



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

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**Code of Conduct
on Energy Efficiency of Digital TV Service Systems
Version 4**

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 for the year 2006. 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 equipment for the reception, decoding, recording and interactive processing of digital broadcasting and related services. Examples of such equipment are stand-alone integrated receiver decoders and other set-top boxes, digital TVs with built-in integrated receiver decoder, internet TV and simple converters to adapt analogue TVs and equipment with recording capabilities (PVR: personal video recording equipment). Furthermore, the Code of Conduct also covers *analogue* PVR equipment for household use that is capable of receiving analogue broadcasts and related services, and of recording on non-volatile memory and of playing the recorded signals.

In the rest of this Code of Conduct these categories of equipment will be simply referred to as “equipment”.

3. AIM

To minimise energy consumption (kWh) per appliance.

4. COMMITMENT

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

- 4.1 Abide by the General Principles contained in Annex A.
- 4.2 Achieve the power consumption targets set out in Annex B for new products placed on the market after the start of the period indicated.
- 4.3 Support the continuing development and acceptance through an ad-hoc Task Force of the Common Power Management Guidelines. (The current guidelines are shown in Annex D)
- 4.4 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 two years ahead.
- 4.5 Facilitate and encourage consumers to adopt energy efficient practices in connection with the use of digital TV services. In particular by providing information to consumers, as specified in Annex C.
- 4.6 Co-operate with the European Commission and Member States in monitoring the effectiveness of this Code of Conduct, through the procedure described in Section 5 of this Code of Conduct.
- 4.7 Ensure that procurement specifications for Digital TV services, systems, equipment and components are compliant with this Code of Conduct.

5. MONITORING

Signatories agree to provide to the European Commission on a yearly basis, starting with the year 2002, information concerning the power consumption of the equipment covered by the present Code of Conduct they produce, specify, buy, etc.

The reported results will be discussed starting with year 2003 at least once a year 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, especially regarding the definition and / or modification of the Common Power Management Guidelines.
- c) Set targets for future time periods.

Reporting: The presentation of the results provided to the Commission will be in the form of the attached Excel Spreadsheet *Code of Conduct Digital TV Service Systems DATA sheet.xls* (Annex E).

Annex A – General Principles

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 minimal degradation of the quality of service provided, when physically reconnected to the mains supply.
- A.5 Common Power Management Guidelines are introduced to ensure that the equipment is always in the mode with the lowest possible power consumption for the functionality required at that moment. This condition applies to all the peripheral components and accessories controlled by the equipment. The Common Power Management Guidelines identify common power management capabilities required for functional blocks in a digital reception platform, and those peripheral components and accessories controlled by that platform, such that the power management system implemented for a specific digital service, can make use of commonly available technology. It is recognised by the signatories that universal power management signalling protocols could be used in the external data addressed to the digital reception platform, and the relevant functional building blocks should be designed with this capability in mind, but that such signalling is not a requirement of these Guidelines.
- A.6 Components and design facilitate, not limit, the development and introduction in the future of operational strategies, which would reduce energy consumption for consumers. To this end, functional blocks defined in the Common Power Management Guidelines should have the common power management control states, as appropriate, such as: Off, Low Power, On. The naming of these states is intended to define three levels of power consumption for any device, but is not intended to imply a direct relationship between these states and the definition of power ‘modes’ discussed elsewhere in this Code of Conduct.
- A.7 Equipment has, as appropriate, an on/off switch or as an alternative a low power mode (deep sleep or hibernation or off mode with power consumption <1 Watt), which is automatically activated when no function is provided.
- A.8 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.9 It is recommended that the STB has an automatic standby feature that ensures that the STB automatically switches itself into the lowest standby mode (allowed by the service provider) 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 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 STB should allow the viewer to continue watching beyond the set period by prompting the viewer to confirm that the STB is still in use. The automatic standby feature may however be able to be overridden by a user for a period up to 1 month.

Annex B – Definitions and Power levels (targets, time schedule)

B.1 Definitions

Definition of the basic configuration of stand-alone STB, digital TVs with integrated receiver and decoder (IRD) and analogue PVR

STB, digital TV with IRD				Analogue ¹ PVR (no CA support)
<i>CABLE</i>	<i>TERRESTRIAL</i>	<i>SATELLITE</i>	<i>DSL</i>	
Single cable tuner /demodulator	Single UHF tuner /demodulator	Single satellite tuner /demodulator Single LNB feed	No tuner /demodulator	Single RF tuner / demodulator
+				
Single MPEG2 Decoder				n/a
RF Modulator / Loop-through				
IR Remote Control				
Support for Off-air Software Upgrade				n/a
Smart Card Interface				n/a
Common Interface / Dataport				n/a
RS232 Serial Port				n/a
Support for remote IR Receiver / IR Blaster				n/a
n/a	PSTN Modem*			n/a

Definition of the simple digital TV converter box

The simple digital TV converter is a stand alone device, using an integral or dedicated external power supply, for the reception of (free) digital broadcasting services and their conversion to analogue RF and / or line signals which has the following components/features:

- no CA support
- Tuner/demodulator:
 - Cable version: Single cable tuner/demodulator
 - Terrestrial version: single RF tuner /demodulator, active antenna powering
 - Satellite version: single satellite tuner / demodulator, single LNB feed.

¹ PVRs for digital broadcasting are included in the category STB

- Single MPEG2 Decoder
- Support for Off-air Software Upgrade

Definition of the modes

Mode	Definition
Off	The equipment is connected to a power source, fulfils no function and cannot be switched into any other mode with the remote control unit, an external or internal signal.
Standby passive	The appliance is connected to a power source, fulfils not the main function but can be switched into another mode with the remote control unit or an internal signal.
Standby active	The appliance is connected to a power source, fulfils not the main function but can be switched into another mode with the remote control unit or an internal signal. It can additionally be switched into another mode with an external signal or it is receiving a minimal level of data from an external source.
On	The appliance is connected to a power source and fulfils a main function, including the provision of signals to supported devices.

B.2 Targets and time schedule

The equipment covered by this Code of Conduct should meet the following maximum power consumption targets and time schedule.

1. For stand-alone STBs in the basic configuration

Mode	from 1-1-2006 to 31-12-2007			
	<i>Cable</i>	<i>Terrestrial</i>	<i>Satellite</i>	<i>DSL</i>
Standby passive (where specified)	3.0 W	3.0 W	3.0 W	3.0 W
Standby active	7.0 W	6.0 W	8.0 W	6.0 W

2. For digital TVs with integrated receiver and decoder (IRD) in the basic configuration

Mode	From 1-1-2005 to 31-12-2006		
	<i>TV with built in Cable(IRD)</i>	<i>TV with built in Terrestrial(IRD)</i>	<i>TV with built in Satellite(IRD)</i>
Standby passive (where specified)	3.0 W	3.0 W	3.0 W
Standby active	8.0 W	7.0 W	9.0 W

Mode	From 1-1-2007 to 31-12-2007		
	<i>TV with built in Cable(IRD)</i>	<i>TV with built in Terrestrial(IRD)</i>	<i>TV with built in Satellite(IRD)</i>
Standby passive (where specified)	1.5 W	1.5 W	1.5 W
Standby active	8.0 W	7.0 W	9.0 W

3. For analogue PVR in the basic configuration

Mode	From 1-1-2006 to 31-12-2007
Standby passive	3.0 W
Standby active	6.0 W

4. For simple digital TV converter boxes

Mode	From 1-1 2006 to 31-12-2007#			
	<i>Cable</i>	<i>Terrestrial</i>	<i>Satellite</i>	<i>DSL</i>
	<i>Simple Converters</i>			
Standby Passive	2W	2W	2W	2 W
ON	7W	7W*	10W	7 W***
	<i>Simple converters for High Definition TV Services</i>			
Standby Passive	2 W	2 W	2 W	2 W
ON (standard definition output)	11 W	11 W**	14 W	11 W***
ON (high definition output)	12 W	12 W**	15 W	12 W***

Values include attached peripheral equipment supplied with the box, e.g. powered antennas

* 9 W: in case of double RF tuner

** 14 W: in case of double RF tuner

*** If the DSL box includes the ADSL modem then there is an additional 2W allowance in **ON mode power** (this allowance is valid only for DSL boxes)

5. Additional allowances on standby active mode targets for components added to the basic configuration

For additional components that may be added on to the equipment in the basic configuration the following additional power allowance can be added to the maximum standby active power consumption targets above.

In any case the total *maximum* power consumption targets in *standby active mode* should not exceed:

- **15 W** for the stand-alone STB (except for high definition: both with MPEG2 and MPEG4, MPEG4 and multi-decode platforms; see point 6 at the following page) and analogue PVRs.
- **16 W** for TVs with integrated digital receiver and decoder.

Feature	Indicative additional maximum power consumption (at the AC mains) for additional features
Internal hard disk drive	2.2 W
IEEE1394 interface	0.8 W
Ethernet interface 100Mbit	0.4 W
Each home network interface	2.5 W
Each serial USB interface	0.3 W
Home automation interface	0.4 W
ADSL modem	2 W
Docsis modem	4.5 W
Additional LNB feed	1.3 W (with an additional 80 mA for the LNB current)
Additional tuner/demodulator	2 W
Powered remote IR receiver (loaded at 15mA)	0.25 W

6. Additional allowances for standby active mode targets for High Definition (both for MPEG2 and MPEG4), MPEG4 and multi-decode platforms

For High Definition (both for MPEG2 and MPEG4), MPEG4 and multi-decode platforms, i.e. products being capable of decoding high definition signals or decoding more than one signal stream, the following additional power allowance can be added to the allowances resulting from the foregoing table and the maximum standby active power consumption targets above.

In any case the total maximum power consumption target in standby active mode should not exceed 20 W² for High Definition (both for MPEG2 and MPEG4), MPEG4 and multi-decode platforms.

Feature	Indicative additional maximum power consumption (at the AC mains) for additional high definition features
MPEG4 standard or high definition decoder	2.5 W
Each additional decoder	1.5 W
Each DVBS2 front end (or demodulator)	2 W

² For cable STB with Docsis modem and VOIP functionality: 22 W

Annex C – Information to be provided

Information on the following items shall be made available to the consumers:

- If the equipment has an off-mode, and in this case the power consumption of the equipment in the off mode
- Power consumption of the equipment in the standby passive mode
- Power consumption of the equipment in the standby active mode
- Power consumption of the equipment in the on mode

It is left to the individual manufacturers as to how to make available the above information to the consumer.

The power consumption shall be measured and declared according to IEC 62087 (first edition; 2002-03). However, the LNB current (for single LNB) should be set at 80 mA during the test.

ANNEX D: INDICATIVE BLOCK FUNCTIONS FOR POWER MANAGEMENT

Indicative Power Management Guidelines

The special task force established under this Code of Conduct has identified the following as potential low power modes for each of the specific functional circuit blocks shown in the appended generic block diagram for a digital receiver. This table does not imply or infer any requirement for equipment made, supplied or specified, by signatories of this Code of Conduct, either to implement or conform to these modes for the standby state shown. Instead it indicates a common set of low power modes that, if implemented by component manufacturers, can be utilised as appropriate, by manufacturers and service providers to achieve the objectives of the Code of Conduct.

CIRCUIT BLOCK	EQUIPMENT STANDBY-ACTIVE	EQUIPMENT STANDBY - PASSIVE
1. RF tuner	Still fully tuned	Minimal Power Sleep Mode
2. 2nd RF tuner	Minimal Power Sleep Mode	Minimal Power Sleep Mode
3. Demodulator and FEC	Option for lower power requirement, e.g. where applicable through lower clock rate to save power when processing data with lower symbol rate.	Minimal Power Sleep Mode
4. 2 nd Demodulator and FEC	Minimal Power Sleep Mode	Minimal Power Sleep mode
5. Upstream amp (cable only)	Normally inactive but rapid wake-up possible when required	Minimal power sleep mode
6. Return path (cable only)	Normally inactive but rapid wake-up possible when required	Minimal power sleep mode
7. Demux & routing	Option to minimise processing by selecting just one signal path through to the processor	Minimal power sleep mode
8. Processor	Option for lower power requirement, e.g. lower level of activity meaning that clock rate can be reduced	Still active and running with reduced activity and lower clock rate
9. Memory	Option for lower power requirement, e.g. lower level of activity meaning that clock rate can be reduced	Low power, self-refresh mode

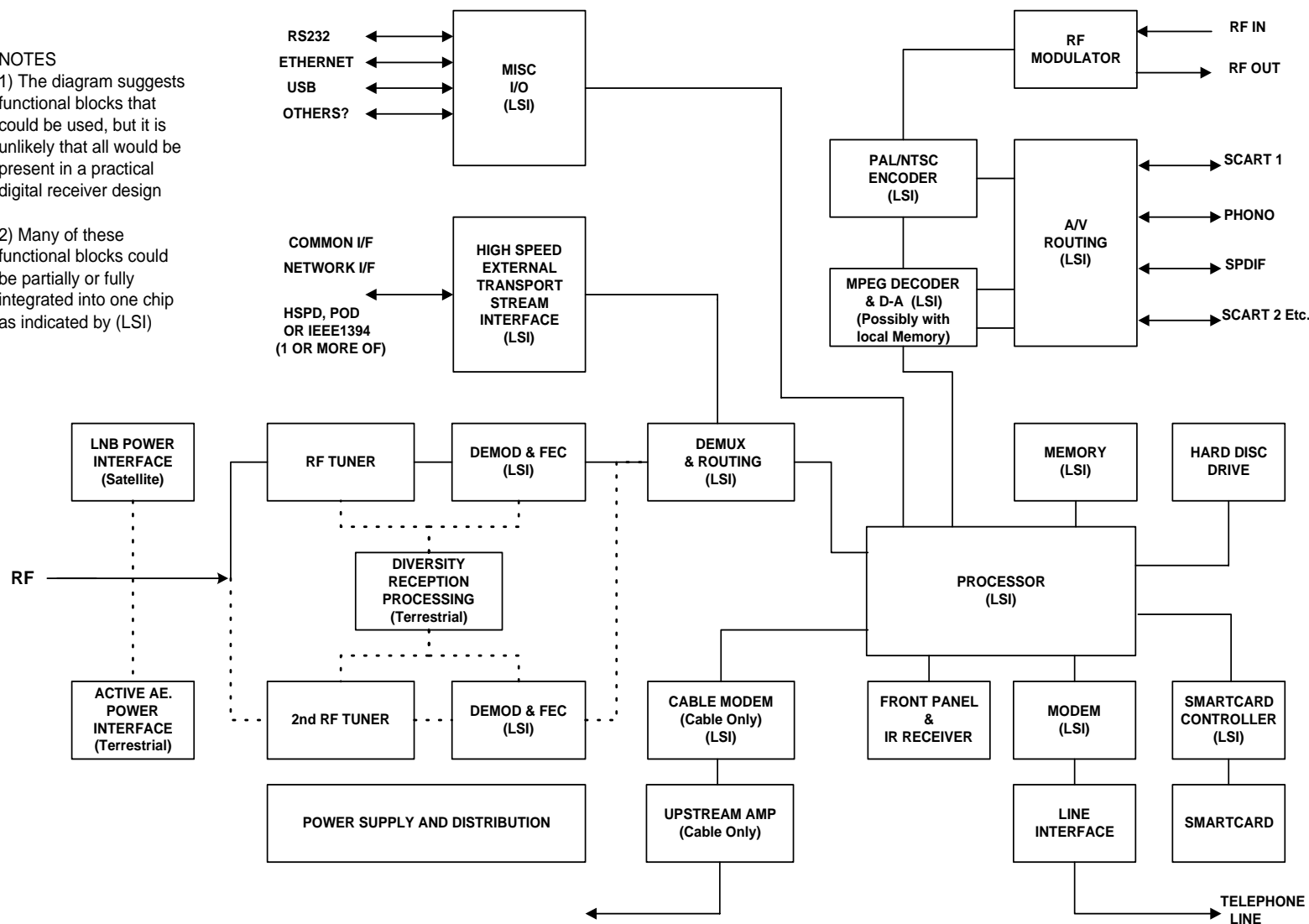
10. Smartcard controller	Option to render inactive, but rapid wake-up possible when required	Minimal power sleep mode
11. Misc I/O	Normally inactive but rapid wake-up possible when required	Minimal power sleep mode
12. Modem	Normally inactive but rapid wake-up possible when required	Minimal power sleep mode
13. Line interface	Minimal power sleep mode	
14. Front panel & IR receiver	Fully active but option to dim any display or indicators	
15. MPEG decoder and D-A	Minimal power sleep mode	
16. PAL/NTSC encoder	Minimal power sleep mode	
17. A/V routing	Only A/V loop through active	
18. RF modulator	Only RF loop through active	
19. Hard disk drive	Minimal power sleep mode	
20.High speed external transport stream interface.	Minimal power sleep mode	
21.LNB Power Interface	Lowest practicable power mode for polarisation	
22.Power supply unit and Power distribution	Best practicable efficiency across all modes of operation.	

An off mode (no functionality; 0 W power consumption) could be implemented by means of a hard on/off switch.

NOTES

1) The diagram suggests functional blocks that could be used, but it is unlikely that all would be present in a practical digital receiver design

2) Many of these functional blocks could be partially or fully integrated into one chip as indicated by (LSI)



GENERIC BLOCK DIAGRAM FOR A DIGITAL RECEIVER

Annex F - Criteria for external power supplies

(According to the Code of Conduct on Energy Efficiency of External Power Supplies)

(version 24 November 2004)

Table 1: Energy-Efficiency Criteria for Active Mode for Phase 2 (after 1.1. 2005)

RATED OUTPUT POWER	100 % LOAD MINIMUM EFFICIENCY REQUIREMENTS
	1/1/2005
$0 \leq W < 1.5$	30
$1.5 \leq W < 2.5$	40
$2.5 \leq W < 4.5$	50
$4.5 \leq W < 6.0$	60
$6.0 \leq W < 10.0$	70
$10.0 \leq W < 25.0$	75
$25.0 \leq W < 50.0$	75
$50.0 \leq W < 150.0$	80

Table 2: Energy-Efficiency Criteria for Active Mode for Phase 2 (after 1.1. 2007)

Rated Output Power (P_{no})	Minimum Average Efficiency in Active Mode (expressed as a decimal) ³
0 to <1 watt	$\geq 0.49 * P_{no}$
1 to 49 watts	$\geq [0.09 * \text{Ln} (P_{no})] + 0.49$
>49 watts	$\geq 0.84^4$

³ (a) “Ln” refers to the natural logarithm. The algebraic order of operations requires that the natural logarithm calculation be performed first and then multiplied by 0.09, with the resulting output added to 0.5.
 (b) An efficiency of 0.85 in decimal form corresponds to the more familiar value of 85% when expressed as a percentage.

⁴ Power supplies that have a power factor correction (PFC) to comply with EN61000-3-2 (above 75 W input power) have an 0.04 allowance, accordingly the minimum 100% load efficiency is 0.80

Code of Conduct On Energy Efficiency of Digital TV Service Systems

SIGNING FORM

The organisation/company/
.....

declares its willingness to sign the Code of Conduct on Efficiency of Digital TV Service Systems and to commit 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. /

Signature

Please send the signed form to :
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