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 7

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 equipment for the reception, decoding, recording and interactive processing of digital broadcasting and related services. Examples of such equipment are complex 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). However, Personal Computers with the added feature of an integrated digital TV tuner are excluded. 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 overall 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, 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, 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 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, a method that allows the user to manually place the product into a low power mode (e.g. 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 and after 1.1.2009 it is required 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 through a special menu option.

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

B.1 Definitions

The Code of Conduct allows two definitions for basic digital television equipment. Firstly, a definition of a **simple digital TV converter box** is given. This type of set-top box (STB), with limited functionality (such as no conditional access), is commonly used to receive free-to-air transmissions. The distinct definition and set of targets is provided to allow easy comparison of this equipment.

A second definition covering **complex** equipment with extended functionality such as conditional access, etc, is also given. This definition describes the functions associated with the equipment in their '**basic configuration**' and covers digital TVs with integrated receiver and decoder (IDTVs), and analogue personal video recorders (PVRs) as well as complex STBs.

In addition to these targets, the Code of Conduct provides for extra functions through additional power allowances (see section B.3).

B.1.1 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) Standard Definition (SD) or High Definition (HD) digital broadcasting services and their conversion to analogue RF and/or line signals, without conditional access[1]. Simple digital PVR are included in this category, but devices that record to a standard library format removable media (e.g. tape, disc), such as devices with integrated VCR and/or DVD player/recorder are excluded. The following components/features are included in the power allowance Targets (section B.2 below) but do not constitute a minimum specification (i.e. they may not be present in the device):

- 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.
- Single MPEG Decoder (SD or HD as appropriate)
- Analogue Composite and Component video outputs
- One Analogue Composite and Component video input
- Stereo analogue audio out
- Stereo analogue audio in
- Support for Software Upgrade
- Electronic Programme Guide (EPG)
- Operating system support for Interactive Services (e.g. MHEG /MHP/OpenTV etc) (no return path)

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1 Conditional Access means an active system that enables the STB to process and apply targeted data from a Service Provider. In the context of the definition of the simple converter STB and PVR this means that the operational state chosen by the user (Off, Standby Passive, and On) can not be restricted or changed by a Service Provider.

- Timer control facilities
- Auto standby (See Annex A.9)

The following features are optional and result in an extra power allowance (see table B2-4 below):
- hard disk (for permanent storage of recordings)
- double RF tuner
- ADSL modem
- EuroDOCSIS modem

B.1.2 Definition of complex STB in the basic configuration, digital TVs with integrated receiver and decoder (IRD) and analogue PVR

Any box with conditional access is a complex STB, the table below shows the components that are included in the basic configuration. Complex boxes do not need to have all the components/features shown below.

STB, digital TV with IRD				**Analogue[2] PVR (no CA support)**
CABLE	***TERRESTRIAL***	***SATELLITE***	***IP***	
Single cable tuner /demodulator	Single UHF tuner /demodulator Active antenna powering	Single satellite tuner /demodulator Single LNB feed	IP front end	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/Conditional Access				n/a
Common Interface / Dataport				n/a
RS232 Serial Port				n/a
Support for remote IR Receiver / IR Blaster				n/a
PSTN Modem				n/a

B.1.3 Definition of the operational modes

Mode	**Definition**

[2] PVRs for digital broadcasting with conditional access are included in the category STB, while PVRs for digital broadcasting without conditional access are included simple digital TV converter box**.**

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, does not fulfils a 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, does not fulfils a 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. The standby passive mode must be available and the target for this mode must be met only if this mode is specified (e.g. by the service provider).

B.2.1 For simple digital TV converter boxes

Mode	From 1-1 2006 to 31-12-2009[3]			
	Cable	*Terrestrial*	*Satellite*	*IP*
	Simple Converters			
Standby Passive	2.0 W	2.0 W	2.0 W	2.0 W
ON	7.0 W	7.0 W	10.0 W	7.0 W
	Simple converters for High Definition TV Services			
Standby Passive	2.0 W	2.0 W	2.0 W	2.0 W
ON (standard definition output)	11.0 W	11.0 W	14.0 W	11.0 W
ON (high definition output)	12.0 W	12.0 W	15.0 W	12.0 W

B.2.2 For analogue PVR and PVR with standard library removable media in the basic configuration

Mode	From 1-1-2006 to 31-12-2009
Standby passive	3.0 W
Standby active	6.0 W

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

B.2.3 For complex STBs in the basic configuration

Mode	from 1-1-2007 to 31-12-2008			
	Cable	*Terrestrial*	*Satellite*	*DSL*
Standby passive (if 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

Mode	from 1-1-2009 to 31-12-2009			
	Cable	*Terrestrial*	*Satellite*	*DSL*
Standby passive (if specified)	3.0 W	3.0 W	3.0 W	3.0 W
Standby active	6.0 W	5.0 W	7.0 W	5.0 W

B.2.4 For digital TVs with integrated receiver and decoder (IRD) in the basic configuration

Mode	From 1-1-2007 to 31-12-2008		
	TV with built in Cable(IRD)	*TV with built in Terrestrial(IRD)*	*TV with built in Satellite(IRD)*
Standby passive (if specified)	1.5 W	1.5 W	1.5 W
Standby active	8.0 W	7.0 W	9.0 W

Mode	From 1-1-2009 to 31-12-2009		
	TV with built in Cable(IRD)	*TV with built in Terrestrial(IRD)*	*TV with built in Satellite(IRD)*
Standby passive (if specified)	1.5 W	1.5 W	1.5 W
Standby active	7.0 W	6.0 W	8.0 W

B.3 Additional allowances

B.3.1 Additional allowances for simple digital TV converter boxes

For additional components that may be added on to the simple digital TV converter box the following additional power allowance can be added to the standby passive and on-mode maximum power consumption targets above.

Feature	Mode	Allowance
Hard disk	Standby Passive	1 W
Double RF tuner	ON	2 W
ADSL modem	ON	2 W
DOCSIS modem	ON	4.5 W
Hard disk (fully active read/write mode)	ON	up to 50 GB: 3 W 51 up to 160 GB: 6 W 161 up to 500 GB: 10 W
MPEG4 standard or high definition decoder	ON	2.5 W

B.3.2 Additional allowances for the complex STB in the basic configuration (standby active mode only)

For additional components that may be added on to the complex STB 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*** *(until 31.12.2008) and* ***13 W***[4] *(from 1.1.2009)* for the complex STB (except for MPEG4 and multi-decode platforms; see point B.3.3 below) and analogue PVRs.
- ***16 W*** *(until 31.12.2008) and* ***14 W*** *(from 1.1.2009)* for TVs with integrated digital receiver and decoder.

Feature	**Indicative additional maximum power consumption (at the AC mains) for additional features in standby active mode**
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
HDMI interface	1.0 W
ADSL modem	2.0 W
Docsis 1.1 or 2.0 modem	4.5 W
Out of Band Transport	4.0 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

[4] For cable with DOCSIS modem (except for MPEG4 and multi-decode platforms - see footnote 5) the ***maximum power consumption*** in ***standby active*** *mode* ***is***: **15 W** (until 31.12.2009)

B.3.3 Additional allowances for MPEG4 and multi-decode platforms (standby active mode)

For MPEG4 and multi-decode platforms, i.e. products being capable of 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 W** (until 31.12.2008) and **17 W**[5] (from 1.1.2009) for MPEG4 and multi-decode platforms.

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

[5] For cable STB MPEG4 and multi-decode platforms with DOCSIS modem the ***maximum power consumption*** in ***standby active*** *mode* ***is***: **22 W** (until 31.12.2008) and **19 W** (from 1.1.2009)

Annex C – Information to be provided

Information on the following items shall be made available to the consumers (if the mode is available on the equipment):

- 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, and the current for active antennas should be set at 35 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.

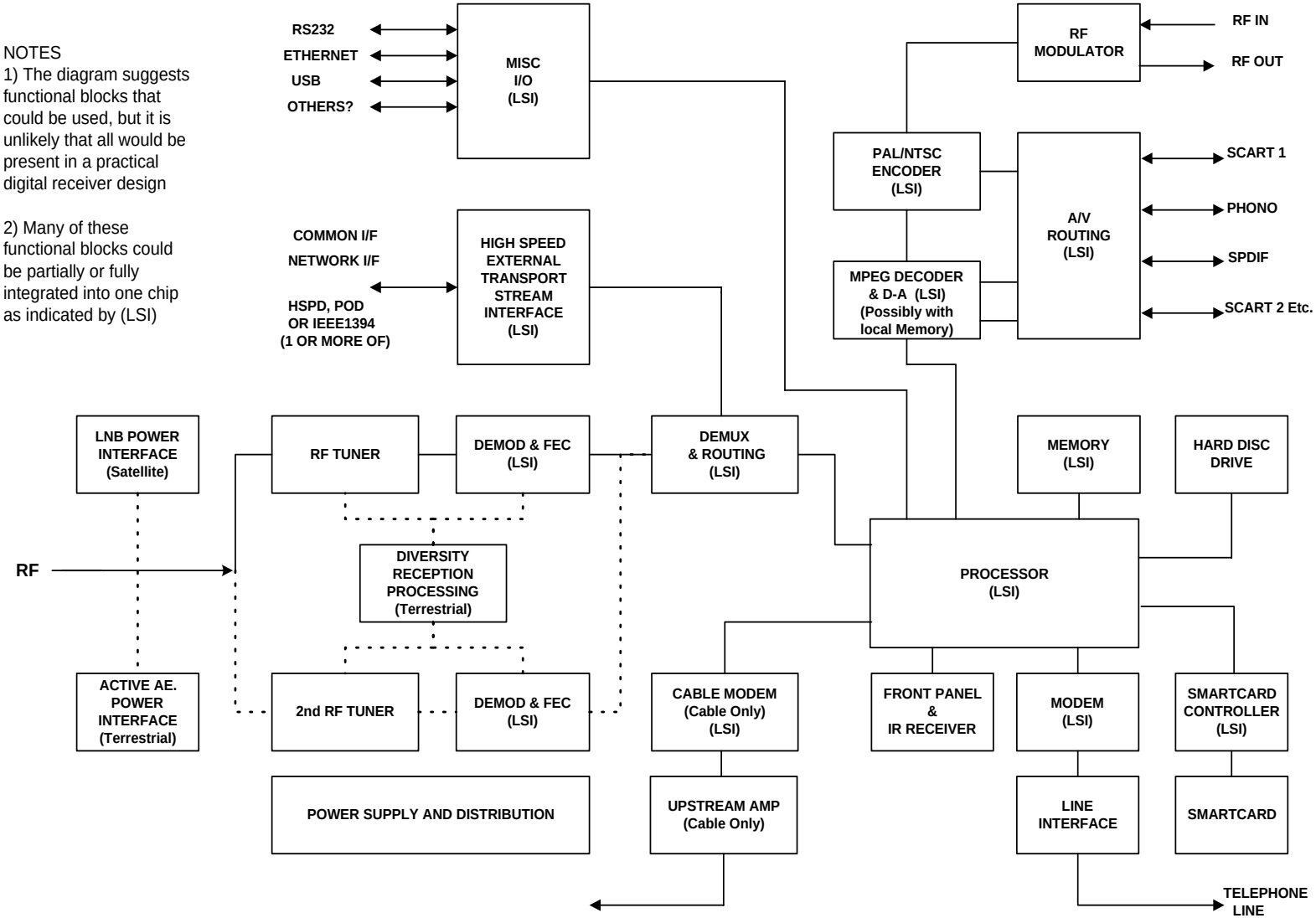
CIRCUIT BLOCK	EQUIPMENT STANDBY-ACTIVE	EQUIPMENT STANDBY - PASSIVE
1. RF tuner	Still fully tuned	Minimal Power Sleep Mode
2. 2nd RF tuner	Minimal Power Sleep Mode	Minimal Power Sleep Mode
3. Demodulator and FEC	Option for lower power requirement, e.g. where applicable through lower clock rate to save power when processing data with lower symbol rate.	Minimal Power Sleep Mode
4. 2nd 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)
and version 28 November 2007 (table 2))

Table 1: Energy-Efficiency Criteria for Active Mode (1.1. 2007 – 31.12.2008)

Rated Output Power (P_{no})	**Minimum Average Efficiency in Active Mode (expressed as a decimal)** [6]
0 < W ≤ 1	≥ 0.49 * P_{no}
1 < W ≤ 49	≥ [0.09 * Ln (P_{no})] + 0.49
49 < W ≤ 250	≥ 0.84[7]

Table 2: Energy-Efficiency Criteria for Active Mode (from 1.1.2009)

Rated Output Power (P_{no})	**Minimum Four Point Average Efficiency in Active Mode (expressed as a decimal)**
0 < W ≤ 1	≥ 0.44 * P_{no} + 0.145
1 < W ≤ 36	≥ [0.08 * ln(P_{no})] + 0.585
36 < W ≤ 250	≥ 0.870

6 (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.

7 Power supplies that have a power factor correction (PFC) to comply with EN61000-3-2 (above 75 W input power) have a an 0.04 allowance, accordingly the minimum 100% load efficiency is 0.80 (valid only until 1.12.2008)

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