1   SCOPE

This is the CEA Test Method for the determination of Download Acquisition Mode (DAM) energy consumption (E_DAM), as applicable to the ENERGY STAR Program Requirements for Televisions. The test procedure herein is applicable to any television using a DAM as defined in the ENERGY STAR Program Requirements document.

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3   REFERENCE DOCUMENTS

1. Energy Star TV Program Requirements – Procedure for DAM Testing
2. ENERGY STAR® Program Requirements for Televisions Eligibility Criteria Versions 4.2 and 5.1

4   Definition of DAM mode

In Energy Star 4.2, the EPA defines the following:

Download Acquisition Mode (DAM): Where the product is connected to a mains power source, is not producing a sound or a picture, and is actively downloading data, to include but not limited to, channel listing information according to a defined schedule for use by the electronic programming guide, TV setup data, channel map updates, TV firmware updates, monitoring for emergency messaging/communications and/or otherwise communicating through a network protocol. The power use in this mode is typically greater than the power requirement in Sleep and less than that in On Mode.

This test procedure introduces the following definitions:

Infrequent Download: Any DAM download that occurs no more than four times per year and has a duration of less than six hours per instance (i.e., total of less than 24 hours/year or 0.27%). Some examples of infrequent downloads are TV firmware updates, TV setup data downloads, and the Rovi EPG Setup State.

Frequent Download: Any DAM download that does not meet the definition of an Infrequent Download.

5   Qualifications to the DAM mode power usage

5.1   All frequent downloads must be included in the DAM mode power measurement. Note: All DAM functionalities, both frequent and infrequent must be declared, but those meeting the definition of infrequent can be excluded from the calculation of total DAM energy consumption (This declaration is so that the EPA is made aware of, and thereby has the option to evaluate the validity of, and test for the occurrences of, those downloads defined as infrequent.)

5.1.1. Downloads that happen at a frequency of less than once per day, but do not meet the definition of infrequent , must be averaged to come up with an equivalent daily value for the DAM measurement.

5.2   There are also various triggers for the initiation of a DAM sequence. It may be a daily trigger at a certain time of day (as an EPG download), or a TV power state trigger (as a clock update that is performed each time the TV "turned off" before it actually enters Sleep mode.) There are also other asynchronous external triggers possible. Daily triggers need no further discussion, a TV power state trigger will be assumed to happen five times per day. Asynchronous triggers must be estimated in good faith, conservatively towards the high side of expected occurrence. (Significant underestimation is clearly grounds for de-listing.)

6   DAM mode power measurement

To test for the power consumed in DAM, the Ideal or the Practical test method may be used.

6.1   Ideal

6.1.1   To ideally measure the DAM mode power consumption, the TV should be connected to power meter that measures the total energy consumed (E_TOTAL) and a signal source that can provide a signal containing the same type and amount or duration of data that the TV will acquire in its actual application DAM use. The following procedure should be followed:

1. UUT shall be connected to a power meter that will measure the total energy consumed over duration of the test.
2. A signal source shall be prepared that can provide a signal containing the same type and amount or duration of data that the TV will acquire over the course of an average 24 hour period. This signal shall include representative segments from all Frequent Downloads.
3. The energy consumption of the UUT shall be measured over a 24 hour period (E_TOTAL), during which the TV is turned on for 1 hour then turned off for 1.5 hours 4 times then turned on for 1 hour and off for 13 hours.
4. The following equation shall be used to derive the energy used in DAM (E_DAM):

$$E\_DAM = E\_TOTAL - (P\_ON * 5 \text{ Hours}) - (P\_SLEEP * 19 \text{ Hours})$$

Where:
E_TOTAL – Total energy used by the UUT over a 24 hour period
P_ON – On mode power consumption
P_SLEEP – Sleep mode power consumption
Time_DAM – Average time spent in DAM per day

6.2   Practical

6.2.1   For practical measurement of DAM mode power consumption, it can be verified that the E_DAM can be calculated by simply multiplying the instantaneous (P_DAM - P_SLEEP) by the time in DAM mode. The following steps should be followed:
1. The TV shall be connected to a power meter and power source.
2. The TV shall be connected to an appropriate signal source for communicating with the DAM function being tested.
3. The signal which causes the TV to activate the DAM function should be applied.

4. Confirm that the TV has activated the DAM function and is communicating with the DAM signal source as appropriate for the DAM function being tested.
5. Record "P_DAM" (watts) power consumption in DAM using the power meter.
6. Confirm "Time_DAM" (hours) time of DAM per day, and calculate "E_DAM" by
   the following equation:
   $$E\_DAM = (P\_DAM - P\_SLEEP) \times Time\_DAM$$
7. If there are different DAM functions for the same TV, repeat steps 1 through 6 for each DAM function. In this case, the total E_DAM is calculated:
   $$E\_DAM = SUM((P\_DAM - P\_SLEEP) \times Time\_DAM)$$
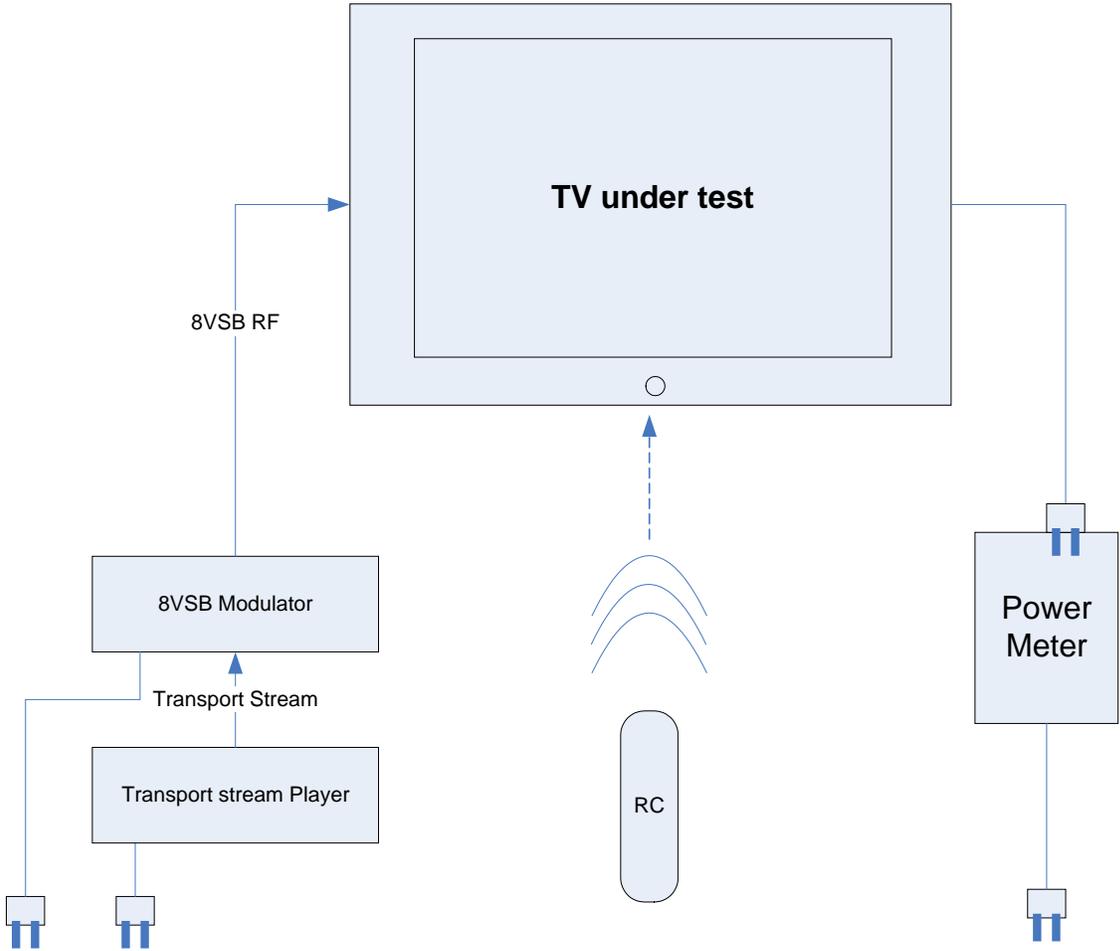   Where:
   P_SLEEP – Sleep mode power consumption
   P_DAM – DAM power consumption for each DAM function
   Time_DAM - Time spent per day in DAM for each DAM function

6.3 Verification

6.3.1 The average time per day spent in DAM mode is easily estimated and easily verified by connecting the TV into its intended application and monitoring the energy usage. It is self evident when the TV is in On mode. When the TV is off and drawing less than 1W it must be in Sleep mode, and when it is off and drawing more than 1W, it must be in DAM mode. The verification should be repeated for several days in case a less frequent download occurs on one day.

7   Connection Diagram

8   Templates

8.1   Data Declaration

8.1.1 As stated above, all DAM functions both frequent and infrequent must be declared. For each function all appropriate columns must be completed. The total E_DAM will be compared against the ENERGY STAR limit for DAM.

8.2   Blank DAM Declaration Template

DAM Declarations					P_DAM	P_DAM - P_Sleep	Time_DAM	E_DAM*	
	Function	Trigger	Duration(s)	Frequency	Estimate	Power (W)		Hrs:Min	(W-hrs)	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
				Total						

8.3   Example DAM Declaration Template

DAM Declarations					P_DAM	P_DAM - P_Sleep	Time_DAM	E_DAM*	
Function	Trigger	Duration(s)	Frequency	Estimate	Power (W)		Hrs:Min	(W-hrs)	Notes
1 Firmware Update	availability detected by Check	1 hr 45 min	Infrequent	2x / year	26.5	26			only if required for feature update/fix
2 Download Setup data	new installation	5 min	Infrequent	Once	26.5	26			
3 Update Setup/Channel Map	availability detected by check	5 min	Infrequent	2x / year	26.5	26			if now channels added or room setup change required
4 Check for new version of 1,2, or 3	Turn off + 15 minutes	3 min	Frequent	5x / day	26.5	26	0:15	6.5	Check for new version - downloads only if new version available
5 Initialize EPG setup	new installation	3 hrs	Infrequent	Once	26.5	26			
6 Update EPG data	daily	15 min	Frequent	4x / day	26.5	26	2:22	62.4	
		2 hrs			26.5	26			
		5 min			26.5	26			
		2 min			26.5	26			
7 Weekly Download	weekly	1 hr	Frequent	1x / week	26.5	26	0:09	3.9	
8									
9									
10									
				Total			2:46	72.8	
									*E_DAM = (P_DAM - P_Sleep) x Time_DAM

* $E\_DAM = (P\_DAM - P\_Sleep) \times Time\_DAM$