Test procedures for network standby – approaches and scope for alignment

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Why are test procedures important?

Underpin all energy policies and programs:

- Mandatory energy standards

- Voluntary energy standards

- Labelling programs (comparative, endorsement)

- Purchaser/consumer information

- Policy insight / monitoring / comparisons

Objective

- **Define test procedure elements that complement IEC62301 to allow the measurement of relevant modes of equipment where a network function present**

- **Aim to provide a platform for a globally relevant, uniform test methods for products with network functions**

- **Relevant modes should cover all levels of network functionality likely to occur during normal use**

Benefits from a global approach

- **Global alignment of testing approaches is good for government and good for industry**

- **Supports energy policies**

- **Allows comparisons and benchmarking**

- **Facilitates trade**

- **But some effort will be required to reach global agreement**

Critical Definition
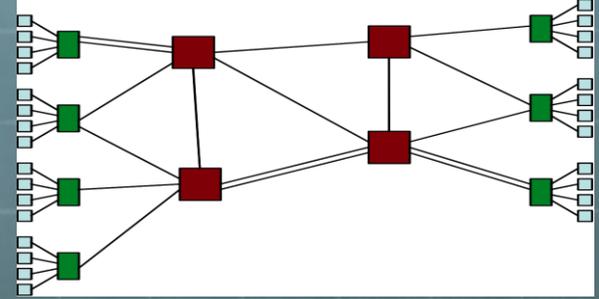
In any discussion about networks and equipment connected to networks, it is important to distinguish two classes of products:

- Network equipment – the devices that make up the network and whose main function is the provision of the network (modems, routers, switches, Wi-Fi access points)

- Edge devices – devices have a network function but their main function is something else (computers, televisions, STB, appliances)

Suggested Scope

- Network connections covered are **digital networks** with bi-directional communication between two or more devices (includes data links – connection between just 2 products)

- Excludes analogue networks (e.g. PSTN telephone)

- Excludes broadcasts (one directional signals from a central source to multiple devices with no return data path) (e.g. television broadcasts)

International Test Method

- **IEC62301 Measurement of Standby Power**, was commenced by TC59 in 2001 and Edition 1 was published in 2005

- Revision of standard started in 2006 and Edition 2 was published in 2011

- Edition 2 had improved definitions and refined measurement and equipment specifications

- Contains state of the art approaches for measurements of low power in appliances and equipment – horizontal standard

Issues covered by IEC62301

- Ambient conditions – **Yes** ✔

- Power supply and power quality – **Yes** ✔
  except for issues such as DC powering – **No** ✖
  (e.g. Power over Ethernet, USB; needs work)

- Power measurement equipment – **Yes** ✔

- Methodology to obtain a valid reading – **Yes** ✔

- Network configuration – **No** ✖

- Important to remember that IEC62301 is written as a generic test method that is designed to be referenced by other standards and regulations, so external documents can set out product specific defined details

Components of test procedures to cover networked devices

- Definitions and Network Technologies

- Product Configuration and Setup Requirements

- Network Connectivity

- Modes and Network Traffic

- Power Measurement

- Reporting Requirements
    - (need to ensure regulator/ program needs are met)

Network-related details

- Cable type/length (where applicable)

- Radio conditions (wireless), power line carrier

- Capabilities of devices connected to tested appliance

- Functions provided by or to other devices

- Cloud / service provider context, internet connection

- Data traffic details – quantity, timing, packet size, content

- Network service environment – addressing, discovery

- Typical usage – modes to measure (not pattern of use)

Why network related elements are important

- Network connectivity adds significant complexity to testing products

- Complexity often independent of product type but dependent on network technology type

- Testing needs to evolve with technologies, usage

- Incorrect or inadequate testing will reduce actual energy savings achieved by programs, send wrong design signals

- Complexity could be a significant burden
    - Policymakers, manufacturers, test labs, users

Current Status

- IEC62301 recognises that networks may be present but does not define requirements for testing

- There are a number of existing test procedures, program requirements and regulations that that cover products with network functions that define at least some of the required elements for testing

- Pathway needed through the current maze

Current Status 2

Examples of existing test method that specify test procedure network elements

- European Commission amending regulation to cover network standby (801/2013)

- European Code of Conduct on Energy Consumption of Broadband Equipment (+TVs)

- Energy Star Small Network Equipment (Large U/D)

- Top Runner network equipment

- Korea requirements for wide range of equipment

Current Status 3

For each network test procedure element there are several possible situations at present:

- There is a single or uniform definition of the element (either only one test procedure defines a requirement or all test procedures define equivalent requirements)

- No test procedure defines requirements (gap)

- Several or many test procedures define different or conflicting requirements

Example: Energy Star
Small Network Equipment

- "All Ethernet cables used for testing shall meet ANSI/EIA/TIA-568 Category 5e (Cat5e) specifications and shall be 1 to 2 meters in length."

- "If the UUT supports IEEE 802.3az protocol, all connected devices must support IEEE 802.3az".

- "Ethernet ports shall be connected at the maximum supported link rate unless otherwise specified in this test procedure."

- "The 1 kb/s data rate test traffic used for qualification shall contain random data in a variety of datagram (or frame) sizes based on an Internet traffic mix (IMIX) sent at random intervals. For the high data rate test traffic, frame size may be increased up to the maximum transmission unit (MTU) as needed to sustain the high data rate traffic."

- "Tests are performed at two data rates, 1 kb/s (0.5 kb/s in each direction), and the highest rate supported by the link shown in Table 8."

Pathway forward

- Ideally, a roadmap to align network related content wherever possible is a desirable objective

- Conceptually, this would mean adapting content from existing approaches where possible
  - Identify clear gaps in content
  - Fill the gaps
  - Resolve conflicts – this may be easier said than done

- Given that the content for network related elements is continually evolving, there needs to be a repository where content can be maintained

Pathway forward 2 - details

- Identify all of the key network testing elements required (not all elements will apply to all products)

- Document existing network related requirements in all significant test methods and regulations

- Identify gaps

- Identify single or uniform technical specifications

- Identify where there are multiple technical specifications for the one parameter

- Set out recommendations for the preferred specifications for each of the key testing components and the rationale as to why these are preferred

Pathway forward 3 - options

- Documenting relevant network components is a significant piece of technical work – as many as 20 existing test procedures and regulations

- Some work has been done – much more to do

- **PASSIVE OPTION**: a) document technical options for each element, b) indicate preferred option c) let each country do what they want

- **ACTIVE OPTION**: Negotiate with key stakeholders (notably the owners of the standards or regulations) to come down to one (or two) options for each test element providing a test element menu – more ambitious

Challenges for test procedures

- Networks are expanding – both types of networks and the number of devices connected

- A variety of factors can affect energy in real use

- Need to minimise chance of "gaming" = circumvention

- Network connectivity may be present in any mode (On, Off, Sleep, Ready)

- Devices may have periodic higher-power activity
  - Internally or externally generated (cyclic)

- Different products of same type have different network capabilities, functions, network activity can affect energy consumption

Some special considerations

- Technology Standards frequently change – need a dynamic link to current version (or relevant version)

- Need to know standard version built into the UUT

- Do you allow the product to update its firmware prior to test (via an internet connection?)

- Need to understand energy management protocols present and how these are assessed and reported in the test procedure

How will this be progressed?

- IEC standards take many years to prepare – given the technical research and possible negotiation required, they may not be the correct body to do this initial work

- Given the strong government ownership of many test procedure elements, it is important that they commission and control this project

- Question about how the preferred test procedure content will be maintained – how would be responsible?

- Once codified and more settled, this could be developed as a companion document to IEC62301 or a sub-part (in the long term, but would still need to reference dynamic content)

Conclusions

- IEC62301 covers many basic requirements

- Much network test content exists

- Content needs to be compiled and documented

- Ensure content gaps are covered, conflicts are harmomised

- It is best that mode categories are NOT included - product experts and regulations are best placed to define the modes at product level

- Externally reference Technology Standards (assess energy management)

- Management of the content during any alignment process (if this pathway is selected)

The end

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Thank you

Solution

"Library" of network related content

- Dropped into product test procedures, requirements and specifications as needed

- Drawn from as applicable to product
  - product types
  - product features

- Updated as technologies and usage change

- Content may be
  - sentences, paragraphs, tables, data, …
  - configuration, test setup, connected devices, network traffic
  - Power levels and adders (as applicable)

- Principle: Be as horizontal as feasible – and no farther

Collecting library content

- Adapt content from existing approaches where possible
  - Energy Star (SNE, PC, imaging), EU COC broadband, Japan Top Runner, ATIS, others

- Evaluate elements

- Try to resolve technical differences

- Recommend preferred elements

- Identify gaps in content
  - Fill the gaps

Library next steps

- Identify a librarian

- Identify resources

- Get started

Thank you