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Additional submitted attachment is included below.

Comments on
Low Power Mode Test Procedure Discussion Document
(docket no. 17-AAER-12)

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About AGGIOS

- AGGIOS is an independent, employee-owned CA corporation providing power management software, tools and services for plugged, mobile and IoT devices
- AGGIOS is frequently involved in energy analysis and testing of plug load devices
- Since 2013 AGGIOS regularly participates in appliance efficiency activities at the state and federal level
- In this document AGGIOS responds to the Request for Public Comment on Low Power Mode Test Procedure Discussion Document (docket no. 17-AAER-12)

Principle of Energy Proportionality

- *Energy proportionality* is a measure of the ratio between the energy consumed in a device, and the useful work done.
  - Useful work is not only the work that is instantaneously beneficial to the user, but also the work that the user or group of users may benefit later (e.g. software update, file system check)
- Ideal devices are fully energy proportional, i.e. only consume energy when delivering useful work
- We recommend to use energy proportionality as the guiding principle for Low Power Mode (LPM) testing
- The essential issue is how to define and measure useful work in LPM, as in real world that work is rarely zero!

Example: Evolution of TV's "standby"

- Typical work done, i.e. functions in standby by:
  - Very old TVs
    - Wait for ON button (keep circuitry energized to enable ON state entry)
  - Old TVs
    - Process infrared (IR) signals of remote (filter out false IR signals)
    - Wait for ON button
  - Newer TVs
    - Process WiFi or wired network messages for software updates and program guide information
    - Process IR signal of remote (filter out false IR signals)
    - Wait for ON button
  - Newest TVs
    - Process microphone signals for user voice commands
    - Process camera signals for user gesture commands
    - Process Bluetooth, WiFi and wired network for user commands over auxiliary devices, e.g. smartphone or tablet
    - Process WiFi and wired network messages for software updates and program guide information
    - Process IR signal of remote (filter out false IR signals)
    - Wait for ON button

Commission's LPM Testing Proposal

- The Commission has correctly identified the horizontal LPM testing issue
  - Each device has specific LPMs which require different LPM tests
  - How to the test the LPM for a class of devices using a single unified test
- Typically, a single test mode, like suspend, is tested with different LPM tests varying from device to device
- The Commission has reversed this relationship and proposes that a single unified LPM test defines multiple device-dependent low power modes
- Although this principle has merits, the real life implementation and the ultimate benefits could be an issue

Our Comments (1 of 3)

- The proposed LPM test is by definition equal for all devices under test
- Under the LPM test the devices continue all typical communication, sensor detection and charging activities as they do in real world settings
- As a consequence, the devices in their respective LPMs shall do different useful work
  - A security camera in LPM shall do different type of work than Amazon Alexa or Google Home
  - A TV that is regularly updating its program guide in LPM shall do different work than a TV that waits for the active state to update the program guide (thereby annoying the user)
  - A security camera with sophisticated motion detection in LPM shall do different work than a camera with simple motion detection

Our Comments (2 of 3)

- Based on the above, we are predicting that:
  - Interpretation and comparison of the LPM test results shall be possible only among device categories of similar devices
  - Even within the same category it shall be impossible to compare devices unless the LPM test makes sure they do the same work during test
    - How to compare TVs that provide different program guide functions in LPM?
    - How to compare cameras that have different quality of motion detection?
  - The proposed LPM test shall require introduction of further device subcategories based on fine granularity of device functions
  - Devices in these subcategories shall be indistinguishable (e.g. security cameras with advanced vs. basic motion detection) unless LPM test defines and verifies the device function

Our Comments (3 of 3)

- The proposed LPM test shall ultimately be complemented with device specific functional testing and the main benefit of the unified LPM test shall be lost
  - The key reason why the EU Code of Conduct and other standards limit the activities and communication traffic during their LPM tests is to make the work and test results comparable
- Without the ability to compare, the benefits of the proposed LPM test shall be limited

Our Recommendations

- The LPM test should measure active power before and after the LPM test
- A device would qualify for LPM testing only if the LPM power is below a certain LPM threshold defined as percentage of active power (e.g. below 10% of active power)
- A device above the LPM threshold power would not qualify for LPM testing, as it effectively does not have a low power mode, but only active modes, i.e. it does significant useful work in all modes
- Our recommendation is to conduct active mode testing for the devices that do not qualify for LPM testing

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