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Code of Conduct on Energy Efficiency of Digital TV Service Systems

Version 9

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1 INTRODUCTION

Equipment for the reception, decoding and interactive processing of digital broadcasting and related services contributes and will continue to contribute substantially to the electricity consumption of households in European Union. The Code of Conduct aims to reduce the potential electrical load represented by this equipment; aiming to ensure that the electrical efficiency of equipment required supporting digital TV and related services is maximized.

This Code of Conduct aims to build upon the normative approach of the Voluntary Agreement on CSTB energy consumption. Participation in that Voluntary Agreement is a necessary precursor to support for this Code of Conduct. The Code of Conduct sets out the principles to be followed by those parties involved in digital TV services, operating in the European Community and aspiring to the best possible outcomes in the area of energy consumption.

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 document specifies energy efficiency requirements and the measurement methods for compliance check against the requirements herein.

It is organized as follows: chapters 1 to 7 deal with high level aspects, and chapters 8 to 11 deal with technical details. Chapter 11, more specifically, contains the list of definitions for all terms used in the document. Terms defined are Capitalized throughout the text. Appendices A and B, in the end, contain some non-normative examples of a power management state machine and of system configuration with assignment of corresponding allowances.

Important note: It is strongly recommended that Chapter 8 (Specific requirements) is read along with Chapter 9 (Test procedures) and Chapter 10 (Definitions), for mutual and complementary comprehension.

2 EQUIPMENT COVERED

This Code of Conduct covers Complex Set Top Boxes (hereafter referred to as Equipment), i.e. devices whose main function is the reception, demodulation, descrambling, interactive processing and optional decoding or/and recording of digital TV and related services accessible through Conditional Access systems. Examples of such Equipment are Headed and Headless Complex Set-Top Boxes, e.g. for Satellite, DTT and/or IPTV, and certain equipment with recording capabilities.

The following products are not covered by this Code of Conduct:

- Simple Set Top Boxes
- Digital TVs with integrated receiver decoder
- Products handling Gateway services to multi-subscriber scenarios
- Devices whose primary function is something else than reception of digital TV signals, e.g. but not limited to:
 - Computers fitted with digital TV tuners or TV add-in cards
 - Game consoles with digital TV tuners

- Digital receivers with recording function based on removable media in a standard library format (VHS tape, DVD, Blu-ray disk and similar)
- External plug in digital receivers for computers (e.g. USB)

3 AIM

The aim of this document is to set requirements to minimize overall energy consumption (kWh) per Equipment without hampering the functionality and the convenient use of Equipment, which can be achieved by those aspiring to the best possible outcomes in the area of energy consumption.

4 GENERAL PRINCIPLES AND REQUIREMENTS

1. Digital TV systems, Equipment and services must be designed to minimize energy consumption within the constraints of the operational specifications, including the implementation of Energy Management policies.
2. Operational and control systems are specified on the assumption that Equipment has Energy Management built in.
3. Headed Equipment must offer at least one Standby mode.
4. Headed Equipment, must be able to go to a Standby mode upon user command.
5. Headed Equipment must be able to go to a Standby mode after a period of time with no user interaction: (user) APD – Auto Power Down functionality.
6. Headless Equipment with Networked Standby functionality must be able to go to a Standby mode after a period of time with no request for service: (system) APD – Auto Power Down functionality.
7. Equipment should be able to exit a Standby mode based on an internal timer to download content, scan for program, system and scheduling information or perform any other maintenance activity. After completion of these tasks, Equipment must switch back to the initial Standby mode within no more than 15 minutes.
8. Digital TV service systems are designed on the assumption that Equipment can be disconnected from the main supply by the consumer from time to time. No degradation should be perceived by the consumer after reconnecting Equipment to the mains supply.
9. Equipment supplied by a Service Provider that provide for Speculative Recording must have a user-accessible menu option allowing the user to disable Speculative Recording at will.

5 COMMITMENT

This Code of Conduct addresses all actors involved in requirement specifications, design, manufacturing and deployment of Equipment, specifically:

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

Any signatory to this Code of Conduct shall be also a signatory to the Voluntary Agreement on CSTB energy consumption.

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 chapter 7 (Monitoring and Review).

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

1. Abide by the general principles and requirements set out in chapter 4.
2. Ensure that New Models of Equipment meet the specific requirements set out in chapter 8 following the time schedule of chapter 6.
3. Ensure that procurement specifications for Digital TV services, systems, equipment and components are compliant with this Code of Conduct.
4. Co-operate with the European Commission and Member State authorities to monitor the effectiveness of this Code of Conduct on a yearly basis through the procedure described below in chapter 7 (Monitoring and Review).
5. Co-operate with the European Commission and Member State authorities in yearly updating the Code of Conduct scope and energy consumption targets that should be valid for at least two years ahead.
6. 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 of Equipment. Such information shall be made available online and, where relevant and possible, at the point of sale.
7. Ensure that the setup of the network infrastructure of the service provider will be in a way that any interaction with 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 Equipment the chance to go into a Standby mode.

6 TIME SCHEDULE – EFFECTIVE DATES

Two tiers are specified: Effective Date for Tier 1 of this Code of Conduct, i.e. the date when the Tier 1 requirements will begin to be effective, is July 1st, 2013. Effective Date for Tier 2 is July 1st, 2015.

7 MONITORING AND REVIEW

Signatories agree to provide the European Commission with information concerning the power consumption of the new models of Equipment they produce, specify, buy, etc that are covered by the present Code. The reporting period is 1st July to 30th of June each year. The report shall be submitted no later than 30th of September of every year. Information will be provided to the Commission in the form of a spreadsheet that can be downloaded from the website <http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/code-conduct-digital-tv-services>

The reported data will be discussed in a confidential and anonymous way by the signatories, as long as they remain committed to the Code of Conduct, the European Commission, Member States and their representatives in order to:

- Evaluate the level of compliance and the effectiveness of this Code of Conduct in achieving its aims.
- 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.
- Set targets for future time periods.

8 SPECIFIC REQUIREMENTS

Equipment meets the specific requirements if the TEC (Total Energy Consumption) of the EUT (Equipment Under Test) is equal to or less than the AEA (Annual Energy Allowance) of the EUT.

The AEA (Annual Energy Allowance) for a specific EUT is determined by summing the relevant allowances specified in Tables 2 and 3 for base and additional functionalities (see section 8.1).

The TEC (Total Energy Consumption) of the EUT (Equipment Under Test) is calculated with the following procedure. The power consumption values On and Standby modes are measured according to the test procedures in chapter 9 and then multiplied by the number of hours that the EUT is assumed to spend in the corresponding mode (see section 8.2).

8.1 Determining the AEA (Annual Energy Allowance)

To calculate the AEA (Annual Energy Allowance) for the EUT, take the sum of the base functionality allowance and any applicable additional functionalities allowances.

$$\text{Annual Energy Allowance [kWh/year]} = \text{Base Functionality Allowance} + \text{Additional Functionalities Allowance(s)}$$

Equation 1 – Annual Energy Allowance equation

Base and Additional Functionality Allowances are listed in next paragraphs.

8.1.1 Base Functionality Allowance

The Base Functionality shall be determined as explained below. The classification of each Equipment is distinct and each classification is mutually exclusive. In the event that an EUT might fall into more than one of the categories below, it shall be treated as falling solely into the first category it is classified.

Cable: If the EUT meets the definition of a Cable CSTB, and the EUT is capable of receiving a cable service protected by conditional access, the base functionality is defined to be cable, regardless of whether the cable reception is considered the “principal functionality” by the Manufacturer or Service Provider.

Satellite: If the EUT base functionality is not cable and the EUT meets the definition of a Satellite CSTB and the EUT is capable of receiving a satellite service protected by conditional access, the base functionality is defined to be satellite, regardless of whether the satellite reception is considered the “principal functionality” by the Manufacturer or Service Provider.

Internet Protocol (IP): If the EUT base functionality is not cable or satellite and the EUT meets the definition of an IP CSTB and the EUT is capable of receiving an IP service protected by conditional access, the base functionality is defined to be IP, regardless of whether the IP reception is considered the “principal functionality” by the Manufacturer or Service Provider.

Terrestrial: If the EUT base functionality is not cable, satellite or IP and the EUT meets the definition of a Terrestrial CSTB and the EUT is capable of receiving a terrestrial service

protected by conditional access, the base functionality is defined to be terrestrial, regardless of whether the terrestrial reception is considered the “principal functionality” by the Manufacturer or Service Provider.

Thin-Client/Remote: Any EUT that meets the definition of Cable, Satellite, IP or Terrestrial CSTB is not a Thin-Client/Remote CSTB. If the EUT base functionality is not cable, satellite, terrestrial or IP, and the EUT otherwise meets the definition of Thin-Client/Remote, the base functionality is defined to be thin-client/remote.

The Base Functionality Allowance shall be determined using values from Table 1.

Base Functionality	Tier1 Annual Energy Allowance [kWh/year]	Tier2 Annual Energy Allowance [kWh/year] (Value to be confirmed 1 year before effective date)
Cable	45	37
Satellite	50	40
IP	26	20
Terrestrial	37	32
Thin-Client/Remote	26	20

Table 1 – Base Functionality Annual Energy Allowance

8.1.2 *Additional Functionalities Allowances*

The Additional Functionalities Allowances, if applicable, shall be determined using values from Table 2. This table contains Tier 1 and Tier 2 values as well as the criteria for allowance applicability, including the number of times the allowance can be claimed by an EUT.

Additional Functionalities	Applicability	Tier 1 Annual Energy Allowance [kWh/year]	Tier 2 Annual Energy Allowance [kWh/year]
Access to additional RF channels	For each additional RF channel. The allowance only applies to RF Tuners, and not to additional network based IP inputs such as an additional Ethernet interface.	7	6
Advanced Video Processing	Once per Equipment – Mutually exclusive with High Efficiency Video Processing allowances. The allowance only applies when decoded video is available in analog or digital form and /or when	0	0

Additional Functionalities	Applicability	Tier 1 Annual Energy Allowance [kWh/year]	Tier 2 Annual Energy Allowance [kWh/year]
	Equipment provides transcoding capability from content encoded with advanced video coder.		
High Efficiency Video Processing*	Once per Equipment – Mutually exclusive with Advanced Video Processing allowances. The allowance only applies when decoded video is available in analog or digital form and /or when Equipment provides transcoding capability from content encoded with advanced video coder.	20	13
Full High Definition Processing*	Once per Equipment – Mutually exclusive with Ultra High Definition, Processing allowances.	0	0
Ultra High Definition Processing*	Once per Equipment – Mutually exclusive with Full High Definition Processing allowances.	20	13
3DTV Processing*	Once per Equipment.	20	13
Advanced Graphics Processing	Once per Equipment.	5	0
Multi-encoding*	For each additional encoder. This allowance may only be used for Equipment that can provide independent content to more than one display device, e.g. TV, portable media player.	10	8
Multi-display	Once per Equipment. This allowance may only be used for Equipment that can provide independent content to more than one display device, e.g. TV, portable media player.	5	5
Basic In-Home Networking, e.g. WiFi, MoCA, Powerline	For each network physical interface technology excluding Ethernet.	18	14
	Once for any network physical interface technology that is also a network port.	12	5

Additional Functionalities	Applicability	Tier 1 Annual Energy Allowance [kWh/year]	Tier 2 Annual Energy Allowance [kWh/year]
	If this allowance is claimed, Equipment shall offer Networked Standby functionality in at least the APD stdby mode or the interface shall be enabled in APD Standby mode.		
In-Home Networking Access Point-Router*	Once per equipment as a complement of Basic In-Home networking allowance	53	37
Return Path technical interfaces: ADSL or DOCSIS 2.0 or VDSL	Once per Equipment.	30	30
Return Path technical interfaces: DOCSIS 3.0	Once per Equipment. Allowance is for 4 bonded RF channels minimum.	45	25
	For each additional 4 bonded RF channels	20	5#
DVR	Once per Equipment. For the allowance to be claimed the recording capability must be greater than 30 minutes	15	10
VOIP	Once per Equipment.	20	16
Smart Home services / Ultra high processing capability	Once per Equipment.	TBD	TBD

* Provisional allowances because functionality not yet implemented in products on the market.

Assuming that DOCSIS 1 by 1 standby is available in 2015.

Table 2 - Additional Functionalities Annual Energy Allowance

8.2 Determining the TEC (Total Energy Consumption)

The TEC of the EUT is determined by Equation 2.

<p>Total Energy Consumption (TEC) [kWh/year] = 0.365 x (T_{On} x P_{On} + T_{Stdby} x P_{Stdby} + T_{APD} x P_{APD})</p>

Equation 2 – Total Energy Consumption equation

In equation 2 terms are defined as follows:

P_{On} , $P_{Standby}$ and P_{APD} are the power consumption in On, (user initiated) Standby and APD Standby modes respectively measured according to the test procedures in chapter 9.

T_{On} , $T_{Standby}$ and T_{APD} are standardized amount of hours per day spent by the EUT in On, (user initiated) Standby and APD Standby modes respectively (see table 3):

- T_{On} is the cumulative amount of time the EUT is considered to stay in any of the On modes.
- $T_{Standby}$ is the cumulative amount of time the EUT is considered to stay in any of the user initiated Standby modes.
- T_{APD} is the cumulative amount of time the EUT is considered to stay in the APD Standby mode: user-APD Standby for Headed Equipment without Networked Standby functionality, user-APD and system-APD Standby for Headed Equipment with Networked Standby functionality and system-APD Standby for Headless Equipment with Networked Standby functionality. For Headed Equipment: if the user-APD timeout is set to less than 4 hours, for each hour less than 4 the timeout is set, T_{On} shall be decreased with half an hour and T_{APD} shall be increased with half an hour.

Daily time duration in this mode	Equipment without Networked Standby functionality [hours/day]		Equipment with Networked Standby functionality [hours/day]	
	<i>Headed</i>	<i>Headless</i>	<i>Headed</i>	<i>Headless</i>
T_{On}	4.5	24	4.5	4.5
$T_{Standby}$	15	0	4.5	0
T_{APD}	4.5	0	15	19.5

Table 3 - Duty Cycle for Total Energy Consumption calculation

9 TEST PROCEDURES

9.1 Overview

All testing shall be carried out as specified below. Functionalities that are not specified in this CoC shall be switched off during testing; if testing results deviate from the expected values, the presence of switched-off functionalities shall be reported.

- A. This section defines a manufacturer independent test process to determine the power consumption of a CSTB under various standardised operating conditions, these are designed to emulate average 'real world' viewing habits. All testing shall be carried out in controlled repeatable conditions, as specified below. The general conditions of test are described in IEC 62301 (Household electrical appliances – Measurement of standby power). As far as timing is concerned user initiated as well as APD Standby mode measurement should be taken no less than 30 minutes after the device enters such a mode. 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 (i.e. powered independently).
- B. 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. Where the same CSTB has been shipped with more than one software version during the course a Reporting Period then a single representative unit may be tested.
- C. The compliance testing shall be carried out on one random sample product. If the product fails then that model does not comply with this document. 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.
- D. Where the energy consumption can be influenced by the end user, then all measurements shall be made using the default (as shipped) settings.
- E. When testing the audio/video content shall be encoded using a qualifying technology (e.g. MPEG2, MPEG 4 with scrambling) and typically a sports or film channel with a high bit rate.
- F. Where an allowance for the Return Path is claimed then the EUT must be operated to the highest version of the Return Path technology with which it is compatible.
- G. Where the allowance for Advanced Video Processing (including High Definition) is taken, then at least 1 test stream shall be encoded using a qualifying technology (e.g. MPEG4, H.264 etc. with scrambling).
- H. Where the allowance for Multi-Encode and Multi-Display are claimed then at least one additional display device shall be connected to the EUT when performing the test methods set out at Sections E4-E9 of this Annex E 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.
- I. Where a product is capable of scheduling a recording in any mode then for all tests a recording shall be scheduled for at least 2 hours after that test will be completed.

- J. Where the allowance for Home network / in-Home Networking 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.
- K. For Networked Standby the CSTB should be operated in the most basic mode required to produce an output from the specified broadcast stream over a network working to the standard of that broadcast stream.
- L. Where the allowance for networked standby functionality is claimed, then it must be tested on all the Home Network Interfaces for which allowance is claimed. Energy Consumption shall be measured on each individual Network Port as detailed below.
- M. The results of the testing shall be documented, including and model tested, the serial number of the EUT and the software version numbers.

9.2 IEC 62301 Basic test requirements

The general conditions of test are described in IEC 62301 (Household electrical appliances - Measurement of standby power). The main requirements are summarized in Table 4 - Main requirements of IEC62301 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 Hz $\pm 1\%$
Supply voltage waveform	Total harmonic content $\leq 2\%$ Crest factor between 1.34 and 1.49
Power measurement accuracy:	
Power level ≥ 0.5 W	Uncertainty $\leq 2\%$ at the 95% confidence level
Power level ≤ 0.5 W	Uncertainty ≤ 0.01 W at the 95% confidence level
Instrument resolution:	
Power ≤ 10 W	Resolution ≥ 0.01 W
Power $10 \leq 100$ W	Resolution ≥ 0.1 W

Table 4 - Main requirements of IEC62301

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

9.3 Test Method for Standby (PStandby, user initiated)

- A. The EUT shall be put into its “On” mode.
- B. After 5 minutes in this mode, the standby or off button on the remote control shall be pressed.
- C. The EUT shall then be left for a maximum of 30 minutes for any housekeeping activities to complete.

- D. At the end of the 30 minutes or completion housekeeping activities (whichever is shorter) the average energy shall be measured for a period of 5 minutes. Based on this 5 minute measurement the standby part of the TEC shall be calculated.
- E. If the EUT has a cycling behaviour in standby (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.
- F. If the EUT is fitted with a front panel switch which initiates a different level of energy 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.
- G. If the EUT is fitted with a manual switch on a rear face then that switch shall be disregarded.
- H. Based on this measurement the User initiated Standby part of the TEC shall be calculated.

9.4 Test Method for Auto Power Down (PAPD, EUT initiated)

- A. The EUT shall be connected to, and displaying a Standard Definition stream
- B. The EUT shall be left until the auto power down takes place.
- C. The EUT shall then be left for a maximum of 30 minutes or for any housekeeping activities (whichever is shorter) to complete. At the end of the 30 minutes or housekeeping activities the average energy shall be measured in accordance with section E3 above.
- D. If the EUT has a cycling behaviour in APD (e.g. 30 minutes passive standby and 5 minutes network standby, test cycle 35 minutes total) the APD part of the TEC shall be calculated based on 1 complete cycle.
- E. Based on this measurement the APD part of the TEC shall be calculated.

9.5 Test method for “On” mode of Standard Definition non-PVR

- A. The EUT shall be connected to, and displaying a standard definition stream.
- B. The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- C. The average energy shall then be measured over a period of 5 minutes.
- D. Based on this 5 minute measurement the “On” mode part of the TEC shall be calculated.

9.6 Test method for “On” mode of HD, Full HD, UHD and 3D-TV non-PVR

Tier1

- A. The EUT shall be connected to, and displaying a stream of the highest resolution it is able to support.
- B. The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- C. The average energy shall then be measured for a period of 5 minutes
- D. The EUT shall then be re-tuned to a standard definition channel and the average energy measured for a further 5 minutes.
- E. Based on these 2 measurements totalling 10 minutes, the “On” mode part of the TEC shall be calculated.

Tier2

- A. The EUT shall be connected to, and displaying a stream of the highest resolution it is able to support and 3DTV if applicable.

- B. The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- C. The average energy shall then be measured for a period of 5 minutes.
- D. The EUT shall then be re-tuned to a 2D high definition channel at the highest supported resolution and the average consumption measured for a further 5 minutes.
- E. Based on these 2 measurements totalling 10 minutes, the “On” mode part of the TEC shall be calculated.

9.7 Test method for “On” mode of Standard Definition PVR

- A. The EUT shall be connected to a Standard Definition stream.
- B. The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- C. The EUT shall then be set to view 1 SD channel whilst a second channel is recorded.
- D. The average energy shall then be measured for a period of 5 minutes.
- E. For the purposes of this test where there is more than 1 tuner the viewed channel shall be different to the recorded channels.
- F. Based on this 5 minute measurement the “On” mode part of the TEC shall be calculated.

9.8 Test method for “On” mode of High Definition, Full High Definition, UHD and 3D-TV PVR

- A. The EUT shall be connected to, and displaying a stream of the highest resolution it is able to support.
- B. The EUT shall then be left for a maximum of 30 minutes or until the EUT has stabilised.
- C. The EUT shall then be set to view 1 channel at the highest resolution supported, whilst a second HD channel is recorded at a minimum resolution of 720P. For products with more than 2 tuners the EUT shall be set to view 1 channel at the highest supported resolution and shall record n-1 channels (where n= the total number of tuners available) at a minimum resolution of 720P. For example with a 5 tuner EUT one channel shall be displayed and 4 channels recorded.
- D. For the purposes of this test where there is more than 1 tuner, each channel shall display or record different content.
- E. The average energy shall then be measured for a period of 5 minutes.
- F. Based on this 5 minute measurement the “On” mode part of the TEC shall be calculated.

9.9 Test Method for Networked standby (PNetworked standby, EUT initiated)

- A. To determine the Network Standby consumption the EUT shall be connected to each qualifying network in turn.
- B. A qualifying Network port is a Local Area network port, wired or wireless, that is intended to handle audio and video streams and, if the EUT is in a network standby mode the port can be used to remotely reactivate the EUT into an ‘on’ mode.
- A. Where multiple network ports of the same technology are used, only 1 network port of each technology shall be tested, selected at random
- C. The energy consumed by the EUT with each Network port shall be recorded.
- D. The network standby consumption TEC shall be the average consumption of all network ports. E.g. if an EUT has Wi-Fi, Ethernet and MoCA network ports then the Network standby consumption shall be the consumption of all 3 port types divided by 3.
- E. Each LAN port type shall be tested in turn with any other possible Network ports disabled. It shall be indicated in the test report which Network ports were disabled during testing.

- F. Networked standby (EUT initiated) is expected to take place from Idle mode.
- G. If the EUT is capable of scheduling a recording then a recording shall be scheduled 2 hours in the future plus the Networked Standby timeout.
- H. The EUT shall be left until it switches into the Networked standby mode.
- I. When in the Network standby mode the average energy shall be measured for a period of 5 minutes.
- J. If an EUT has more than one network port type, steps F to J shall be repeated for each network port type and the average network standby figure calculated in accordance with E.9 E.
- F. If the EUT has a cycling behaviour in standby (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.
- K. Based on this measurement the Network Standby part of the TEC shall be calculated for this networked standby mode.

9.10 Test Method for Networked on mode (PNetworked, user initiated)

- B. If Networked standby is expected to take place from an “On” mode then the EUT shall be set in that “On” mode, i.e. delivering a stream through the network port under test.
- C. A qualifying Network port is a Local Area network port, wired or wireless, that is intended to handle audio and video streams and, if the EUT is in a network standby mode the port can be used to remotely reactivate the EUT into an ‘on’ mode.
- D. Where multiple network ports of the same technology are used, only 1 network port of each technology shall be tested, selected at random
- E. The energy consumed by the EUT with each Network port shall be recorded.
- F. The network standby consumption TEC shall be the average consumption of all network ports. E.g. if an EUT has Wi-Fi, Ethernet and MoCA network ports then the Network standby consumption shall be the consumption of all 3 port types divided by 3.
- G. Each LAN port type shall be tested in turn with any other Network ports disabled.
- H. If the EUT is capable of scheduling a recording then a recording shall be scheduled 2 hours in the future.
- I. The EUT shall be put into Networked standby.
- J. The EUT shall then be left for a maximum of 30 minutes for any housekeeping activities to complete.
- K. At the end of the 30 minutes or completion housekeeping activities (whichever is shorter) the average energy shall be measured for a period of 5 minutes. Based on this 5 minute measurement the Network standby part of the TEC shall be calculated.
- G. If the EUT has a cycling behaviour in standby (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.

10 DEFINITIONS

10.1 General definitions

Annual Energy Allowance (AEA): The maximum amount of energy (kWh/year) Equipment is allowed to consume in one year in order to comply with the Code of Conduct.

Conditional Access: Encryption, decryption, and authorization techniques employed to limit access to content to authorized parties. This definition includes content protection technologies used to protect access to content in the end user's home network after the network Conditional Access has been terminated.

Direct to Retail Equipment: Equipment purchased directly by the user and not supplied by the Service Provider.

Duty Cycle: The amount of time Equipment is presumed to cycle through in the power states considered in this Code of Conduct.

Energy Management: Equipment capability to manage energy consumption depending on the functionality required of the unit.

Equipment / Complex Set Top Box (CSTB): A device equipped with Conditional Access technology whose primary function is the reception, demodulation, descrambling, interactive processing and optional decoding or/and recording of data from digital TV streams and related services and their conversion to format suitable to feed an external display. It may have audio and video decoding and output capability.

Equipment Under Test (EUT): A random selected unit of Equipment tested to check compliance with the Code of Conduct.

Headed Equipment: A Complex STB equipped with a "head" meaning capable of the all the following specific functionalities:

- Audio-Video programs decoding,
- Graphic composition especially for user interface.
- Mixing the corresponding content and convert to Audio-Video signal.
- Directly feeding an external TV with Audio-Video signal.
- Capability to be controlled by mean of local control or remote control.

Headless Equipment: A complex STB not being Headed Equipment.

Cable, Satellite, and IP/Telecom Service Provider: An entity that provides video content (and possibly other types) to subscribers with whom it has an ongoing contractual relationship. A Service Provider in the context of Code of Conduct is one that distributes equipment covered by this specification to end users under an agreement such as a lease or rental arrangement.

Simple Set Top Box: A stand-alone device without Conditional Access whose main function is the reception, demodulation, descrambling, decoding, interactive processing and optional recording of digital TV and related free services and their conversion to format suitable to feed an external display.

Total Energy Consumption (TEC): The amount of energy (kWh/year) Equipment consumes, determined by applying a specified duty cycle to the measured power levels for that Equipment.

TV: Any device capable of sinking and displaying real-time video sourced by the Equipment.

New Model: A new design first placed on the market during the current reporting period.

Network: An infrastructure with a certain topology of links, an architecture including the physical components, organizational principles, communication procedures and formats (protocols).

10.2 Operational modes, power management and functionalities

10.2.1 Operational modes definitions and power management

(user-)APD (Auto Power Down): The mandatory capability of Headed Equipment to automatically switch from the On mode to the lowest-power Standby mode the Service Provider deems to be appropriate after a period of time without user input in the On mode. The destination Standby mode is named APD Standby in this document. Before switching to APD Standby a GUI may prompt the user to confirm that the Equipment is still in use; in such case the transition takes place only if the end user provides no response within a (further) timeout. The APD timeout shall be set at a default of no more than 4 hours by the manufacturer and may be adjusted by the user to no more than 8 hours. The user may override this functionality through a special menu option.

(system-)APD (Auto Power Down): The mandatory capability of Headless or Headed Equipment with Networked Standby functionality to automatically switch from the Active (Headless) or (user-)APD (Headed) mode to the lowest-power Standby mode the Service Provider deems to be appropriate after a period of time without service request. The system-APD timeout shall be set at 20 minutes by default and may be adjusted by the user through a special menu option.

Network physical interface: A (physical) interface of the LAN network connection.

Network Port: A Network physical interface of the equipment through which the equipment can be reactivated. Each Equipment manufacturer must clearly indicate which interfaces implement Networked Standby Functionality and are consequently called Network Port. Note that for the Code of Conduct the definition is limited to Local Area Network Ports/In-Home networking Network Ports.

Networked Standby Functionality: A condition where Equipment is able to resume a function (reactivation) through a Remotely Initiated Trigger via a Network Port (remote access).

On (Headed equipment) Active (Headless Equipment): Operational mode(s) in which the Equipment is actively delivering at least one of the functionalities it implements, not necessarily including the Base Functionality and not necessarily limiting to it. There may be more On modes for Equipment providing the main functionality as well as additional ones: for instance, a hybrid IPTV/DTT STB could be considered in an On mode when either functionality is operational, or both (if supported). Note that the energy requirements related to On mode(s) might be variable over the time and dependent on the real functionality requested from the Equipment. For Headless Equipment the On mode is called Active mode.

Remotely Initiated Trigger: A signal that comes from outside the Equipment (Note that the remote control delivered with the Equipment is considered to be part of the Equipment).

Standby: Operational mode(s) in which Equipment has less energy consumption, capability, and responsiveness than in the On (Headed) or Active (Headless) mode. The power consumption related to Standby mode might be variable and dependent on the real functionality requested from the CSTB. For this Code of Conduct the following Standby modes are used in the Duty Cycle for the TEC calculation: user initiated Standby, and user and system APD Standby:

- user initiated **Standby** (Headed Equipment only): the mode(s) into which the Equipment is switched when the user presses shortly the Standby button on the remote control or, if applicable, the Standby switch on the front panel of the Equipment. In this mode the Equipment shall at least be able to be reactivated by using the remote control.
- **APD Standby:** the mode(s) into which the Equipment is switched by user-APD (Headed Equipment) or system-APD (Headed and Headless Equipment). If the Equipment has Networked Standby Functionality, this functionality shall be available in the APD Standby mode.

10.2.2 Base Functionality and Additional Functionalities

The **Base Functionality** of all Equipment includes the reception of digital TV signals from one or more Cable, Satellite, IP, Terrestrial, distribution systems with Conditional Access to allow audio video content descrambling and local consumption or distribution of content to one or more CSTBs with Thin-Client functionality, as further specified below. Note that Audio and video decoding & outputting functionality is optional, for instance devices for distribution of content do not need it. Return Path functionality is included in base functionality.

Cable CSTB: a CSTB which is capable of receiving digital television signals from a coaxial or hybrid fiber/coaxial distribution system and deliver them to a consumer display and/or external rendering/recording device.

Satellite CSTB: it is a CSTB which is capable of receiving digital television signals from satellites and deliver them to a consumer display and/or external rendering/recording device.

Internet Protocol (IP) CSTB: it is a CSTB which is capable of receiving digital television/video signals encapsulated in IP packets directly from the Service Provider and deliver them to a consumer display and/or external rendering/recording device.

Terrestrial CSTB: it is a CSTB which is capable of receiving digital television signals over the air (OTA) and deliver them to a consumer display and/or external rendering/recording device.

Thin-Client/Remote: A CSTB that is designed to interface between another CSTB, acting as a server, and a TV (or other output device). Thin clients have no ability to interface with the Service Provider directly and rely solely on another CSTB for content.

Access to Additional RF channels: This may be achieved by either adding additional RF tuners or by providing a wideband tuner capable of accessing multiple video, audio, interactive media, service information or EPG data channels simultaneously. 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.

Advanced Video Processing: A set of advanced methods for video encoding, transcoding or decoding, giving compression efficiency significantly beyond MPEG-2. Examples include, but are not limited to, H.264/AVC and SMPTE 421M

High Efficiency Video Processing: High Efficiency methods for video encoding, transcoding or decoding, giving compression efficiency significantly beyond H.264/AVC and SMPTE 421M. This includes, but is not limited to, the example of HEVC.

High Definition (HD) resolution: Video decoding & outputting capability with resolutions greater than or equal to 720p (1280 pixels x 720 lines at 50 frames/s progressive) or 1080i (1920 pixels x 1080 lines at 25 frames/s interlaced).

Full High Definition Processing: Video decoding & outputting capability with resolutions greater than or equal to 1080p (1920 pixels x 1080 lines at 50 frames/s progressive).

Ultra High Definition Processing: Video decoding & outputting capability with resolutions greater or equal to 4Kx2K (3840 pixels x 2160 lines at 50 frames/s progressive).

3DTV Processing: Capability to produce a 3D output by using a method that requires the processing of some form of difference signal. This includes, but is not limited to, MPEG MVC. It excludes frame compatible representation of 3D.

Advanced Graphics Processing: capability to produce 3D graphics by mean of hardware acceleration giving support for OpenGL ES2.0 or higher.

Multi-encoding: A Cable, Satellite, IP or Terrestrial CSTB that is also capable of audio-video encoding from the highest claimed decoding resolution of the device.

Multi Display: A Cable, Satellite, IP or Terrestrial CSTB that is also capable of providing independent content streams to multiple end points external to the CSTB, e.g. TVs or Thin-Clients, within a single family dwelling.

Home Network Interface: a IEEE 802.3 wired Ethernet Network interface port.

Basic In-Home Networking : The capability to interface with external devices over a high bandwidth network (e.g., IEEE 802.11 (WiFi), MoCA, HPNA) in order to exchange data as a client or an external Access Point.

In-Home Networking Access Point-Router: The capability to route IP traffic of the home network between several clients. This functionality requiring high network availability is generally combined with Access Point functionality to broadband network (WAN).

Return Path Functionality: Provides a two way data link between the Equipment and the service provider. For the purpose of this Code of Conduct, this functionality is supposed to be included in the basic functionality.

Return Path technical interface: A high speed digital modem contained within the CSTB and used for the purpose of two way communications between the CSTB and the service provider. Examples include xDSL, GPRS (or other 2G/3G/4G mobile radio technologies) DOCSIS, EURODOCSIS, (Examples of DOCSIS/EURODOCSIS modems are 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).

Digital Video Recorder (DVR): A device that stores digital video, and possibly other media, to a rewritable disk drive or other non-volatile storage media local to the unit. Functionalities offered by DVR are not limited recording, e.g. they could ‘live pause’. As used in this report, the DRV term covers only DVR functions integrated in the CSTB. Server based DVR capabilities are excluded.

Speculative Recording: Automated recording based on customer profiling.

VOIP (Voice Over IP): A communication (telephony) service over internet protocol networks such as the Internet.

Smart Home services / Ultra high processing capability: High-end services requiring ultra-high-end CPU and memory concept providing:

- high (DMIPS) processing capability
- capability to run securely and independently concurrent applications

This is a non-exhaustive list of possible “Smart Home” services:

- Support to “Smart Grids” concept
- Home security, monitoring and automation
- E-Health
- Connected Home usage learning and users profiling....

10.3 Miscellaneous

xDSL: An international suite of standards that define interface requirements for modems involved in high-speed data and video/audio content distribution over telephone subscribers lines. This functionality includes only high speed modems. Residential Gateway functionalities are not covered by this CoC. They are covered instead by the EU CoC on Broadband Equipment.

EuroDOCSIS (European Data Over Cable Service Interface Specification): 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.

IEC: International Electro technical Commission.

IEC 62301: Household electrical appliances - Measurement of Standby power.

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.

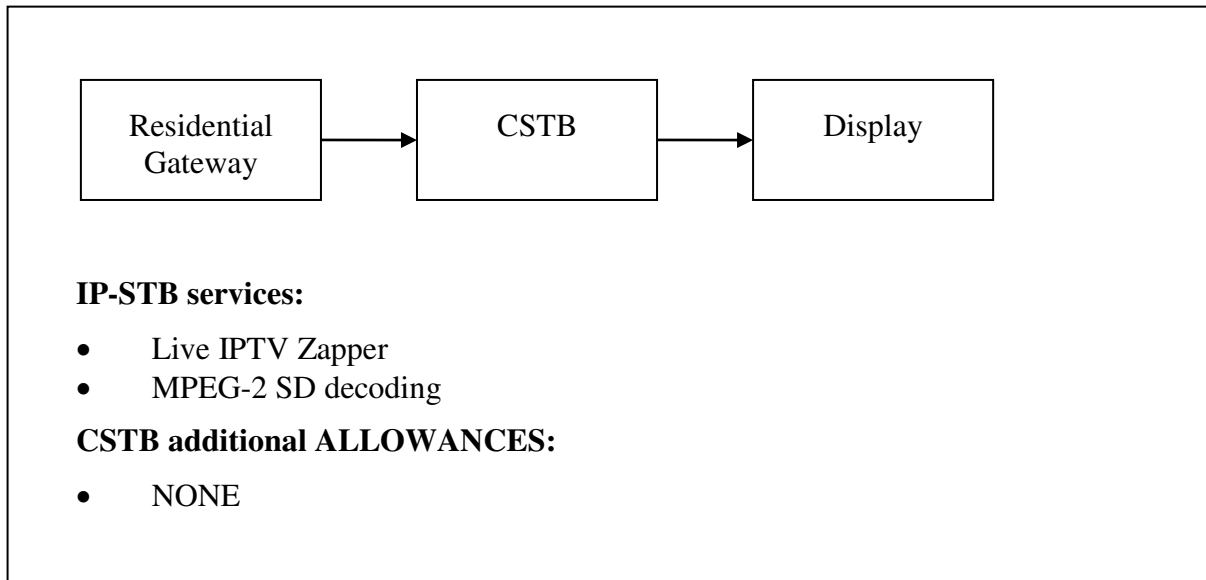
Tuners: This means only a tuner in the conventional sense, i.e. a device or component that has the capability to demodulate physical transmissions from the DTV. These Tuners work at the OSI Physical Layer 1. Examples include DVB-S, DVB-T, DVB-C, DVB-H, ITU G.992.x (G.DMT etc), IEEE 802.16 (WiMAX). A tuner may also incorporate functionality from higher OSI layers (for example Ethernet), but to be classified as a “tuner” for the purposes of this code it must provide OSI Layer 1 functionality and be used for the purpose of reception of digital media (DTV) content. A “Return Path” and an “Out-of-Band Tuner” is not considered a tuner for the purposes of this code – see separate definitions. For the avoidance of doubt an Ethernet connector is not a tuner since it does not provide any specific OSI layer1 functionality like demodulation or extraction of the MPEG-2 TS provided by a DTT decoder.

DMIPS: Dhrystone Million Instruction per Second.

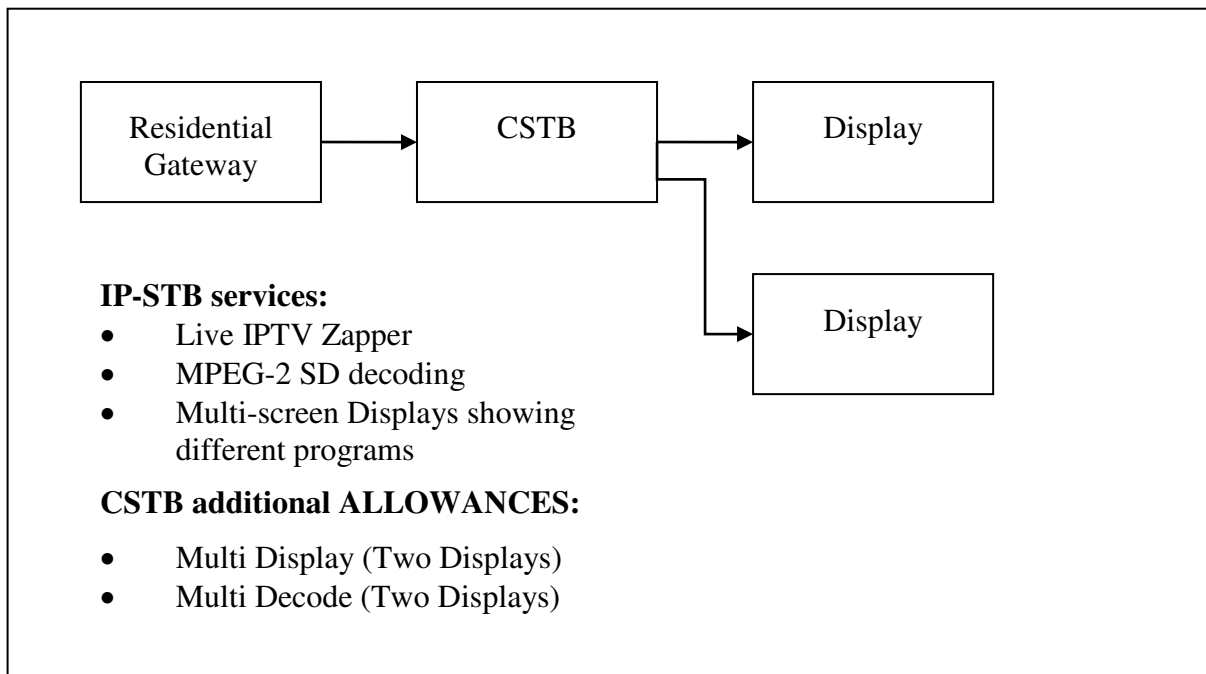
APPENDIX A – EXAMPLE CONFIGURATIONS AND ASSOCIATED ALLOWANCES

In all cases the Base functionality is IP CSTB.

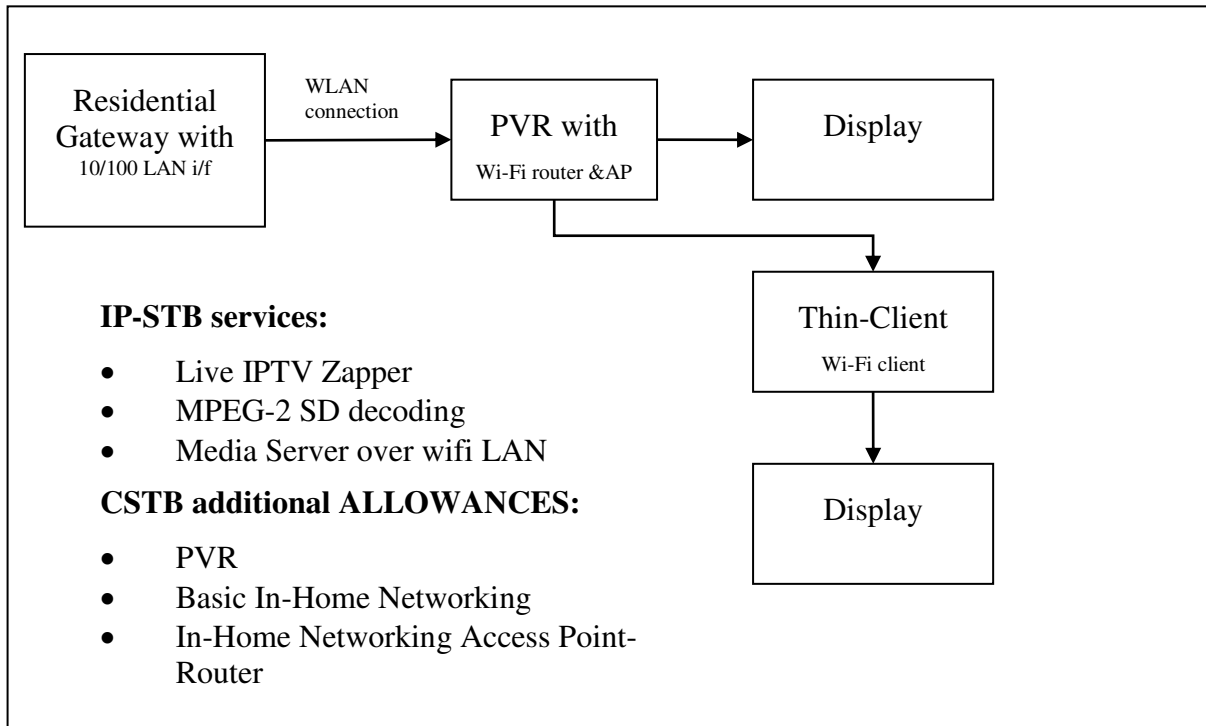
Basic case



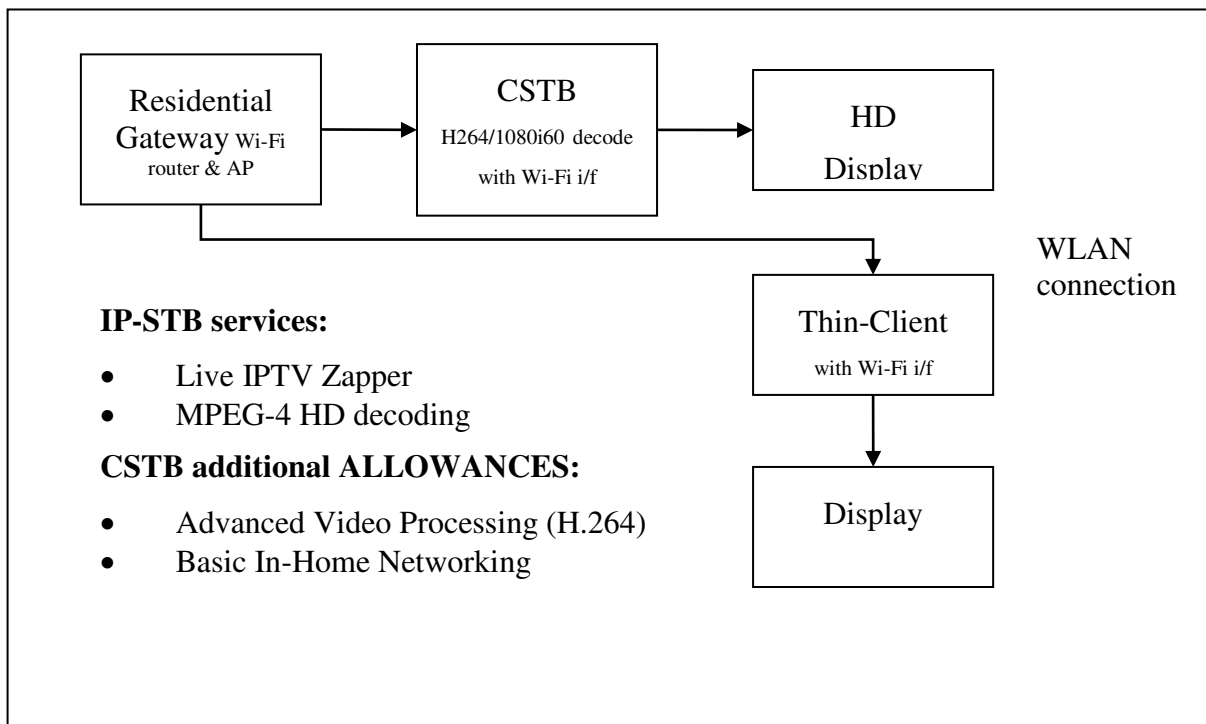
2 Displays



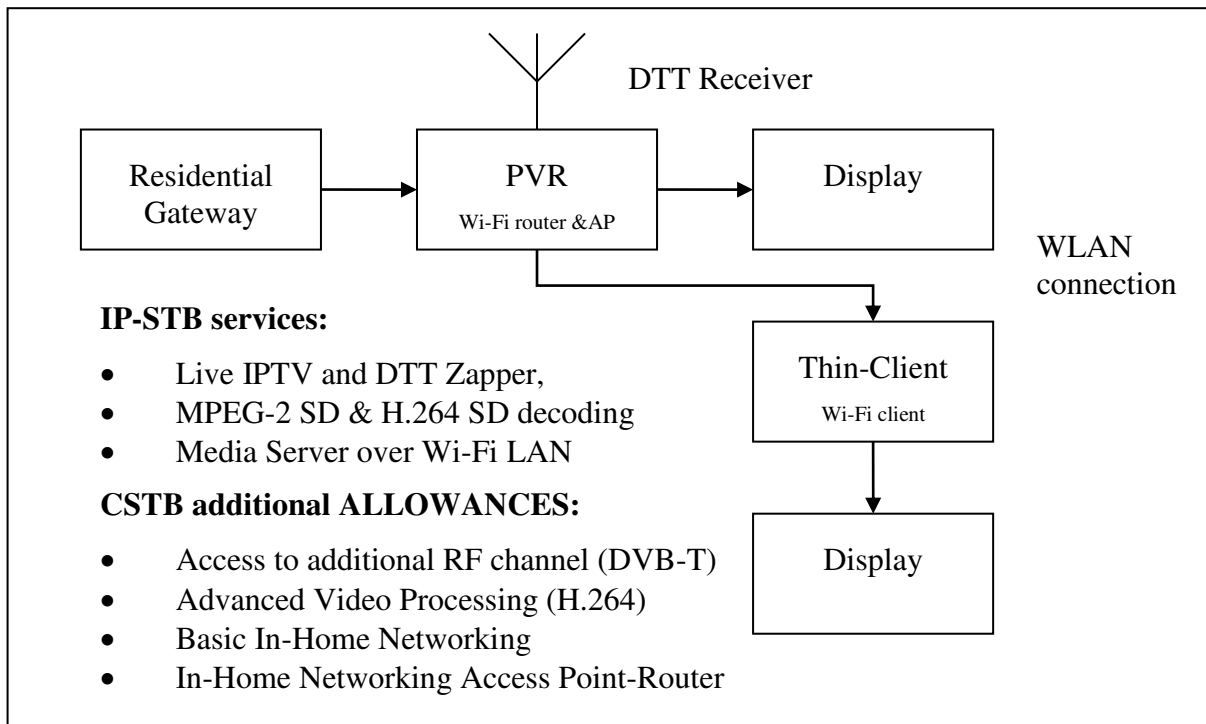
IP Media Server Wifi AP, WAN access via an external GTW through Ethernet



Advanced Video Processing



Hybrid Media Server Wifi AP



APPENDIX B – SIGNING FORM

Code of Conduct

On Energy Efficiency of Digital TV Service Systems

The organisation/company/

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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 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 TP450

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