as conformant with the physical layer core specifications when it satisfies all the selected physical layer conformance requirements contained in the CRSL based upon completing the required tests and executing the DoC.

For example, the radio physical layer conformance requirements of ZigBee devices are derived from the basic IEEE802.15.4 radio layer specification over the operational temperature and humidity range of the device as declared in the PIXIT, and include: power spectral mask and density, center frequency and tolerance, sensitivity/packet error rate, modulation/demodulation, error vector magnitude, adjacent and alternate channel rejection, turnaround time, clear channel assessment, energy detection, and link quality indication.

An implementation is found as conformant with the physical conformance related core specifications when it satisfies all the selected physical conformance rquirements contained in the CRSL based upon completing the required tests and executing the DoC.

3.3.4.2. Protocol Conformance Testing (PCT)

Protocol Conformance Testing assesses the compliance of the protocols implementing the MAC layer and Network Layer of the implementation seeking certification to the applicable base and core specification (IEEE802.15.4:2006 and ZigBee IP for ZigBee, HomePlug SE Specification for HomePlug, IEEE802.11b/g for Wi-Fi).

Protocol Conformance Testing does not add constraints to those stated in the core specifications and consist of a series of tests against the protocol conformance requirements stated in the applicable protocol conformance testing specification.

A protocol conformance requirement defines the core specification stating what an implementation seeking certification is required or not to support.

For example, The ZigBee-related protocol conformance requirements are derived from the IEEE802.15.4 MAC layer and ZigBee IP specification along with the PICS and PIXIT documents relating to those MAC and NWK layers.

An implementation is found as conformant with the protocol-related core specifications when it satisfies all the selected protocol conformance requirements contained in the CRSL based upon completing the required tests and executing the DoC.

3.3.4.3. Interoperability Testing (IOT)

Interoperability is key to customer acceptance. Interoperability testing for Logo Certification requires a minimum of three different golden unit vendor devices. The interoperability configuration scenario must include at least two different physical layer chipset vendors. Each

end product/module must demonstrate interoperability with at least three different certified Energy Service Interface (ESI) if it is not an ESI; if an ESI, it shall demonstrate interoperability with at least three different PCT and IHD combination. This enables the basic network interoperability.

Additional to the above requirement, each product/module must demonstrate interoperability with at least two different certified end product/module (from at least two vendors) and at least one device should be the reference unit selected by industry WG. This enables general market device interoperability.

Interoperability testing is enhanced as more vendor equipment is made available from different vendors.

The interoperability certification test bed shall be available at each APCL for all currently required interoperability tests. The tests shall include all relevant profile device roles and application functionality declared in the PICS and PIXIT, and test for: trust center policy, network management policy, commissioning and installation, power failure/start-up, use cases, stress cases, over-the-physical media download.

A implementation is found as conformant with the interoperability core specifications when it satisfies all the selected interoperability requirements contained in the CRSL based upon completing the required tests and executing the DoC.

3.3.4.4. Physical Performance Testing (PhyPT)

Physical Performance Testing (PhyPT) requirements provide physical layer performance metrics intended to determine the limits of performance of End Products and modules, for example in an over-the-air (RF) environment. In such case, tests are intended to determine the transmitter and receiver performance and sensitivity in normal operation in the presence of far-field (for RF case) interferers causing transceiver desensitivity. PhyPT tests are critical in that they provide necesssary information on the radiation pattern of the device as used, and the effect of interaction factors between the radiated field and the circuitry of the device.

The PhyPT shall include the following based on the PIXT and PICS declarations: range and directionality (link budget and sensitivity verification), and immunity/desensitivity to known interferers.

PhyPT is required for the Certification of End Product/module. The test report will be included in the Compliance Folder and test results become part of the Compliant Portion of the end product/module. It is the intent of industry WG to conduct a regression analysis across the applicable Certification profiles on data collected during PhyPT. Industry WG will then request an approval of a baseline criteria for example, Smart Energy 2.0 for future PhyPT testing.

3.3.4.5. Network Conformance Testing (NCT)

Network Conformance Testing (NCT) complements PhyCT, PCT, IOT as a system level conformance testing for end-to-end from the utility head end to the HAN network.

NCT ensures that compatible state machines and protocols are employed at the product level, as with the utility head end. This includes frame compatibility with communication between the servers and client applications.

Network Conformance Testing does not add constraints to those stated in the core specifications and consist of a series of tests against the network conformance requirements stated in the applicable network conformance testing specification.

A network conformance requirement defines the core specification stating what an implementation seeking certification is required or not to support.

For example, The ZigBee-related network conformance requirements are derived from the ZigBee IP and SE 2.0 application protocol specification along with the PICS and PIXIT documents.

An implementation is found as conformant with the network-related core specifications when it satisfies all the selected network conformance requirements contained in the CRSL based upon completing the required tests and executing the DoC.

3.3.5. Software System Compliant Portion Testing

The system is subject to testing for its proposed compliant portion. The testing involves the entire set of use case tests as derived from relevant abstract test suites.

3.3.5.1. Authentication and Encryption

The system is subject to testing the mechanism for establishing secure sessions. Testing involves negotiating key, access level, and establishing a session for a specific account.

3.3.5.2. Protocol Conformance

Verify that the system implements methods, data frames, and interfaces of the prescribed in the communication method.

3.3.5.3. Network Interoperability

Communication between Server to Client reference systems. Network API shall be consistent with SE 2.x implementations and shall either be RESTful or SOAP but not both.

3.3.5.4. System Functional Testing

Verification of state machine according to requirements of OpenADR or OpenADE or AMI-ENT. The testing shall be based on defined test cases derived from abstract test case scenarios of the System Requirements from OpenSG. Use cases shall be derived from the various functional requirements as stipulated by the abstract test cases, and such testing shall be performed using a Reference System or a validated Test Harness agreed by the SSO.

3.3.6. Certification Requirements Status List (CRSL)

3.3.6.1. Definition

The Logo Certification Program currently certifies devices on 3 levels of conformance and interoperability test specifications. The corresponding PICS documents specify the mandatory and optional requirements for all the test specification documents. The Certification Requirements Status List (CRSL) specify the testing requirements at any given time, and gives guidance to APCL and APCB on testing and recommendation for certifications. The CRSL is maintained by the LL.

CRSL versions include changes to the test requirements and test specifications. Requirements for certification are set by the CRSL version effective on the date that the device is certified.

A CRSL Interim Release includes the results of the CCB process, and introduces new requirements that will become active in future CRSL Major Releases. A (x.0.0) of the CRSL shall occur twice annually. A public interim release of the CRSL (x.y.0) shall occure no more frequently than once per month.

Requirements upgraded in Major Release (x.0.0) shall be available in an interim release of the Major Release (x-1.y.0) effective 45 days prior to Major Release (x.0.0). Vendors have 90 days to submit their equiment for certification to be tested against this major release.

IUT undergoing certification testing when the next major release becomes effective have 45 days to complete testing. Test requirements are defined by the major release under which the IUT is submitted. Test cases which become active after the next major release are not required.

3.3.6.2. CRSL Structure

The CRSL defines the current status of each test case in a list. The list contains the following information:

Designator - test case identifier
Name - descriptive text from the test specification
Current requirement -
Test specification number and version
Test Case Category
Available date: date at which the test case may be used as the indicated Test Case Category
Active date: date at which the test case shall be use d at the indicated Test Case Category
Associated notes
Previously published requirement
-Test specification number and version
-Test Case Category
-Status
-Active date
-Associated notes
Informative
-Test Case Priority
-Test Platform: Validated test platforms for both the current and previous test case

The following applies for each test case requirement:

- Prior to the Available date of the current requirement, the previously published requirement shall apply.
- From the Available date until the active date of the current requirement, the vendor shall choose to apply either the previously published requirement or the current requirement.
- From the Active date, the current requirement shall apply.

Issue of an update to the CRSL is managed and approved by the industry WG. Updates to the CRSL include changes to test case categories to reflect the addition of new validated test

cases, the downgrade of previous validated test cases, and the revalidation of downgraded test cases. The LL shall implement the CRSL updates.

3.3.6.3. Test Case Categories

The Logo Certification Program assigns each test case from the test specification a Test Case Category. A test case is validated when a validated test platform is available, and required for implementation.

Category A

The device shall pass each Category A test case at the APCL on a validated test platform. These are the validated test cases. A test report shall be generated according to ISO Guide 17025.

Category B

The device shall pass each Category B test case at the APCL. Pass/Fail verdict is assigned and the test reported generated according to ISO Guide 17025. These are typically test cases that have been verfiied and can be executed with unambiguous results, but for which test case validation is incomplete.

Category C

The device shall pass each Category C test case either at the manufacturer or the APCL. In case the test is done by the manufacturer, a test report shall be submitted to the APCL. Pass/Fail verdict shall be assigned.

Category D

Test cases may be downgraded from A or B or C by the LL, but must be revalidated and reinstated to its prior status without delay, upon resolution of any issues.

Category E

The device shall perform Category D tests at the APCL and a test report generated. However there is no Pass/Fail verdict assigned.

Category I

Test cases planned for further development and listed for informational purpose.

Category P

Test case planned for validation or awaiting approval but currently listed for informational purposes.

3.3.6.4. Test Case Category Transition

A Test Case Category for a test case may or may not change over time. Test Case Status is communicated using the CRSL Interim and Major release. The following list describes, in part, the typical assignment and re-assignment of test case categories:

- All test cases start as Category I.
- Test cases selected from development are moved to Category P in the next major release.
- If a test case upgrade proposal from Category B to Category A is accepted for inclusion in the next Interim Release of the CRSL, the following rule shall apply
- The upgrade is effective immediately
- Testing underway may (test start date prior to upgrade) may continue their certification testing without regression testing.
- The initial Available Date shall not precede the CRSL publication date. Test cases may be immediately downgraded temporarily to Category D in specific circumstances under the authority of LL and reinstated without delay, maintaining the original active date if the reinstatement does not occur past the original active date. Test cases are not necessarily downgraded due to a single test platform losing validated status.
- All other category transsitions (upgrades) are effective at the next Major Release of the CRSL.

3.3.7. Testing and Interoperability Principles

The ultimate goal of the ICP is an eco-system of *interoperable* devices and systems. For the purpose of this discussion, interoperability may be loosely defined as a correspondance of interfaces between two abstract functional units, of which communication is possible.

To this end, it is important for the certification program to assure a well defined minimum interoperable set of features, whether it be functionality, user interface, or application interface.

3.3.7.1. Non-overlapping Feature Set

A simple set of best practice principles help facilitate a robust interoperable interface. These are:

a) a specific set of functions shall be defined into “profiles”. A profile is a finite set, or grouping, of functionality.

any function belonging to a profile shall be reproduced by implementing the entire profile of mandatory functions by another device sharing that function. In other words, profiles are exclusionary of other like functions. For example, a mandatory function A, belonging to a profile X can be implemented in another device via the entire profile X, and never a partial implementation of X. A device adopting profile X must therefore implement the whole mandatory function set that includes function A.

A function in profile X shall not be duplicative of another function in profile Y, if that function is already existing in profile Y.

The above principles dictate that extreme care must be taken to design profiles; in other words, profiles need to be designed to coexist with other profiles; functions within profiles X and Y need to be exclusionary yet complimentary, but never overlapping.

Test suites shall evaluate individual profiles, with test cases addressing functions of said profile.

The non-overlapping feature set may be coupled with a branidng or logo program

3.3.8. Certified Product Listing

When the Logo Certification criteria are satisfied, and with the agreement of the vendor, the APCB shall post the product / module onto the Logo Certified Product registry with the following information:

Product Name
Certified Product Type
Certification Number
Date of Certification
CRSL date
CRSL associated version number
Detailed product information in text form (not more than 200 words)
Product image in jpg format no larger than 300 x 300 pixels
Company logo in jpg format no larger than 300 x 300 pixels

The APCB shall ensure, prior to completing the product certification process, that the equipment vendor is still a member in good standing with the logo program, and that the certification testing fee and certifcation logo fee are collected per certification. With the explicit agreement of the applicant, the APCB will enter the data into the Logo Certified Product registry and create an electronic Logo Certification Certificate from this data.

3.3.8.1. Digital Certificates

Once a product enters the Logo Certified Product registry, the CA shall generate a digital certificate for that product and issue it to the applicant.

3.3.8.2. Compliance Folder

The Compliance Folder shall provide the actual Record of Work for conformance to the certification process. The minimum required information is listed below. For additional information, see Annex.

Minimum contents in the Compliance Folder:

Member name
Exact model number
Exact kit number if applicable (i.e. variant number)
Hardware version and change history
Software version and change history
CRSL version number
PICS
PIXIT
Test Report
Applicable waivers and their descriptions and reasons, and any change requests
Declaration of Conformance

All vendors shall maintain a duplicate set of Compliance Folder for their certified product. The logo program, at its discretion, order additional reviews of the Compliance Folder. Any such additional Compliance Folder reviews shall be at the expense of the logo program and be conducted by a mutually agreeable third party contractor that is not an employee of another manufacturer.

3.3.8.3. Logo Certificate

After the Logo Certified product is listed in the Logo Certified Product List, the Certification Program Manager shall issue a hard copy of the Certification to the vendor with special heavy stock paper.

3.3.8.4. Removal of Products from Certified Product List

The primary contact for the particualr product posted on the Logo Certified Product List may request that the product be removed from public view anytime. The removal request should be sent to the Certification Program Manager. This action only affects the public view of the product on the List.

3.3.8.5. Changes to Certified Products

Any change to a certified product falls under one of two classes: Class I or Class II.

3.3.8.6. Determining Class of Change

All devices put on the market shall meet the requirements for which the product has been certified. The Logo Certified Product List registers products/modules having a specific hardware and software version. The product manufacturer is responsible to ensure that the Compliant Portion of all production units are identical to the certified version in all material aspects.

Any change to the Compliant Portion of the Logo Certified Product shall be documented in the Compliance Folder of the manufacturer, and the manufacturer shall notify the APCB of those changes. The manufacturer may initially classify the class of change; however the classification noted by the APCB shall be the class of record. The APCB shall determine what additional testing is required, according to the Annex guidelines and documentation provided.

Class I Changes

A Class I change is a product change that has no impact to the hardware or software within the Compliant Portion and no change to the declared functionality in the PICS.

For Class I change, no testing is required. For any change in the product name or product version, the Compliant Folder will be revised to reflect the change, and the APCB is responsible to effect the change in the Logo Certified Product List.

Class II Changes

A Class II change is a software or hardware change to the Compliant Portion or to the functionality declared in the PICS.

The member shall supply the APCB with the detailed change description, and estimated impact to the results of the tests implemented according to the CRSL in effect at the time of the certification testing at the APCL. The member may add a proposal on the scope of required re-testing.

The recertification testing is done by the APCL using the current CRSL. Based on the technical evaluation of the supplied change documentation, the APCB may determine that certain prior test results may be reused.

The test requirements shall be determined by APCB based on the current CRSL. Test reports from the former certification testing may be reused in portions or in its entirety depending on the test requirements and judgement of the APCL.

Based on the review of product change documentation, the APCB shall determin test cases to be conducted on the product.

The APCB may require additional informaiton as necessary to determine test cases to be conducted.

3.3.8.7. Re-certification versus Change to Certification

The change classification to a certified product is determined by the impact of that change on the Compliant Portin as shown in the table below.

Class Category	Definition	Re-certification	Responsibilities
I	Software and/or Hardware change outside the Compliant Portion	No	Manufacturer is responsible for any testing, and informational changes and any test results are recorded in the Compliance Folder.
II	Software and/or Hardware change affecting the Compliant Portion	Yes	Any and all tests are to be performed by the APCL. Changes and test results need to be recorded in the Compliance Folder

For Class I changes, any testing are responsibility of the member, and testing can be conducted by the manufacturer, or by APCL. Test results shall be recorded in the Compliance Folder. For Class II changes, any and all tests are to be performed by the APCL.

3.3.8.8. Module Policy

A Logo Certified Product may be designated as a Module at the option of the member responsible for the listing. Desiginating the Logo Certified Product as a Module facilitates the reuse of the Module in a broader range of End Products. Certification requirements for the Module include all requirements for the Logo Certified Product, and additionally information described in this section.

A Module is a hardware and software combination that constitutes a Compliant Portion when installed within a specified hardware and software environment. Typically, a Module will include a software driver, hardware module, and antenna. Annex gives an informative guideline on Modules.

The description of the Module on the Logo Certified Product List shall identify:

- hardware and software comprising the entire Compliant Portion,
- description essentional to operation of the module,
- hardware and software versions certified.

To certify a Module, the APCB shall determine that

- the vendor supplied product satisfies all current certification requirements,
- the entire Compliant Portion is contained within the Module,
- the hardware and software environment required for the Module is sufficiently specified to ensure adherence of the Compliant Portion to the certified conditions.

The same Product change rules apply to Modules.

3.3.8.9. Inheritance of Compliant Portion of Modules

When a certified Module is incorporated into a product, the integrator may change the antenna front end to the module. The integrated product may be certified as a End Product when the APCB determines that a APCL RPT test yields results with acceptable outcomes. Exception applies when there are no changes to the antenna front end, housing, or any characteristics impacting the Compliant Portion.

An example for a streamlined process for OEMs using a previously certified Module is shown in the table below as a guide.

Vendor	Scenario	Required Testing	Approximate Cost	Documents
Module Vendor	Initial Certification	PhyCT, RCT, IOT, PhyPT, NCT	Full certification testing cost and logo fee	All test reports and Compliance Folder

End Product Vendor	Initial Certification using a certified Module	PhyPT	PhyPT test cost and logo fee	PhyPT test report and Compliance Folder, plus a reference to Compliance Folder of Module

3.3.8.10. Integrated Products and Re-Branded Products

During its life cycle in the market, certified products may at times be integrated into larger systems, or re-branded without the Compliant Portion undergoing any material change. In order to maintain traceability of the certified product through the market place, and to ensure that Compliant Portion certified status is indeed maintained, it is necessary to manage the integration and re-branding processes.

Using a new brand name for a previously certified product is allowed without additional logo fee if a new listing is not requested. However, in such cases, the product shall bare clearly the original certification ID. If a new listing is requested, a logo listing fee shall be charged, and a replica record created in the Logo Certified Product list with the new brand information.

Additionally, original design manufacturers (ODM) may design, manufacture, and certify a product or module for a second client company. In such cases, the client company is responsible to create a new listing request for the product to be Logo Certified Product under the client company.

Any change in the Compliant Portion shall be processed under the change classifications scheme.

3.3.9. Certified System Listing

When the Logo Certification criteria are satisfied, and with the agreement of the vendor, the ASCL shall post the system onto the Logo Certified System registry with the following information:

System Name
Certified Feature Set
Date of Certification
CRSL date
CRSL associated version number
Detailed system information in text form
Company logo in jpg format

The ASCB shall ensure, prior to completing the system certification process, that the system vendor is still a member in good standing with the logo program, and that the certification testing fee and certification logo fee are collected per certification. WIth the explicit agreement of the

applicant, the ASCB will enter the data into the Logo Certified System registry and create an electronic Logo Certification Certificate from this data.

3.3.9.1. Compliance Folder

The Compliance Folder shall provide the actual Record of Work for conformance to the certification process. The minimum required information is listed below.

Minimum contents in the Compliance Folder:

-Member name
-System name
-Software execution environment
-Software version and change history including MD5 Hash
-CRSL version
-PICS
-PIXIT
-Test Report
-Applicable waivers and their description and reasons, and any change requests
-Declaration of Conformance

All vendors shall maintain a duplicate set of Compliance Folder for their certified system. The logo program, at its discretion, may order additional reviews of the Compliance Folder. Any such additional Compliance Folder reviews shall be at the expense of the logo program and be conducted by mutually agreeable third party contractor that is neither an employee of another vendor.

3.3.9.2. Logo Certificate

After the Logo Certified system is listed in the Logo Certified System List, the Certification Program Manager shall issue a hard copy of the Certification to the vendor with special heavy stock paper.

3.3.9.3. Removal of Systems from Certified List

The primary contact for the particular system posted on the Logo Certified System List may request the system be removed from public view any time. The removal request should be sent to the Certification Program Manager. This action only affects the public view of the system on the List.

3.3.9.4. Changes to Certified System

Any change to the system shall require regression testing as a rule, unless deemed unnecessary by the ASCB.

3.3.9.5. Reference System Instantiations

Vendor systems derived from Reference System is considered an instantiation of the Reference System and not the Reference itself. As such, the practical status of instantiated reference system is the same as any system claiming conformance to specification.

3.3.9.6. Equivalent Clean Room Implementations

Vendor systems implementing a parallel Reference System is same as any system claiming conformance to specification.

3.3.9.7. Candidate Reference Implementations

Vendor systems implementing a Candidate Reference System is same as any system claiming conformance to specification.

3.3.10. Validation of Test Harness for Device Testing

3.3.10.1. Submittal Process

A test harness subject to consideration as part or whole of a validated test system for Logo Certification shall satisfy the following submittal criteria:

a) be available for commercial purchase by testing laboratories and Member companies
b) support the Test Control Interface (TCI) for relevant Primary Test Categories and protocol layers
c) include scripting capability for automated test runs
d) supply test cases in accordance with the CRSL; implementation must be at least one complete test category out of five Primary Test Categories
e) as appropriate, subject to calibration cycles

The CPM shall review the test harness submittal for the above minimum submittal criteria (may be outsourced to LL), to be an eligible candidate system of detailed evaluation for validation as an official Logo Certification Test Harness.

3.3.10.2. Evaluation Process

A test harness, accepted for consideration as part or whole of a validated test system for Logo Certification, shall undergo technical evaluation by the LL, and the LL is responsible to sign-off on the technical viability of the system as a test harness for the industry.

The validation process shall at minimum involve the following steps:

1. Execution of the relevant CRSL scope, through a Test Control Interface (TCI), as implemented for the Primary Test Category of the test harness, and obtaining the expected results that include the use of the Golden Units designated by the CPM for the Product Logo Certification Program.
2. Examination of the upper tester and lower tester logs, along with the over-the-air/physical media results, to determine the proper recording and evaluation of the test results.
3. Test harness shall exhibit a gage R&R of relevant reference Primary Test Category tests of less than 5%.
4. Test harness shall exhibt a gage R&R of relevant reference Primary Test Category tests of less than 10% between homogenous and heterogenous test harness set-ups at different laboratory locations (i.e. in APCLs).

Note that the procedure to perform the Gage R&R using the reference Primary Test Category tests are the responsibility of the LL.

3.3.11. Validation of Test Harness for System Testing

In order to institute a stable Logo Certification Program, a reliable testing program is essential. One basis of such a program is the use of well defined “test harness”. Any such test harness shall be officially “validated” by the CPM as capable of performing the required testing. All ASCL are required to have access to and use reference system or validated test harness to peform Logo Certification testing for relevant test categories.

System tests are required for the following:

A/E : Authentication and Encryption
PCT : Protocol Conformance
NIOT: Network Interoperability
FUNC: Functional Testing

All test harnesses tasked to perform the test need to be able to complete the entire set of tests as described in the applicable CRSL for at least one primary test category.

Once a test harness(es) is validated to perform the CRSL tests, all such instances of the test harness at or accessed by ASCL need to be monitored for continual validity of the entire Logo Certification Program. Therefore, it is critical that tests be repeatable and reproducible, i.e. repeated measurement results are consistent, and that those measurements are reproducible by other laboratories that may be using different instances of the validaged test harnesses. The Certification Program shall maintain a specific level of software version for all testing. The representative tests (reference primary category tests) shall be selected by the LL on an ongoing basis, and verifcation performed across the ASCL at least once a year.

3.3.11.1. Submittal Process

A test harness subject to consideration as part or whole of a validated test system for Logo Certification shall satisfy the following submittal criteria:

A. be available for commercial purchase by testing laboratories and Member companies
B. support the Test Control Interface (TCI) for relevant Primary Test Categories and protocol layers
C. supply test cases in accordance with the CRSL; implementation must be at least one complete test category out of Primary Test Categories
D. maintain strict version control through CVS or SVN

The CPM shall review the test harness submittal for the above minimum submittal criteria, to be an eligible candidate system of detailed evaluation for validation as an official Logo Certification Test Harness.

3.4. Improvement and Corrective Action / Feedback

3.4.1. Certification Process Exceptions

While the present Certification Program Reference Manual attempts to cover all contingencies that may occur during the Certification Program, inevitably, new needs and issues continually arise, and the program shall install processes to enable a flexibility in the program for continual improvement.

In general contingencies will occur that interrupt the planned certification process. These contingencies may occur at various steps along the device testing and certification process, and can generally be categorized into two characters:

Problems arising in the course of executing the certification process: Process Problem
Problems arising due to strong and quantifiable objection by members: Disputes

The following describes the nominal process to handle such contingencies.

3.4.1.1. Process Problem Resolution

There can arise may potential problems within the Logo Certification Process that can cause significant delays in certification of a vendors product. These problems include, but are not limited to

- Test Harness issues,
- Interoperability issues between optional or conditional features of vendor devices and implementations
- Specification issues, etc.

The following creates a process framework to provide at a minimum, a predictable path to resolution for any potential problem that may arise.

Change Request Process

In order to provide a solution to a problematic component of the certification process, the program provides its members the possibility to go through the Certification Change Request process (CCR). The CCR process is based on three steps: generation, evaluation, and resolution.

1. CCR generation: Vendor issues a CCR describing the problem and the test cases, PICS, specifications affected by this problem to the APCB. The APCB is responsible to review the CCR and consult with the LL.
2. CCR evaluation: LL, along with the APCB evaluates the CCR and endorses or rejects the CCR. In the case of endorsing the CCR, the LL shall recommend a resolution. The endorsement is forwarded to the TAB. The process shall take place within 5 business days from reception of the CCR.
3. CCR resolution: The LL has further 5 business days to implement any technical resolution to the CCR under the LL's direct control and implement any necessary CRSL revisions. The TAB shall locate, as necessary a sponsor within the industry

WG to affect any change in the technical specifications by the CCB process to institute a permanent fix to the problem.

CCR

The SSO and CPM must implement a the submittal and template for the Certification Change Request (CCR).

3.4.1.2. Process Dispute Resolution

All disputes relating to product certification shall be resolved by the following process.

Overview

Disputes not immediately affecting the certification process, but nonetheless are deemed serious enough for a vendor to raise, can be processed in a procedural way. The following is essentially a formalized disupute resolution, when other alternatives methods of are not available.

Binding Resolution

tbd.

3.4.1.3. Jurisdiction

A vendor may initiate a dispute resolution proceeding in accordance with this section for a dispute that relates to a certified feature or aspect of a Certified Product.

Informal Dispute Resolution

Prior to initiating formal dispute resolution the member shall seek in good faith to resolve disputes informally.

A. Dispute Resolution Demand

If parties are unable to resolve the dispute within 30 days after the parties commenced informal efforts to resolve the dispute, either party may demand formal dispute resolution by delivering a demand in writing to the other party and to the Certification Program Manager.

B. Hearing by Dispute Resolution Committee

Each dispute brought pursuant to this section shall be heard by a dispute resolution committee defined by these rules. The decidion fot he Dispute Resolution Committee shall be final and binding to both parties with respect to all certification matters. The Dispute Resolution Committee is formed by the Certification Program Manager at his/her discretion.

C. Dispute Resolution Fee

Before the Dispute Resolution Committee considers the dispute, the party demanding adjudication of the dispute shall pay a non-refundable processing fee. The Certification Program Manager and the Dispute Resolution Committee shall not

act unless the fee has been paid. Where the final decision is deemed favorable to the party demanding adjudication, the fee shall be reimbursed.

D. Hearing Schedule

Upon receipt of the demand notice for the dispute resolution and payment of the processing fee, the Certification Program Manager shall promptly set up the Dispute Resolution Committee and send a copy of notice to parties involved via email with acknowledgement. This notice shall define a “Notice Date” for purpose of calculating all further actions in the dispute resolution process.

If the decision fo the Dispute Resolution Committee requires action by a product manufacturer in order to bring a Certified Product into conformity with applicable certification requirements, the manufacturer shall either implement those changes with ninety days of the Notice Date, or submit a schedule that is deemed acceptable by the Dispute Resolution Committee and commence diligent efforts to implement the change in accordance with the imposed or submitted timeline.

E. Revocation of Certification

If the Dispute Resolution Committee deems that a manufacturer has failed to implement corrections as required by the binding resolution within the imposed or submitted timeline, and the Committee determines that no viable corrective action plan is in progress to resolve the dispute, the Dispute Resolution Committee can recommend to the Certification Program Manager that the product in question may be removed from the Logo Certified Product List. The Certification Program Manager may then remove the product from the Logo Certified Product List until the Dispute Resolution Committee deems that the manufacturer has rectified the problem.

Dispute Resolution Committee

A. Composition

The Dispute Resolution Committee shall have the following composition:

- Lead Lab Representative
- ASCL Representatives
- SSO/SDO Representative

B. Committee Actions

In considering a dispute, the Dispute Resolution Committee shall consider the materials presented by each party involved to the dispute, and may in addition consier such other materials and information as it deems appropriate to settle the dispute.

A copy of all asssociated documents used in resolving the dispute sahll be mainted by the vendor and APCB in the Compliance Folder.

(C) Committee Decisions

The Dispute Resolution Committee shall decide on matters by a majority vote.

(D) Role of Certification Working Group

All decisions of the Dispute Resolution Committee shall be binding and final upon the parties, provided however that it becomes evident that the dispute may be related to a flaw in the certification test or the certification process. In that case, the Dispute Resolution Committee or either party in the dispute may request the matter by transferred to the industry WG for consideration.

3.4.2. Certification Requirement Waiver Process

The waiver process allows a manufacturer to apply for a dispensation (exception) from a specific certification requirement that the manufacturer is unable to meet and that will prevent or delay certification. The waiver process is intended to be used in cases where a manufacturer believes it has a justifiable reason that a waiver should be granted. The waiver process is not intended to deal with test harnss or test case problems that are preventing a device from achieving certification. Such issues are dealt with the CCR process.

Waiver requests are reviewed by an independent body, the Waiver Review Board (WRB) which reviews and takes decisions on waiver requests. This body must be independent of the manufacturer submitting the waiver request, and have no conflict of interest with respect to the waiver request application for the device. Waiver requests are confidential and are not shared between manufacturers.

Waiver requests are submitted to the Certification Program Manager through the APCB, using the Waiver Template (see Annex A2.4). The Program Manager forwards the request to the Waiver Review Board for consideration. Waivers are reviewed on a case by case basis. Submission of a waiver request does not guarantee consideration nor approval of the waiver request by the WRB. A waiver request can be submitted at any time in the certification testing process and the process can be applied for both inital and re-certification of Logo Certified Products.

3.4.3. Surveillance of Certified Product Validity

The ICP is responsible to ensure the continued validity of certified products , modules and software systems in the market.

The ICP is responsible to compile an ongoing verification record of certified products out in the market

CPM is responsible to take mitigative, corrective and preventive action to the non-compliant Member, APCB, and the APCL involved using the following procedure outlined, upon discovery of a certified product that breaches the original certified condition of the product.

3.4.3.1. Corrective and Preventive Action

CPM shall discuss with the involved APCB & APCL the issuance in writing of the Mitigation, Corrective, and Preventive Action Request (MCPAR), to the APCB & APCL, the non-compliant Member and the APCL. The MCPAR shall indicate the following:

- Detail on the observed breach of certification requirements
- Assigns APCB & APCL as party responsible to close the open action item identified on the MCPAR
- Orders Member to account for units already in the market
- Orders APCB, APCL Member to institute corrective action of this event and preventive action of similar events
- Order APCB, APCL to work with Member to mitigate the impact of released devices
- Order APCB, APCL to institute corrective action for this event, and preventive action to forestall future similar events
- After set date, obtain the report on the corrective and preventive action from Member, APCB, APCL
- CPM shall evaluate validity and effectiveness of the response.

APCB & APCL shall monitor the corrective and preventive action after a set time indicated by response on the MCPAR. When subsequent verification determines that corrective and preventive actions are effective, APCB & APCL shall report to CPM, and the case can be closed; if it is found to be insufficient, CPM shall initiate complete review of APCB, APCL appointed status.

3.5. Security Considerations

t.b.d.

4. ANNEX

4.1. Summary Matrix

Requirement	OpenHAN	OpenADR	OpenADE
Program Version	Yes	Yes	Yes
Lead Laboratory	Yes	Yes	Yes
Appointed Labs	Yes	Yes	Yes
Certification Body	Yes	No	No
Program Manager	Yes	Yes	Yes
Test Harness	Yes	Yes*	Yes*
Reference System	No	Yes*	Yes*
Technical Advisory Board	Yes	Yes	Yes
Test Case Reference List	Yes	Yes	Yes
Compliance Folder	Yes	Yes	Yes

* Either Test Harness or Reference System may be used