



EUROPEAN COMMISSION
DIRECTORATE-GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Environment and Sustainability
Renewable Energy Unit

Ispra, 15 July 2009

**Code of Conduct
on Energy Efficiency of Digital TV Service Systems
Version 8**

1. INTRODUCTION

Expectations are that equipment for the reception, decoding and interactive processing of digital broadcasting and related services will contribute substantially to the electricity consumption of households in European Community in the near future. Depending on the penetration level, the specifications of the equipment and the requirements of the service provider, a total European consumption of up to 23 TWh per year can be estimated. With the general principles and actions resulting from the implementation of this Code of Conduct the (maximum) electricity consumption could be limited to 15 TWh per year, this is equivalent to total saving of about 750 Million EURO per year.

The potential new electrical load represented by this equipment poses a problem for EU energy and environmental policies. It is important that the electrical efficiency of equipment required to support digital TV and related services is maximised.

To help all parties to address the issue of energy efficiency whilst avoiding competitive pressures to raise energy consumption of equipment all service providers, equipment and component manufacturers are invited to sign this Code of Conduct. Taking into account that the energy consumption of the equipment is influenced by the services offered, the number of features as well as the components used.

This Code of Conduct sets out the basic principles to be followed by all parties involved in digital TV services, operating in the European Community in respect of energy efficient equipment.

2. EQUIPMENT COVERED

This Code of Conduct covers **complex set top boxes** and similar equipment for the reception, decoding, recording and interactive processing of digital TV and related services (the “Equipment”) accessible through **Conditional Access** system.

Examples of such Equipment are complex integrated receiver decoders and other set-top boxes, and certain equipment with recording capabilities. However, devices whose primary function is something other than reception of digital TV signals, such as personal computers and game consoles fitted with integrated digital TV tuners, are excluded.

This Code of Conduct addresses all actors involved in requirement specification, design, manufacturing and deployment of equipment especially:

- Service providers
- Hardware component and software stack providers
- Product manufacturers and system integrators

3. DEFINITIONS

Refer to Annex B – Definitions.

4. AIM

To minimise overall energy consumption (kWh) per Equipment without hampering the functionality and the convenient use of the Equipment.

5. COMMITMENT

Any signatory of the Code of Conduct will commit only to the parts which are under its level of influence, control and responsibility. Signatories remain committed to the Code of Conduct until they indicate to the European Commission that they no longer wish to be a Signatory or until they fail to provide the annual report as required by section 6 (*Monitoring and Review*).

Signatories of this Code of Conduct agree to make all reasonable efforts to:

- 5.1 Abide by the general principles and requirements set out in Annex A (General Principles and Requirements).
- 5.2 Not exceed the maximum energy consumption targets set out in Annex D (*Maximum Energy Consumption Targets and Time Schedule*) in respect of Equipment placed on the market from the Effective Date as specified in Annex D.
- 5.3 Co-operate with the European Commission and Member State authorities in an annual review of the scope of the Code of Conduct and the power consumption targets for at least two years ahead.
- 5.4 Facilitate and encourage consumers to adopt energy efficient practices in connection with the use of digital TV services. In particular, Signatories shall provide consumers with detailed information about power consumption levels. Such information shall be made available online and where relevant and possible, at the point of sale.
- 5.5 Co-operate with the European Commission and Member State authorities to monitor the effectiveness of this Code through the procedure described below in Section 6 (*Monitoring and Review*).
- 5.6 Ensure that procurement specifications for Digital TV services, systems, equipment and components are compliant with this Code of Conduct.
- 5.7 Ensure that the setup of the network infrastructure of the service provider will be in a way that any interaction with the Equipment over the network, driven by the service provider and not by the customer, will be within a limited timeframe over 24 hours to give the Equipment the chance to go into the standby mode.

6. MONITORING AND REVIEW

Signatories agree to provide to the European Commission on a yearly basis no later than 1 March of the following year, while signatories remain committed to the Code of Conduct, starting with the year in which they signed the Code of Conduct, information concerning the power consumption of the Equipment covered by the present Code of Conduct they produce, specify, buy, etc.

Starting with the year the Code of Conduct is signed and thereafter at least once a year while signatories remain committed to the Code of Conduct, the reported results will be discussed in a confidential and anonymous way by the signatories, the European Commission, Member States and their representatives in order to:

- a) Evaluate the level of compliance and the effectiveness of this Code of Conduct in achieving its aims.
- b) Evaluate current and future developments that influence energy consumption, (i.e.. Integrated Circuit development, Conditional Access systems, etc.) with a view to agreeing actions and/or amendments to the Code of Conduct.
- c) Set targets for future time periods.

The presentation of the results provided to the Commission will be in the form of the spreadsheet that can be downloaded from the website <http://re.jrc.ec.europa.eu/energyefficiency/index.htm>.

Annex A – General Principles and Requirements

Signatories of this Code of Conduct should endeavour and make all reasonable efforts to ensure:

- A.1 Digital TV services and systems are designed so as to minimise energy consumption.
- A.2 Operational and control systems are specified on the presumption that hardware has power management built in, i.e. depending on the functionality required of the unit, the hardware will automatically switch to the mode with the lowest possible power consumption.
- A.3 Digital TV service Equipment is designed to minimise energy consumption, within the constraints of the operational specification.
- A.4 Digital TV service systems are designed on the assumption that the Equipment may be physically disconnected from the mains supply by the consumer, from time to time, at his or her discretion, with no user-relevant degradation of the service provided, when physically reconnected to the mains supply.
- A.5 If Equipment is supplied with an external power supply, the power supply has to meet the current on-mode efficiency requirements specified by the European Code of Conduct on Energy Efficiency of External Power Supplies (See Annex F).
- A.6 It is required that the Equipment has an auto power down feature that ensures that the Equipment automatically switches itself into the lowest standby mode which the service provider deems to be appropriate after a period of time in the on mode following the last user interaction. This period of time shall be set at a default of no more than 4 hours by the manufacturer and may be user adjustable but shall not be able to be set to a period of more than 8 hours. The Equipment should allow the viewer to continue watching beyond the set period by prompting the viewer to confirm that the Equipment is still in use. The auto power down feature may however be able to be overridden.
- A.7 The Equipment may exit a standby mode in order to download content and scan for program and system information, scheduling information, or any other maintenance activity. After activity is complete, the Equipment must return to the standby mode within no more than 15 minutes.
- A.8 Direct to retail devices, that is, Equipment not supplied to an end user via a Service Provider, that provide for speculative recording must have a user-accessible menu option allowing the user to disable this feature at will. Manufacturers must also include instructions for disabling speculative recording in product materials. Equipment supplied by a Service Provider that provide for speculative recording must have a user-accessible menu option allowing the user to disable this feature at

will. The Service Provide must also include instructions for disabling speculative recording in product materials.

Annex B – Definitions

B.1 Equipment

A STB is any dedicated equipment that receives, processes and stores data from digital broadcasting streams and related services, and provides output audio and video signals.

All STB types can come as stand-alone tuners or as part of a larger device with other tuners and/or secondary functions such as, but not limited to:

- networking capability: the STB is able to interface with external devices through a network, e.g. via a network interface;
- recording/playback capability:
 - data storage on a removable standard library format
 - data storage on a non standard library format

B.2 Base Functionality of set-top boxes

- A. Cable STB: A STB whose principal function is to receive television signals from a coaxial or hybrid fibre/coaxial distribution system and deliver them to a consumer display and/or external recording device.
- B. Internet Protocol (IP) STB: A STB whose principal function is to receive television/video signals encapsulated in IP packets and deliver them to a consumer display and/or external recording device.
- C. Satellite STB: A STB whose principal function is to receive television signals from satellites and deliver them to a consumer display and/or external recording device.
- D. Terrestrial STB: Any STB whose principal function is to receive television signals over the air (OTA) and deliver them to a consumer display and/or external recording device.
- E. Thin-Client/Remote: A STB that is designed to interface between a Multi-Room STB and a TV (or other output device) that has no ability to interface with the Service Provider directly and relies solely on a Multi-Room STB for content. Any STB that meets the definition of Cable, Satellite, IP or Terrestrial STB is not a Thin-Client/Remote STB.

B.3 Components of set-top boxes

- F. Conditional Access: The encryption, decryption, and authorization techniques employed to protect content from unauthorized viewing.
- G. European Data Over Cable Service Interface Specification (EuroDOCSIS): An international suite of standards that define interface requirements for cable modems involved in high-speed data and video/audio content distribution over

cable television systems.

B.4 Additional Functionalities of set-top boxes

H. Additional Tuners: An additional tuner provides a second source of media content either from a physically separate A/V input or from the primary input (used concurrently); they need not be for the same source media type. Out-Of-Band tuners built in compliance with standards ANSI/SCTE 55-1 2002 and ANSI/SCTE 55-2 2002 and other similar types of technologies are not considered additional tuners for the purposes of this specification. For example, a device with additional tuners has the ability to tune into two or more separate streams of video simultaneously and place those on separate outputs (outputs being either physical outputs, picture-in-picture, or recording mechanisms). Note that network-based outputs are not covered under the additional tuners definition but are covered under the definition of a Multi-Room STB.

Note: IP STB do not have tuners in a conventional sense, and therefore can not have additional tuners.

I. Additional Tuners – Terrestrial: An Additional Tuner of terrestrial type.

J. Advanced Home Network Interface: An advanced network interface such as WiFi, MOCA, etc. that allows a STB to interface with external devices through a network.

The allowance regarding this functionality can be applied only to devices that are NOT Multi-Room or thin client devices (as the network capability of those devices is already accounted for in their allowances).

K. Advanced Video Processing/Codecs: Advanced methods for video encoding, transcoding and decoding. Examples include, but are not limited to, H.264/MPEG 4 and SMPTE 421M.

L. Digital Versatile Disk (DVD): An optical disc storage media format that can be used for data storage, including movies, with high video and sound quality.

M. Digital Video Recorder (DVR): A device that stores video in a digital format to a rewritable disk drive or other non-volatile storage media local to the unit. The term covers DVR functions integrated in a STB; it does not include software for personal computers that enables video capture and playback to and from the computer's data storage nor does it include server based DVR capabilities. DVR capability may also provide 'live pause' functionality. For the DVR allowance to be claimed the recording capability must be greater than 15 minutes for the highest quality that the STB can record.

N. High Definition ("HD") Resolution: Video output with resolutions greater than 720i.

- O. Multi-Room STB: A STB that meets the definition for Cable, Satellite, IP or Terrestrial STB above and is capable of providing independent content to multiple TVs within a single family dwelling. Products handling gateway services to multi-subscriber scenarios are not covered under this specification.

B.5 Operational modes and power states

- P. On: Operational state in which the STB is at least actively delivering the Base Functionality.
Note that the energy requirements related to “On” mode might be variable over the time and dependent on the real functionality requested from the STB.
- Q. Network Standby: State in which the STB does not have the functionality of the “On” state but is at least capable to switch to another state by responding to a notification by an external signal, e.g. from the service provider.
- R. Standby passive: State in which the STB does not have the functionality of the “On” state but is only capable to switch to another state by responding to a user notification by a remote control of the unit, or an internal signal of the unit, e.g. “wake-up timer”.

The STB may enter a Standby state from the On state after:

- a) the STB receives a notification from the user to enter a standby state via a power button press on a remote control or front panel of the unit, or through an electronic signal or data packet received via a digital interface on the STB; or
- b) the STB auto powers down to a standby state.

Note: the energy consumption after auto power down to standby and after a user initiated power down to standby may, or may not be equivalent.

B.6 Miscellaneous

- S. Auto Power Down: The capability to automatically switch from the On state to a standby state after a period of time without user input, generally based on the amount of time the unit has remained “idle” from last active use, i.e., user input such as channel change, volume change, menu access, etc.
- T. Cable, Satellite, and Telecom Service Provider – “Service Provider”: An entity that provides video (and possibly other) content to subscribers with whom it has an ongoing contractual relationship. A Service Provider in the context of Code of Conduct is one that distributes to end users STBs covered by this specification under an agreement such as a lease or rental arrangement.
- U. IEC: International Electro technical Commission

- V. IEC 62301: Household electrical appliances - Measurement of standby power
- W. Out-Of-Band Tuners: Tuners compliant with standards ANSI/SCTE 55-1 2002 and ANSI/SCTE 55-2 2002 and other similar types of technologies used to gain access to data channels outside of the audio/video source signal. These may facilitate two-way communication and allow the box to send diagnostic information back to the Service Provider as well as enabling pay-per-view content and other rich media interactive content.
- X. Simple Digital TV converter box: a stand alone device for the reception of **(free)** digital broadcasting services and their conversion to interface suitable to feed an external display **without Conditional Access**.
Note: Simple Digital TV converter boxes are not covered by this Code of Conduct.
- Y. Speculative recording: special technology allowing automatic programs recording based on user's profile analysis.
- Z. Total Energy Consumption ("TEC"): yearly energy consumption (kWh/yr) of the equipment calculated according to a duty cycle and measured power levels for various states.
- AA. Equipment Under Test ("EUT"): EUT refers to the product being tested

Annex C – Measurement Method and Conditions

The energy consumption shall be measured and declared taking into account the relevant provisions of this Annex. In this measurement process, the power consumed in the On and standby states will be multiplied by the number of hours a defined typical device spends in On and Standby. The result will be a single energy value representing the energy usage of the device over the course of an entire year: its **Total Energy Consumption** (TEC).

For monitoring and information purposes Signatories shall provide both the measured power consumption values in the On and Standby states as well as the calculated TEC value for each product covered by the Code of Conduct.

Standby state measurement should be taken no less than 30 minutes after the device enters such a state.

The STB *Total Energy Consumption* is compared to its *Annual Energy Allowance* to determine its compliance with this Code of Conduct. The following parts describe the way for determining STB Annual Energy Allowance as well as calculating their Total Energy Consumption.

C.1 General

The STB should be tested as normally installed for the end-user. Where the STB is capable of supporting a wired or wireless local area network this should be disabled. If it can not be disabled, the STB should be operated in the most basic mode required to produce picture and sound from the specified broadcast stream, for one local monitoring point working to the standard of that broadcast stream

One appropriate digital (test) HD broadcast stream shall be fed into the equipment. If the equipment does not accept HD inputs a standard (SD) stream shall be used.

No peripherals shall be attached except when necessary for feeding the broadcast stream into the equipment and delivering the function(s) as described in this Annex. Where such a peripheral requires power from the STB (e.g. a powered antenna for a terrestrial STB or a Low Noise Block (LNB) for a satellite STB) but is not of a unique design specific to the STB and essential to make the STB function, then the power required for the peripheral shall not be included in the test measurement.

The duration of measurement should be according to IEC62301.

C.2 Calculated Total Energy Consumption criteria

The criterion used in order to assess compliance of set-top boxes with this Code of Conduct is whether its calculated Total Energy Consumption (TEC - in kWh/yr) is equal or less than the Annual Energy Allowance. The Annual Energy Allowance is an

allowance for Base Functionality, plus allowances for specific, additional functionalities present across a duty cycle. This duty cycle is further explained in Sub-Section C.7.1.

C.3 Base Functionality Allowance

The Base Functionality shall be established as detailed below. The corresponding allowances values are given in the Table 3 of Annex D "Maximum Power Consumption Targets and Time Schedule".

- a. If the STB meets the definition of Cable STB above, regardless of whether the cable reception is considered the "principal functionality" by the manufacturer or Service Provider, and/or the STB is capable of receiving cable service using other type of conditional access (CA) system, the Base Functionality is cable.
- b. If the STB Base Functionality is not cable, and the STB meets the definition of Satellite STB above, regardless of whether the satellite reception is considered the "principal functionality" by the manufacturer or Service Provider, the Base Functionality is satellite.
- c. If the STB Base Functionality is not cable or satellite, and the STB meets the definition of IP STB above, regardless of whether the IP reception is considered the "principal function" by the manufacturer or Service Provider, the Base Functionality is IP.
- d. If the STB Base Functionality is not cable, satellite or IP and the STB meets the definition of Terrestrial STB above, regardless of whether the terrestrial reception is considered the "principal function" by the manufacturer or Service Provider, the Base Functionality is terrestrial.
- e. If the STB Base Functionality is not cable, satellite, terrestrial or IP, and the STB otherwise meets the definition of Thin-Client/Remote, the Base Function is thin-client/remote.

C.4 Additional Functionality Allowance

The Additional Functionalities Allowance, if applicable, shall be determined using values from Table 4 (Annex D).

C.5 Calculating Device Energy Allowance

To calculate the Code of Conduct allowance for a given STB, take the sum of the base functionality allowance and all applicable additional functionalities allowances (Note that there may not be any additional functions in devices such as standard cable or satellite STBs). This sum is the calculated annual kWh limit, or the annual energy allowance. This sum equals the maximum amount of energy the box can use in a given year as calculated following the measurement procedure described in this Annex C.

Annual Energy Allowance (kWh/year) = Base Functionality Allowance + Additional Functionalities Allowance

C.6 Multi-Room STBs

When using the Multi-Room Additional Functionalities energy allowance to establish the criteria for a STB, the following procedure must be followed. This allowance may only be used for STBs that can provide independent content to more than one display device, e.g., TV, PC, portable media player, etc. For the purposes of this specification, TV can be any device capable of streaming and displaying real-time video from the UUT. Specific requirements for testing Multi-Room STBs are included below.

- First, test the multi-room STB and compare the results to the specification criteria assuming the STB will deliver content to only one display device, i.e., do not include the Multi-Room allowance. If the STB meets the targets, no further measurement.
- If the STB does not pass the single display device STB test, then determine if it qualifies as a Multi-Room STB.
 - Retest with a second display device running the same test simultaneously with the first.

Add the Multi-Room additional annual energy allowance listed in Table 3 of Annex D to the criteria established for the STB. Compare the test results to the Multi-Room criteria to see if the STB is compliant with Code of Conduct. For units that can support a second display device without the need for a thin client, the manufacturer can add in half of the relevant thin client adder.

C.7 Device Total Energy Consumption (TEC) Assessment

In this specification, the power consumed in the On and Standby states will be multiplied by the number of hours a defined typical device spends in On and Standby. The result will be single energy value representing the energy usage of the device over the course of an entire year.

C.7.1 Duty cycle for basic functionalities

The Base Duty Cycle defines the number of hours during which a STB is considered to be working in “On”(=> T_{On}) and “Standby states” (=> $T_{Standby}$ or T_{APD}).

Table 1: Base Functionality Duty Cycle

	On	Standby	Standby from APD
Daily time duration in this mode	$T_{On}= 4.5h$	$T_{Standby}=15h$	$T_{APD}=4.5h$

If the APD default is set to less than 4 hours, for each hour less than 4 the default is set T_{on} shall be decreased with half an hour and T_{APD} shall be increased with half an hour.

C.7.2 TEC Assessment

Calculate the TEC by multiplying the measured power consumption as specified in this test procedure by the hours per day values in the equation below.

P_{On} , $P_{Standby}$ and P_{APD} are power levels in watts as measured according to the measurement procedure set out in this Annex C.

Annual energy (kWh/yr) for a product:

$$TEC = 0.365 \times (T_{On} \times P_{On} + T_{Standby} \times P_{Standby} + T_{APD} \times P_{APD})$$

Example:

The EUT (HD DVR cable STB, Tier 1) has Auto Power Down capability with default set to 3 hours, and the measurements during the measurement procedure are similar to example A: $P_{On} = 24.0$ watts, $P_{Standby} = 15.0$ watts and $P_{APD} = 3$ watts. The annual energy consumption is then:

$$TEC = 0.365 * [(4.5-0.5) * 24.0 + 15 * 15.0 + (4.5+0.5) * 3.0] = 122.6 \text{ kWh/yr}$$

If the TEC assessed for the product is equal or less than the Annual Energy Allowance calculated from Annex D below, the product is compliant with Code of Conduct targets.

Annex D – Maximum Energy Consumption Targets and Time Schedule

D.1 Effective Date: This Code of Conduct is effective January 1, 2010 (Tier 1). Tier 2 will become effective on January 1, 2013.

D.2 Base Functionality Allowance

The Base Functionality Allowance, if applicable, shall be determined using values from Table 3.

Table 3: Base Functionality Annual Energy Allowance

Base Functionality	Tier1 Annual Energy Allowance (kWh/year)	Tier2¹ Annual Energy Allowance (kWh/year)
Cable	60	53
Satellite	60	53
IP	40	31
Terrestrial	47	31
Thin-Client/Remote	40	31

D.3. Additional Functionalities Allowance

The Additional Functionalities Allowance, if applicable, shall be determined using values from Table 4.

¹ Tier 2 limits have been provided throughout this specification as preliminary targets that will be re-evaluated and finalized at least nine months prior to the Tier 2 effective date.

Table 4: Additional Functionalities Annual Energy Allowance

Additional Functionalities	Tier 1 Annual Energy Allowance (kWh/year)	Tier 2 Annual Energy Allowance (kWh/year)
Additional Tuners ²	6	3
Advanced Video Processing ³	18	15
DVR	32	21
DOCSIS/EuroDOCSIS ⁴	53	35
Home Network Interface	18	18
Multi-Room	18	18

² For each additional tuner.

³ Includes allowance for High Definition (if applicable); the Advanced Video Processing adder only applies once per box.

⁴ OEMs must test with EuroDOCSIS enabled if EuroDOCSIS is present. Service providers can test with it and take the allowance only if they use it.

Annex E - Test Procedure

1 GENERAL

- 1.1 The intention of this section is to define a manufacturer independent test process to determine the power consumption of a STB under various standardised operating conditions, these are designed to emulate 'real world' viewing habits.
- 1.2 All testing shall be carried out in controlled repeatable conditions, as specified below.
- 1.3 Unless otherwise specified, all commands to the equipment under test (EUT) shall be via the supplied remote control.
- 1.4 Except for a smart card or conditional access module there shall be no external loads connected to the EUT, unless these are required for the EUT to function, if other external loads are required these shall not measurably increase the load on the EUT e.g. for satellite the LNB supply shall be via a DC block.
- 1.5 All compliance testing shall be carried out on products representative of production units. To provide results that will give an accurate representation of actual deployed usage the software used in the EUT shall be the same as the software used by the product when deployed by the service provider.
- 1.6 The compliance testing shall be carried out on one random sample product. If the results show a margin of greater than 10% then the product is deemed to have passed. If the product fails then that model does not comply with the Code of Conduct. If the product passes with a margin of less than 10% then 2 further random samples shall be taken, if both of these pass then the product complies, if any one exceeds the limits then the product does not comply.
- 1.7 When testing standard definition operations the audio/video content shall be encoded using a qualifying technology where MPEG-2 content must be at a minimum of 5Mbps data rate. (Typically Sports or film channels)
- 1.8 When an allowance for high definition is taken the audio/video content shall be encoded using a qualifying technology where MPEG-2 content must be at a minimum of 17Mbps data rate. (Typically HD Sports or film channels)
- 1.9 Where an allowance for DOCSIS or Euro-DOCSIS modems is claimed then the EUT must be operated to the highest version of DOCSIS that it is compatible with.
- 1.10 Where the allowance for advanced video processing is taken, then at least 1 test stream shall be encoded using a qualifying technology (e.g. MPEG4, H.264 etc.).

- 1.11 Where the power savings can be influenced by the end user then all measurements shall be made using the factory default settings.
- 1.12 Where the allowance for Multi-Room is claimed then at least one additional display device shall be connected to the EUT when performing test methods 5, 6, 7, 8 or 9 and the secondary display device shall render different content than the primary display device being used for the test. The EUT shall provide content to the additional display device for the duration of the test.
- 1.13 Where the allowance for Home network interface is claimed then the network interface must be enabled and connected to a standard Client or Host, but it is not necessary for the network to transfer video or audio data.

2 GENERAL TEST CONDITIONS

- 2.1 The general conditions of test are described in IEC 62301 (Household electrical appliances – Measurement of standby power). The main requirements are summarised briefly below.

Test Conditions	Value
Ambient temperature	23 ± 5 °C
Air speed close to the unit	≤ 0.5 m/s
Supply voltage	$230V \pm 1\%$ $50 \text{ Hz} \pm 1\%$
Supply voltage waveform	Total harmonic content $\leq 2\%$ Crest factor between 1.34 and 1.49
Power measurement accuracy:	
Power level $\geq 0.5W$	Uncertainty $\leq 2\%$ at the 95% confidence level
Power level $\leq 0.5W$	Uncertainty $\leq 0.01 \text{ W}$ at the 95% confidence level
Instrument resolution:	
Power $\leq 10 \text{ W}$	Resolution $\geq 0.01 \text{ W}$
Power $10 \leq 100 \text{ W}$	Resolution $\geq 0.1 \text{ W}$

- 2.2 Test instruments shall be calibrated annually to traceable national standards to maintain the levels of accuracy above.

3 TEST METHOD FOR STANDBY (USER INITIATED)

- 3.1 The EUT shall be put into its on mode.
- 3.2 If the EUT is capable of scheduling a recording then a recording shall be scheduled 2 hours in the future.
- 3.3 After 5 minutes in this mode, the standby or off button on the remote control shall be pressed.
- 3.4 The EUT shall then be left for a maximum of 30 minutes for any housekeeping activities to complete.
- 3.5 At the end of the 30 minutes or housekeeping activities the average power in watt/hours shall be measured for a period of 10 minutes. Based on this 10 minute measurement the standby part of the TEC shall be calculated.
- 3.6 If the EUT has an automatic passive/network standby cycle where automatic wake up from a low power mode is used periodically to receive network updates then the test cycle duration shall be amended to 1 complete passive/network cycle (e.g. 30 minutes passive standby and 5 minutes network standby, test cycle 35 minutes total) the standby part of the TEC shall be calculated based on 1 complete cycle.
- 3.7 If the EUT is fitted with a front panel switch which initiates a different level of power saving, then the test shall be repeated using the front panel switch to initiate the standby mode, with the test cycle as sections 3.1-5. if the results are different then the higher value shall be used.

4 TEST METHOD FOR AUTO POWER DOWN

- 4.1 The EUT shall be connected either to a live stream or a pre-recorded stream and left until the auto power down is initiated.
- 4.2 If the EUT is capable of scheduling a recording then a recording shall be scheduled 2 hours in the future.
- 4.3 The EUT shall then be left for a maximum of 30 minutes for any housekeeping activities to complete. At the end of the 30 minutes or housekeeping activities the average power in watt hours shall be measured in accordance with section 3 above. Based on this measurement the APD aprt of the TEC shall be calculated.

5 TEST METHOD FOR NORMAL OPERATION STANDARD DEFINITION NON-PVR

- 5.1 The EUT shall be connected either to a live stream or a pre-recorded stream.
- 5.2 The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- 5.3 The average power in watt hours shall then be measured for a period of 10 minutes.
- 5.4 Based on this 10 minute measurement the on mode part of the TEC shall be calculated.

6 TEST METHOD FOR NORMAL OPERATION HIGH DEFINITION NON-PVR

- 6.1 The EUT shall be connected to, and displaying a stream of high definition content.
- 6.2 The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- 6.3 The average power in watt hours shall then be measured for a period of 5 minutes (P_{HD-NPVR}).
- 6.4 Using the standard remote control the EUT shall then be retuned to a standard definition channel and the average consumption measured for a further 15 minutes (P_{SD-NPVR}).
- 6.5 The average HD non PVR watt/hours = $\frac{1}{4} P_{HD-NPVR} + \frac{3}{4} P_{SD-NPVR}$.
- 6.6 Based on this 20 minute measurement the on mode part of the TEC shall be calculated.

Note: it is expected that as the quantity of High Definition content increases later versions of this document will require a higher ratio of HD content.

7 TEST METHOD FOR NORMAL OPERATION STANDARD DEFINITION PVR

- 7.1 The EUT shall be connected either to a live stream or a pre-recorded stream.
- 7.2 The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- 7.3 The EUT shall then be operated in accordance with Table 1. For typical 2 tuner EUT this means 1 channel will be viewed whilst a second is recorded, for a 6 tuner EUT 1 channel will be viewed and 5 recorded.

- 7.4 For the purposes of this test where there is more than 1 tuner the viewed channel shall be different to the recorded channels

Viewing	Recording	Duration
1	0	10
1	1	10

Table 1a – normal operation duty cycle – single tuner

Active Tuners	Viewing	Recording	Duration
1	1	0	10
2	1	1	10

Table 1b – normal operation duty cycle – dual tuners

Active Tuners	Viewing	Recording	Duration
1	1	0	5
2	1	1	10
3+	1	All -1	5

Table 1c – normal operation duty cycle – multi-tuners

- 7.5 The average power in watt/hours shall then be measured for each period. Based on this 20 minute measurement the on mode part of the TEC shall be calculated.

8 TEST METHOD FOR NORMAL OPERATION HIGH DEFINITION PVR

- 8.1 The EUT shall be connected either to a live stream or a pre-recorded stream.
- 8.2 The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.

- 8.3 The EUT shall then be operated in accordance with Table 1. For typical 2 tuner EUT this means 1 channel will be viewed whilst a second is recorded, for a 6 tuner EUT 1 channel will be viewed and 5 recorded.
- 8.4 For the purposes of this test where there is more than 1 tuner the viewed channel shall be different to the recorded channels.

Viewing HD	Viewing SD	Recording HD	Recording SD	Duration
1	0	0	0	5
0	1	0	0	5
1	0	1	0	5
0	1	0	1	5

Table 2a – normal operation duty cycle – single tuner

Active Tuners	Viewing HD	Viewing SD	Recording HD	Recording SD	Duration
1	1	0	0	0	5
2	0	1	0	1	5
2	1	0	0	1	5
2	0	1	1	0	5

Table 2b – normal operation duty cycle – dual tuner

Active tuners	Viewing HD	Viewing SD	Recording HD	Recording SD	Duration
1	1	0	0	0	5
2	0	1	1	0	5
3	1	0	2	0	5
n > 3	0	1	2	All remaining	5

Table 2c – normal operation duty cycle – multi tuner

For example if 5 tuners are fitted then the final test shall be view 1 SD channel, record 2 HD channels and record 2 SD channels

- 8.5 The average power in watt/hours shall then be measured for each period. Based on this 20 minute measurement the on mode part of the TEC shall be calculated.

9 REPORTING

The following data shall be reported for *Monitoring and Review*:

- Identification of the EUT: manufacturer, modelname
- Type of STB: Base Functionality and claimed Additional Functionalities
- APD default value
- Annual Energy Allowance
- Measured power consumption P_{on} , $P_{standby}$, P_{APD}
- TEC value calculated with the measured power consumption values

Annex F - Criteria for external power supplies

(According to the Code of Conduct on Energy Efficiency of External Power Supplies – Version 4 of 8 April 2009)

Rated Output Power (P_{no})	Minimum Four Point Average Efficiency in Active Mode (expressed as a decimal) ⁵
	from 1.1.2009
$0 < W \leq 1$	$\geq 0.48 * P_{no} + 0.140$
$1 < W \leq 49$	$\geq [0.0626 * \ln(P_{no})] + 0.622$
$49 < W \leq 250$	≥ 0.870

⁵ “ln” refers to the natural logarithm. An efficiency of 0.88 in decimal form corresponds to the more familiar value of 88% when expressed as a percentage.

Code of Conduct On Energy Efficiency of Digital TV Service Systems

SIGNING FORM

The organisation/company/
.....

signs the Code of Conduct on Efficiency of Digital TV Service Systems and commits itself to abide to the principles described in point 4 "Commitment" for the Equipment it produces, buys or specifies.

The organisation, through regular upgrade reports, will keep the European Commission informed on the implementation of the Code of Conduct of Digital TV Service Systems.

for the organisation

Director or person authorised to sign:

Name:

Managerial Function:

.. ..

Address:

Tel. / Fax.:/

Email:

Date:

Signature

Please send the signed form to :
Paolo Bertoldi
European Commission - DG JRC
TP 450
I-21020 Ispra (VA)
tel. +39 0332 78 9299 (secretary 9145)
fax. +39 0332 78 9992

E-mail: paolo.bertoldi@ec.europa.eu