Smart Grid Standards Information

Version 1.7
Tuesday, May 11, 2010

Section I: Use and Application of the Standard

A. Identification and Affiliation

1.	Number of the standard	ANSI/CEA-709.2-A
2.	Title of the standard	Control Network Power Line (PL) Channel Specification
3.	Name of owner organization	ANSI/CEA
4.	Latest versions, stages, dates	September 2006
5.	URL(s) for the standard	http://www.ce.org/Standards/browseByCommittee_2545.asp
6.	Working group / committee	R7.1 HCS1 Subcommittee
7.	Original source of the content (if applicable)	Echelon Corporation
8.	Brief description of scope	This document specifies the CEA-709 Control Network Power Line (PL) Channel and serves as a companion document to CEA-709.1-B. Its purpose is to present the information necessary for the development of a PL physical network and nodes to communicate and share information over that network. This is one of a series of documents covering the various media that comprise the CEA-709 standard. This document covers the complete physical layer (ISO OSI layer 1) including the interface to the Medium Access Control (MAC) Layer and the interface to the medium. It includes parameters specific to the CEA-709.2 PL channel type, even though the parameters may be controlled at an OSI layer other than layer 1. The document also provides a set of guideline physical and electrical specifications for the power line environment as an aid in developing products for that environment. Note: This standard represents the SDO standardization of the power-line communications channel for the LONWORKS controls-networking protocol.

B. Level of Standardization

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1.	Names of standards development organizations that recognize this standard and/or accredit the owner organization	American National Standards Institute (ANSI); Association of American Railroads (AAR); British Standards Institute (BS); Consumer Electronics Association (CEA); Electronics Industries Alliance (EIA), formerly before CEA; European Committee for Standardization (CEN); European Committee of Domestic Equipment Manufacturers (CECED); Institute of Electrical and Electronics Engineers (IEEE); International Electrotechnical Commission (IEC); International Forecourt Standards Forum (IFSF); International Organization for Standardization (ISO); Standardization Administration of China (SAC)
2.	Has this standard been adopted in regulation or legislation, or is it under consideration for adoption?	☒ Yes ☐ No
3.	Has it been endorsed or recommended by any level of government? If "Yes", please describe	☐ Yes ☒ No
4.	Level of Standard (check all that apply)	☒International ☒National ☒Industry ☒de Facto ☐ Single Company
5.	Type of document	☒Standard ☐ Report ☐ Guide ☐ Technical Specification
6.	Level of Release	☒ Released ☐ In Development ☐ Proposed
C. Areas of Use		
1.	Currently used in which domains? (check all that apply)	☐ Markets ☒ Operations ☒ Service Providers ☒ Generation ☒ Transmission ☒ Distribution ☒ Customer
2.	Planned for use in which domains? (check all that apply)	☒ Markets ☒ Operations ☒Service Providers ☒ Generation ☒ Transmission ☒ Distribution ☒ Customer
3.	Please describe the Smart Grid systems and equipment to which this standard is applied	Is used in thermostats, appliances, controllers, lighting, and other small devices within the home or commercial facilities. Used in substation monitoring and automation, and electricity metering. Used in transportation (locomotive, light rail, subway, bus, automotive) for controls and monitoring. Used for commercial demand response, and building automation. Used in PV and Wind farms for monitoring and gen-set interfacing. Used in backup generator monitoring and control. Used for medium-voltage monitoring and distribution-transformer monitoring.

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D. Relationship to Other Standards or Specifications

1.	Which standards or specifications are referenced by this standard?	ANSI/CEA-852.1 47CFR15, Subpart B (Unintentional Radiators), U.S. Code of Federal Regulations, (formerly known as FCC Part 15, Subpart J.) Comité international spécial des perterbations radioélectriques (CISPR) 16 Specification for radio interference measuring apparatus and measurement methods, Commission Electrotechnique International (International Electrotechnical Commission), Second edition, 1987. IEEE C62.41-1991, IEEE Recommended Practice on Surge Voltage in Low-Voltage AC Power Circuits.
2.	Which standards or specifications are related to this standard?	AAR S-200 ANSI/CEA 709.1, .3, and .4 CECED CHAIN EN 14908-1 through -6 GB/Z 20177.1 through .4 GB/T 20299.4 IEEE 1473-L ISO/IEC 14908-1 through -4
3.	Which standards or specifications cover similar areas (may overlap)?	ANSI/CEA-600 (CEBus)
4.	What activities are building on this work?	Specifications by the AAR, Chinese Ministry of Construction, IEEE. Smart Grid considerations include Appliances, DR Signaling, Generation, Metering, and PEVs.

E. Dept of Energy Smart Grid Characteristics

Please describe how this standard may encourage each of the following:

1.	Enables informed participation by customers	☐ Yes ☒ No Specification concerns only the physical syntax layer
2.	Accommodates all generation and storage options	☐ Yes ☒ No Specification concerns only the physical syntax layer
3.	Enables new products, services and markets	☒ Yes ☐ No
4.	Provides the power quality for a range of needs	☐ Yes ☒ No Specification concerns only the physical syntax layer
5.	Optimizes asset utilization and operating efficiency	☒ Yes ☐ No By use of existing power mains instead of new wires
6.	Operates resiliently to disturbances, attacks, and natural disasters	☐ Yes ☒ No Specification concerns only the physical syntax layer

F. Priority Areas Previously Mentioned by FERC and NIST

Please describe if and how this standard may be applied in each of the following areas. Note that there is space in section J to discuss any other significant areas where the standard may be applied.

1.	Cybersecurity and physical security	☐ Yes ☒ No Specification concerns only the physical syntax layer
2.	Communicating and coordinating across inter-system interfaces	☐ Yes ☒ No Specification concerns only the physical syntax layer
3.	Wide area situational awareness	☐ Yes ☒ No Specification concerns only the physical syntax layer
4.	Smart grid-enabled response for energy demand	☐ Yes ☒ No Specification concerns only the physical syntax layer
5.	Electric storage	☐ Yes ☒ No Specification concerns only the physical syntax layer
6.	Electric vehicle transportation	☒ Yes ☐ No Used in subways, light-rail, & buses.
7.	Advanced metering infrastructure	☒ Yes ☐ No Deployed in 30M+ meters and AMI infrastructure
8.	Distribution grid management	☒ Yes ☐ No AMI system provides information for Distribution grid mgmt.

G. Openness

1.	Amount of fee (if any) for the documentation	$75.00 USD (normal purchase); $56.25 USD (CEA Member)
2.	Amount of fee (if any) for implementing the standard	None
3.	Amount of fee (if any) to participate in updating the standard	None
4.	Is the standard documentation available online?	☒ Yes ☐ No URL: http://global.ihs.com/doc_detail.cfm?document_name=CEA-709.2 for fee.
5.	Are there open-source or reference implementations?	☐ Yes ☒ No
6.	Are there open-source test tools?	☐ Yes ☒ No
7.	Would open-source implementations be permitted?	☒ Yes ☐ No
8.	Approximately how many implementers are there?	Under 10 organizations implement the standard; many of organizations build products based upon the implementations
9.	Approximately how many users are there?	Unknown, over 90 Million devices contain the underlying protocol (based upon MAC ID consumption)
10.	Where is the standard used outside of the USA?	Nearly everywhere but Iran and North Korea
11.	Is the standard free of references to patented technology?	☒ Yes ☐ No
12.	If patented technology is used, does the holder provide a royalty-free license to users of the standard?	☐ Yes ☐ No ☒ Not Patented
13.	Can an implementer use the standard without signing a license agreement?	☒ Yes ☐ No
14.	Are draft documents available to the public at no cost?	☐ Yes ☒ No
15.	How does one join the working group or committee that controls the standard?	Through participation in either CEA or CEN working groups
16.	Is voting used to decide whether to modify the standard? If Yes, explain who is permitted to vote.	☒ Yes ☐ No Voting members of working groups must maintain eligibility by attending meetings/calls.
17.	Is an ANSI-accredited process used to develop the standard?	☒ Yes ☐ No
18.	What countries are represented in the working group or committee that controls the standard?	US and several EU countries

H. Support, Conformance, Certification and Testing

1.	Is there a users group or manufacturers group to support this standard?	☒ Yes ☐ No
2.	What is the name of the users group or manufacturers group (if any)?	LonMark® International: http://www.lonmark.org
3.	What type of test procedures are used to test this standard? (please check all that apply)	☒ Internal to the lab ☐ Published by standards organization ☒ Published by users group ☐ No procedures, informal testing

4.	Are there test vectors (pre-prepared data) used in testing? (please check all that apply)	☐ Internal to the lab ☐ Published by standards organization ☒ Published by users group ☐ No procedures, informal testing
5.	What types of testing programs exist? (check all that apply)	☒ Interoperability Testing ☒ Conformance Testing ☐ Security Testing ☐ No Testing
6.	What types of certificates are issued? (check all that apply)	☒ Interoperability Certificate ☒ Conformance Certificate ☐ Security Certificate (text document) ☐ No Certificates
7.	Are there rules controlling how and when to use the logo?	☒ Yes ☐ No ☒ Standard has no logo The standard has no logo but the user group has logos for devices tested for interoperability and conformance, and for user-group membership.
8.	Is there a program to approve test labs?	☒ Yes ☐ No
9.	Approximately how many test labs are approved (if any)?	Testing is in vendor labs while connected to the Internet-based testing tool.
10.	Is there a defined process for users to make technical comments on the standard or propose changes to the standard and have these issues resolved?	☒ Yes ☐ No
11.	Is there a published conformance checklist or table?	☒ Yes ☐ No
12.	Are there defined conformance blocks or subsets?	☐ Yes ☒ No
13.	Approximately how many vendors provide test tools?	Approximately 5-to-10 vendors provide various test tools but only the user group's test tool qualifies a device to use the logo.
14.	Are there tools for pre-certification prior to testing?	☒ Yes ☐ No
15.	Can vendors self-certify their implementations?	☐ Yes ☒ No The testing is accomplished by the vendors in a self-certification method but the user group's tools determine passing/failing.
16.	Is there application testing for specific uses?	☒ Yes ☐ No ☐ Not applicable
17.	Is there a "golden" or "reference" implementation to test against?	☐ Yes ☒ No
18.	Who typically funds the testing? (check all that apply)	☐ User ☐ Users Group ☒ Vendor ☐ Confidential
19.	Is there a method for users and implementers to ask questions about the standard and have them answered? (check all that apply)	☐ Yes, official interpretations ☒ Yes, informal opinions ☐ No
20.	Does the users' group (or some other group) fund specific tasks in the evolution of the standard?	☒ Yes ☐ No The user group has a small staff that participates in the SDOs and maintains the testing tools.
21.	Is the users' group working on integration, harmonization or unification with other similar standards?	☒ Yes ☐ No

22.	What other standards is this standard being integrated, harmonized, or unified with (if any)?	Other narrowband technologies represented in the SGIP PAP 15 working group. CENELEC EN 50065−1
23.	Are there application notes, implementation agreements, or guidelines available describing specific uses of the standard?	☒ Yes ☐ No ☐ Not applicable

J. Notes

Please present here any additional information about the standard that might be useful:

1.	Any power line technology that does not comply with EN 50065-1 cannot be used in any of the CENELEC countries. In addition, a power-line technology that uses only the CENELEC 'A' band cannot be used for consumer use in CENELEC countries. ANSI/CEA-709.2 complies with current FCC and CENELEC regulations and also makes use of the EN 50065-1 'band-in-use' signaling to allow for coexistence with other technologies in that consumer bands.

Section II: Functional Description of the Standard

K. GridWise Architecture: Layers

Please identify which layers this standard specifies, as described in http://www.gridwiseac.org/pdfs/interopframework_v1_1.pdf, and the applicable section of the standard. Note the mapping to the Open Systems Interconnect (OSI) model is approximate.

2.	**Layer 8: Policy**	☐ Yes ☒ No Communications Protocol
3.	**Layer 7: Business Objectives**	☐ Yes ☒ No Communications Protocol
4.	**Layer 6: Business Procedures**	☐ Yes ☒ No Communications Protocol
5.	**Layer 5: Business Context**	☐ Yes ☒ No Communications Protocol
6.	**Layer 4: Semantic Understanding (object model)**	☐ Yes ☒ No Uses EN 14908-5, -6
7.	**Layer 3: Syntactic Interoperability (OSI layers 5-7)**	☐ Yes ☒ No Uses EN 14908-5, -6
8.	**Layer 2: Network Interoperability (OSI layers 3-4)**	☐ Yes ☒ No Uses ANSI/CEA-709.1
9.	**Layer 1: Basic Connectivity (OSI layers 1-2)**	☒ Yes ☐ No Defines PHY & MAC interaction

L. GridWise Architecture: Cross-Cutting Issues

Please provide an explanation in the box beside the heading for any questions answered "Not applicable". If the question is not applicable because the function is provided in another layer or standard, please suggest any likely candidates. Note that "the standard" refers to the technology specified by the standard, not the documents themselves.

	Shared Meaning of Content	
1.	Do all implementations share a common information model?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
2.	Can data be arranged and accessed in groups or structures?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
3.	Can implementers extend the information model?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
4.	Can implementers use a subset of the information model?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
	Resource Identification	
5.	Can data be located using human-readable names?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
6.	Can names and addresses be centrally managed without human intervention?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
	Time Synchronization and Sequencing	
7.	Can the standard remotely synchronize time?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
8.	Can the standard indicate the quality of timestamps?	☐ Yes ☐ No ☒ Not applicable: handled by ANSI/CEA-709.1 & EN 14908-5, -6.
	Security and Privacy	

Section II: Functional Description of the Standard		
9.	Where is security provided for this standard?	☐ Within this standard ☒ By other standards
10.	Does the standard provide authentication?	☐ Yes ☒ No: handled by ANSI/CEA-709.1.
11.	Does the standard permit role-based access control?	☐ Yes ☒ No: handled by ANSI/CEA-709.1.
12.	Does the standard provide encryption?	☐ Yes ☒ No: encryption for authentication handled by ANSI/CEA-709.1.
13.	Does the standard detect intrusions or attacks?	☐ Yes ☒ No: handled by ANSI/CEA-709.1.
14.	Does the standard facilitate logging and auditing of security events?	☐ Yes ☒ No: handled by ANSI/CEA-709.1.
15.	Can the security credentials be upgraded remotely?	☐ Yes ☐ No ☒ No Credentials: handled by ANSI/CEA-709.1.
16.	Can the security credentials be managed centrally?	☐ Yes ☐ No ☒ No Credentials: handled by ANSI/CEA-709.1.
17.	Please list any security algorithms and standards used	
18.	Please provide additional information on how the standard addresses any “Yes” answers above	
19.	Please provide additional information about why any of the questions listed above do not apply to this standard	PHY layer and interaction to MAC layer only. To be used with ANSI/CEA-709.1 and other networking technologies.
	Logging and Auditing	
20.	Does the standard facilitate logging and auditing of critical operations and events?	☐ Yes ☒ No
21.	Can the standard gather statistics on its operation?	☐ Yes ☐ No ☒ Not applicable
22.	Can the standard report alerts and warnings?	☐ Yes ☐ No ☒ Not applicable
	Transaction State Management	
23.	Can the standard remotely enable or disable devices or functions?	☐ Yes ☐ No ☒ Not applicable
	System Preservation	
24.	Can the standard automatically recover from failed devices or links?	☒ Yes ☐ No ☐ Not applicable ☐ Provided in another layer
25.	Can the standard automatically re-route messages?	☐ Yes ☐ No ☐ Not applicable ☒ Provided in another layer
26.	Can the standard remotely determine the health (as opposed to just connectivity) of devices or software?	☐ Yes ☐ No ☒ Not applicable
	Other Management Capabilities	
27.	Please describe any other system or network management capabilities the standard provides.	
	Quality of Service	
28.	Is data transfer bi-directional?	☒ Yes ☐ No
29.	Can data be prioritized?	☐ Yes ☐ No ☒ Not applicable

Section II: Functional Description of the Standard		
30.	What types of reliability are provided?	☐ Reliable ☒ Non-guaranteed ☐ Both ☐ Either ☒ Provided in another layer
31.	Can information be broadcast to many locations with a single transmission?	☒ Yes ☐ No ☐ Not applicable
32.	Please describe any other methods the standard uses to manage quality of service.	Can use increased output for areas without such restrictions; can use an alternate frequency, if implemented with such feature.
	Discovery and Configuration	
33.	Can the software or firmware be upgraded remotely?	☐ Yes ☐ No ☒ Not applicable
34.	Can configuration or settings be upgraded remotely?	☐ Yes ☐ No ☒ Not applicable
35.	Can implementations announce when they have joined the system?	☐ Yes ☐ No ☒ Not applicable
36.	Can implementations electronically describe the data they provide?	☐ Yes ☐ No ☒ Not applicable
	System Evolution and Scalability	
37.	What factors could limit the number of places the standard could be applied?	High-speed communications (*e.g.*, video streaming) is not supported.
38.	What steps are required to increase the size of a system deploying this standard?	Logical segmentation is required for multi-resident buildings for logical signal separation. Authentication may need to be turned-on (adding to communication traffic).
39.	Is the information model separate from the transport method?	☒ Yes ☐ No
40.	Does the standard support alternate choices in the layers(s) below it?	☐ Yes ☐ No ☒ No layers below
41.	List the most common technology choices for layers implemented below this standard	
42.	Does the standard support multiple technology choices in the layers above it?	☐ Yes ☒ No ☐ No layers above
43.	List the technologies or entities that would most commonly use this standard in the layer above	ANSI/CEA-709.1; EN 14908-5, -6.
44.	Please describe any mechanism or plan to ensure the standard is as backward-compatible as possible with previous versions	Frequency adjustment (dual-frequency support) could ensure compatibility if FCC restrictions were put in place for the present frequency band.
45.	Please describe how the design of this standard permits it to be used together with older or legacy technologies	
46.	Please describe how the design of this standard permits it to co-exist on the same network or in the same geographic area with similar technologies, and give examples	Conforms to CENELEC EN 50065-1 and therefore can coexist with other technologies compliant to 50065-1.
47.	**Electromechanical**	

Section II: Functional Description of the Standard

M. Architectural Principles

Please describe how this standard may apply any of these principles:

1.	Symmetry – facilitates bi-directional flow of energy and information	CSMA/CA and band-in-use signaling.
2.	Transparency – supports a transparent and auditable chain of transactions	N/A, handled by layers above.
3.	Composition – facilitates the building of complex interfaces from simpler ones	N/A, handled by layers above.
4.	Loose coupling – can support bilateral and multilateral transactions without elaborate pre-arrangement	N/A, handled by layers above.
5.	Shallow integration – does not require detailed mutual information to interact with other components	N/A, handled by layers above.
6.	Please list any other architectural models, reference architectures or frameworks this standard was designed to be compliant with, e.g. W3C, IEC TC57, OSI and how it fits those models	The standard is designed to the ISO OSI Reference Model to fit into a 7-layer, complete solution. It is not specific to a single geographic region; it is designed to be a transport PHY for L-N, L-E, multi-voltage, multi-frequency power-line carriers (or even unpowered lines; if power is sourced elsewhere or by battery).