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Code of Conduct
on Energy Consumption of Broadband Equipment

Draft Version 3

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1. INTRODUCTION

Expectations are that broadband equipment will contribute 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 50 TWh per year can be estimated for the year 2015. With the general principles and actions resulting from the implementation of this Code of Conduct the (maximum) electricity consumption could be limited to 25 TWh per year, this is equivalent to 5,5 Millions tons of oil equivalent (TOE) and to total saving of about € 7,5 Billions per year.

The potential new electrical load represented by this equipment needs to be addressed by EU energy and environmental policies. It is important that the electrical efficiency of broadband equipment is maximised.

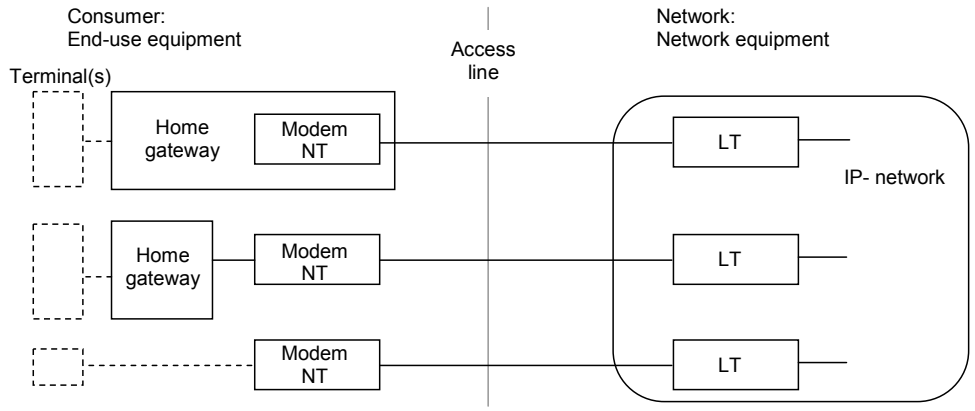
To help all parties to address the issue of energy efficiency whilst avoiding competitive pressures to raise energy consumption of equipment all service providers, network operators, equipment and component manufacturers are invited to sign this Code of Conduct.

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

2. EQUIPMENT COVERED

This Code of Conduct covers home gateway and modem equipment as listed in table 1 and 2, both on the consumer side (customer premises equipment) and the network side (network equipment), for broadband services. Figure 1 below gives examples of a home gateway/modem configuration with the boundary between customer premises and network equipment that this Code of Conduct takes into account. Terminals like PCs, TVs are not covered by this code of conduct.

Figure 1. Examples of configurations



Broadband access requires an access line capable to provide more than 2048 kbit/s (ITU-T recommendation I.113 [1]) full capacity in at least one direction.
In DSL-low-power-state the access line data rate can be much lower and even be close to zero. When the equipment is in DSL-low-power-state or in the CPE-low-power-state, broadband services need to be offered to a user with almost the same quality and setup times as in on-state. This is required independently from the origin of the service (LAN or WAN side).

In the rest of this Code of Conduct these categories of equipment will be simply referred to as “customer premises equipment” (CPE) and “network equipment” or “broadband equipment” in general. Tables 1 and 2 list the broadband equipment covered by this Code of Conduct.

Table 1: **Customer premises equipment covered**

Customer premises equipment[1] **associated with broadband distribution for residential customers and SOHO**
• DSL CPEs powered by USB • Other DSL CPEs • Simple Cable CPEs or PLC CPEs • Cable CPEs with DOCSIS 3.0 capability • Optical network termination (ONT): CPEs and converters (PON and P2P) • Routers up to **5** (1 WAN and **4** LAN) Ethernet 10/100/1000 ports • WIMAX CPEs Extra allowances for additional functionality integrated into the home gateway equipment for residentials and SOHOs are given for: • Ethernet switch up to 4 ports in total • Wi-Fi interface 802.11 b/g/n • FXS ports • DECT GAP/Cat-iq interface • Bluetooth interface • USB interface • Femtocell • Embedded handfree system • Wide band voice codec • DHA LAN Interface (MoCa, HPNA,…) Further home network infrastructure devices: • Wi-Fi access points • Small hubs and non-stackable Layer 2 switches • Powerline Adapters • LAN technos (HPNA, MoCA adapters • Optical LAN adapter • Near field communication (IEEE802.15) adapter Other home network devices: • ATA / VoIP gateway • VoIP telephone • Printer Server

[1] Stand alone devices which are not included in a computer or a set top box. The power requirements for computers are covered by Energy Star programme. The power requirements for a set top boxes are covered by the Code of Conduct for Digital TV Services [2]. Certain power values will be included in the next revision only when reference definitions, standards and/or data are available.

Extra allowances for additional functionality integrated into other home network devices: • Embedded handfree system • Wide band voice codec • Additional Colour Display (typically found in VoIP devices) TFT QVGA and VGA

Table 2: **Network equipment covered**

• xDSL Network equipment (example: ADSL, ADSL2, ADSL2+, VDSL2) • Combined xDSL/Narrowband Network equipment (example: MSAN where POTS interface is combined with DSL BroadBand interface, etc) • Optical Line Terminations (OLT) for PON- and P2P-networks • Wireless Broadband network equipment (example: Wi-Fi access points for Hotspot application, WiMax Radio Base Station) • Cable service provider equipment • Powerline service provider equipment

3. AIM

To target reduced energy consumption of broadband communication equipment without hampering the fast technological developments and the service provided.

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 at least 90% of the number of the new[2] models of broadband equipment that are introduced on the market or installed in the network after the indicated date.

4.3 Provide end-users with information about power consumption of customer premises equipment (CPE-on-state, CPE-low power state) and about switching off customer premises equipment in the user manual and/or on the Internet and/or the packaging and/or at the point of sales.

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 Co-operate with the European Commission and Member States in monitoring the effectiveness of this Code of Conduct through the reporting form that is available on the homepage of the EU Standby Initiative [3]

4.6 Ensure that procurement specifications for broadband equipment 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 of the signing of the Code of Conduct, by the end of February of the following year, information concerning the power consumption of the equipment covered by the Code of Conduct they produce, specify, buy, or install etc.

The reported results will be discussed starting with the year of the signing of the Code of Conduct 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, etc.) with a view to agreeing actions and/or amendments to the Code of Conduct.

c) Set targets for future time periods.

Reporting: The presentation of the results provided to the Commission will be in the form of the Reporting sheet available on the homepage of the EU Stand-by Initiative [3].

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[2] New broadband equipment models means that the equipment has been produced during the corresponding year. This requirement does not apply when retrofitting or completing the configuration of existing equipment.

Annex A – General Principles

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

For broadband equipment in general

A.1 Broadband equipment should be designed to achieve reduce power consumption targets on the whole system as well as individual components at the condition that implemented power management is not hampering the user experience or the targeted service, disturbing the network the CPE is connected to, nor in contradiction with applicable standard.

A.2 Operational and control systems are specified on the presumption that hardware has power management built in, where applicable, i.e. depending on the functionality required of the unit, the hardware will automatically switch to the state with the lowest possible power consumption.[3]

For customer premises equipment

A.3 Any external power supplies used for customer premises equipment shall be in accordance with the EU Code of Conduct for External Power Supplies [4]. Power consumption of the external power supply shall be included in the power measurement.

A.4 Customer premises equipment is designed on the assumption that the equipment may be physically disconnected from the mains or switched off manually by the customer, from time to time, at his or her discretion. A fast and dependable start-up and re-entry into operating state has to be guaranteed.

A.5 Power delivered to other equipment (e.g. over USB or PoE) shall not be included in the power consumption assessment. This further equipment shall be disconnected for the power consumption measurement, except when this is in contradiction with the operation of the product

For network equipment

A.6 Broadband Network equipment should be designed to fulfil the environmental specifications of Class 3.1 for indoor use and even more extended environmental conditions than Class 3.1 for use at remote sites according to the ETSI Standard EN 300019-1-3 [5]. It should be preferably cooled with fresh air (fan driven, no refrigeration). The COP 'Coefficient Of Performance' of new site cooling systems, defined as the ratio of the effective required cooling power to the energy needed for the cooling system, should be more than 10.

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[3] For DSL systems, this function will have to be activated when concerns about problems connected to these non-stationary states have been solved. To this end signatories will endeavour to develop the necessary standards. Until then a special focus is put on the reduction of the power consumption in DSL-full power state.

Annex B – Power levels: targets and time schedule

B.1 Customer premises equipment

The equipment covered by this Code of Conduct should meet the following maximum power consumption targets in CPE-On-State (definition in table 9), CPE-Low-Power-State (definition in table8) and CPE-Off-State (power always measured on the 230 Vac input).

The equipment should apply all possible energy saving actions minimizing the overall consumption whenever possible (e.g. when all or part of its functions are not operating).

The power levels indicated further in this document for all states are mean values based on sufficient long measurements periods of energy consumption.

Table 3: **Power targets for home gateway equipment for Residential and SOHOs. All states refer to the whole home gateway and not only to single port.**

Equipment	**Tier 2009/2010:** 1.7.2009 - 31.12.2010			**Tier 2011:** 1.1.- 31.12.2011		
	CPE-Off-State[4] (W)	***CPE-Low Power State[4] (W)***	***CPE-On-State (W)***	***CPE-Off-State[4] (W)***	***CPE-Low Power State[4](W)***	***CPE-On-State (W)***
ADSL / VDSL-modem powered by USB[5]	0	NA	2,0	0	NA	1,5
ADSL-CPE[6] (maximum ports or functionalities: 1 DSL, 1 port Ethernet 10/100, Router, NAT, firewall)	0,3	3,5	4,0	0,3	3,0	4.0
VDSL2-CPE (maximum ports or functionalities: 1 DSL, 1 port Ethernet 10/100/1000, router, NAT, firewall)	0,3	4,5	6,0	0,3	4,0	5,0
Simple Cable CPE or PLC CPEs (maximum ports or functionalities: 1 WAN, 1 port Ethernet 10/100, router,	0,3	NA	6,0	0,3	4,0	5,0

4 Only when applicable and authorized by the targeted service.

5 USB Modem Power consumption (W) is defined at the 5 V USB Interface

6 DSL modem shall be capable of supporting network power management for example ADSL2 and ADSL2+.

NAT, firewall)						
Cable CPE with DOCSIS 3.0 capability (maximum ports or functionalities: 1 WAN (f) without videooverlay, 1 port Ethernet 10/100, router, NAT, firewall)	0,3	NA	8,0	0,3	5,5	7,0
GPON ONT (maximum ports or functionalities: 1 GPON optical WAN interface, 1 LAN port Ethernet 10/100/1000, router, NAT, firewall)	0,3	5,0	9,0	0,3	4,0	7,5
PtP ONT (maximum ports or functionalities: 1 PtP 1000Mbit/s LX&BX optical WAN interface, 1 LAN port Ethernet 10/100/1000, ,router, NAT, firewall)	0,3	3,0	5,0	0,3	2,0	4,0
Routers up to **5** (1 WAN and **4** LAN) Ethernet 10/100/1000 ports	0,3	2,0	5,0	0,3	1,5	4,5
Wimax CPE	0,3	8,5	11,5	0,3	8	11

Table 4: **Extra allowances for additional functionality integrated into the home gateway equipment for residentials and SOHOs**

Equipment	**Tier 2009:** 1.7.2009-31.12.2009		**Tier /2010:** 1.1.2010-31.12.2011		**Tier 2011:** 1.1.- 31.12.2011	
	CPE-Low Power State[7] (W)	***CPE-On-State (W)***	***CPE-Low Power[7] State (W)***	***CPE-On-State (W)***	***CPE-Low Power[7]State (W)***	***CPE-On-State (W)***
Ethernet switch up to 4 ports in total 10/100/1000Mbits	1,4	2,0	1,2	1,5	1,0	1,2

[7] Only when applicable and authorized by the targeted service

1xPort Gbits (Phy Gbits Ic)	0,8	1,5	0,6	1,3	0,5	1,1
Wi-Fi interface IEEE 802.11 b/g	1,5	1,5[8]	1,25	1,25	1,0	1,0 **Error! Bookmark not defined.**
Wi-Fi interface IEEE 802.11n Draft 2 and other proprietary re-n solutions	2,0	2,0**Error! Bookmark not defined.**	1,75	1,75	1,5	1,5**Error! Bookmark not defined.**
FXS port (embedded ATA)	1,2	1,2[9]	1,1	1,1	0,7	0,7**Error! Bookmark not defined.**
FXO port (with fall back)	0,4	0,4	0,4	0,4	0,4	0,4
DECT GAP interface, DECT Cat-iq interface	1,0	1,0 **Error! Bookmark not defined.**	1	1	0,75	0,75**Error! Bookmark not defined.**
Bluetooth interface	TBD	TBD	TBD	TBD	TBD	+2,0 or TBD
USB host interface (supply of connected devices not included)	+0,3	+0,3	+0,3	0,3	+0,2	0,2
Femto cell	NA	9,0			TBD	8.0
Handset DECT	1	1,5	1	1,5	0,8	1,2
Embedded handfree system	0,5	0,5**Error! Bookmark not defined.**	0,5	0,5**Error! Bookmark not defined.**	0,5	0,5 **Error! Bookmark not defined.**

Table 5: **Power targets for Home Network Infrastructure Devices (HNID)**

Equipment	**Tier 2009/2010:**	**Tier 2011:**

[8] The CPE-on-state is defined with no traffic on the Wi-Fi port. Therefore there is no difference in power consumption between the CPE-on-state and the CPE-low-power-state for this port.

[9] The CPE-on-state is defined with all voice functions (VoIP, DECT,..) to be on-hook. Therefore there is no difference in power consumption between the CPE-on-state and the CPE-low-power-state for this port.

	1.7.2009- 31.12.2010			1.1.- 31.12.2011		
	CPE-Off-State[10] (W)	***CPE-Low Power State[10] (W)***	***CPE-On-State (W)***	***CPE-Off-State[10] (W)***	***CPE-Low Power State[10] (W)***	***CPE-On-State (W)***
Wi-Fi Access Points with single band 802.11b/g Or router Wi-Fi b/g 4xEth 10/100/1000Mbits	***0,3***	***3,5***	***3,5***	***0,3***	***3***	***3***
Wi-Fi Access Points with single band 802.11a/n Or router Wi-F b/g 4xEth 10/100/1000Mbits	0,3	5,0	5,0[11]	0,3	4.5	4,5
Wi-Fi Access Points with dual band (e.g. 802.11b/g/a) Eth 10/100/1000Mbits	0,3	13,0	13[10]	0.3	2,0	11,5
Small hubs and non-stackable Layer 2 switches (up to 8 Ethernet 10/100/1000 ports) without VPN or VoIP support.	0,3	3.0	4.5	0,3	2.5	4.0
Powerline adapters	0,3	2,0	7,0	0,3	TBD	6,0
LAN technologies (HPNA, MoCA adapters …)	0,3	NA	5,0	0,3	NA	4,5

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Table 6: **Power targets for other home network devices**

Equipment	**Tier 2009/2010:** 1.7.2009- 31.12.2010			**Tier 2011:** 1.1.- 31.12.2011		
	CPE-Off-State[10](W)	***CPE-Low Power State[10](W)***	***CPE-On-State (W)***	***CPE-Off-State[10](W)***	***CPE-Low Power State[10](W)***	***CPE-On-State (W)***
ATA / VoIP gateway	0,3	0,5	2,0	0,3	0,5	1,5

[10] Only when applicable and authorized by the targeted service.

[11] The Access Point-on-state is defined with no traffic on the Wi-Fi port. Therefore there is no difference in power consumption between the AP-on-state and theAP-low-power-state for this port.

VoIP telephone (G711 codec)	0,3	3,5	3,5	0,3	3	3
Printer Server	0,3	3,0	4,5	0,3	2,0	4,0

Table 7: **Extra allowances for additional functionality integrated into other home network devices**

Equipment	**Tier 2009-2010:** 1.7.2009- 31.12.2010			**Tier 2011:** 1.1.- 31.12.2011		
	CPE-Off-State[12] (W)	***CPE-Low Power State[12] (W)***	***CPE-On-State (W)***	***CPE-Off-State[12] (W)***	***CPE-Low Power State (W)***	***CPE-On-State[12] (W)***
Additional Colour Display (typically found in VoIP devices) TFT QVGA and VGA	0	0,7	2,0	0	0,5	1,0

Example:

VDSL gateway, 4 Ethernet-ports (2 of these connected with a device), 2 USB ports (1 of them connected with a device), 2 FXS-ports:

Tier 2010:

- 0,3 W in CPE-off-state
- 7,2 W in CPE-low power state for 2010: 3 W + 1,4 W (4-port-Ethernet-switch) + 0,3 W*2 (2 USB ports) + 2* 1,1 W (2 FXS ports)
- 10,8 W in CPE-on-state for 2010: 6 W + 2 W (4-port-switch) + 2*0,3 W (2 USB-ports) + 2* 1,1W (2 FXS ports)

Tier 2011:

- 0,3 W in CPE-off-state
- 5,1 W in CPE-low power state for 2010: 2,5 W + 1,0 W (4-port-Ethernet-switch) + 0,3 W*2 (2 USB ports) + 2* 0,5 W (2 FXS, device on hook)
- 7,8 W in CPE-on-state for 2010: 5 W + 1,2 W (4-port-switch) + 2*0,2 W (2 USB-ports) + 2* 0,5W (2 FXS ports, device on hook)

Definitions of home gateway operation states

The **CPE-off-state** is the state where the equipment is not fulfilling any functionality. This state is reached when the supply is switched off with a mechanical or electronic switch.

[12] Only when applicable and authorized by the targeted service.

The only possible power consumption remaining is for the power supply which should fulfil the Code of Conduct of external Power supplies [4]. The equipment can only be switched on manually.

CPE-low-power-state:

The CPE-low-power state for home gateways (including/excluding modem) is based on putting LAN side modules that are not needed or active into a low-power state. The home gateway in the CPE-low-power state needs to run a minimum of basic functions (e.g. router, bridge, firewall, parental control, etc.…). Further power savings can be reached e.g. with low power mechanisms of the main chipsets and a higher effectiveness of the power conversion. Note that low power state may not exist when it is in contradiction with a targeted service or in contradiction with applicable standards.

Table 8: **The definition of the CPE-low-power-state**

Port / component	Situation in CPE-low-power-state
WAN port	Configurable limited bit rate
Home gateway system	Routing, Firewall, OAM (e.g. TR-069), User Interface, VoIP Codecs ready for immediate use
LAN Ethernet ports	Ports in standby, detection of Ethernet link active, Cable length = 2m
Wi-Fi	Beacon on, maintenance data exchange on, no payload traffic
FXS	Phone(s) connected on hook, off hook detection active
FXO	Call detection active, no call
VoIP phone	VoIP Phone(s) NW connected on hook, off hook detection active, call detection active, inactive display. The handset is on base, in slow/trickle charge, not in fast charge.
DECT handset	On hook, off hook detection active, call detection active, inactive display. The handset is on base, in slow/trickle charge. when the DECT feature is present with a specify cradle for charge, this consumption should be added to the equipment
USB	Not connected, controller: device like USB stick or HD drive can be detected

When the data rate on the WAN access port or any other port (Ethernet, Wi-Fi, FXS, FXO, USB exceeds a configurable value the home gateway will switch to the CPE-on-state also activating the necessary subcomponents
The transition time should less than 1 second in order to not reduce the customer experience.

CPE-on-state
The CPE-on-state is the mode where the product is providing its “nominal” functionality. The equipment is connected to the power source, the network, and the necessary minimum external equipment necessary to exercise the main services provided by the CPE which have to be activated. In table 9 the CPE-on-state is defined. In the future, standardization bodies like ETSI could provide a more detailed specification for the measurement of the power consumption in the CPE-on-state.
Further CPE-on-states could be defined but for this Code of Conduct it is important to focus on the definition in Table 9 in order to have reproducible measuring results.

Table 9: **The definition of the CPE-on-state**

Port / component	Situation in CPE-on-state
WAN port	Bit rate capability higher than 160 kbit/s
Home gateway system	Routing, Firewall, OAM (e.g. TR-069), User Interface are active, VoIP Codecs ready for immediate use
LAN Ethernet ports	1 Port active, further Ports in standby, detection of Ethernet link active, Cable length=2m
Wi-Fi	Beacon on, maintenance data exchange on, no payload traffic
FXS, FXO	1 Phone connected on hook, off hook detection active
VoIP phone	VoIP Phone(s) NW connected on hook, off hook detection active, and call detection, active display. The handset is on base, in slow/trickle charge, not in fast charge.
DECT handset	On hook, off hook detection active, call detection active, inactive display. The handset is on base, in slow/trickle charge. when the DECT feature is present with a specify cradle for charge, this consumption should be added to the equipment
USB	Not connected, controller: detection of devices like USB stick or HD drive active
Accessible embedded feature/service	⇨ Adjustment related to Screen light and contrast or volume control sets in their default configuration, ⇨ Volume controls should be set in its default configuration.

B.2 Network equipment

The following targets are consumption targets per port. All power values measured at the "A" interface as described in the standard ETSI 102 533 [8] or at the AC input, in case of directly mains powered systems. For directly mains powered systems, the power limits stated in tables 10 trough 16, will be increased by 10%.

B.2.1 Broadband xDSL Network equipment

Table 10: **Broadband ports – DSL-Full Power State**

Equipment	**Tier 2009-2010** (01.01.2009) (W)	**Tier 2011** (01.01.2011) (W)
ADSL 2+ (including ADSL and ADSL2 and with transmission power of 19,8 dBm)	1,3	1,2
VDSL2 (profile 8b)	2,0	1,8
VDSL2 (profile 12a and 17a)	1,8	1,6
VDSL2 (profile 30a)	2,5	2,0

The above values are for fully equipped with maximum configuration DSLAMs with more than 100 ports. For equipment up to 100 ports (and with maximum configuration) 0,3 W per line may be added to the above values, with a minimum value of 10 W for the whole DSLAM.
The additional allowance for the uplink interface is:

- **4,5W per equipment for each Point to Point 1000Mbit/s interface**
- **18W per equipment for each Point to Point 10Gbit/s interface**
- **6W per equipment for each Point to Multipoint (GPON) interface**

Table 11**: Broadband ports – DSL-Low Power State**[13]

Equipment	**Tier 2009-2010** (01.01.2009) (W)	**Tier 2011** (01.01.2011) (W)
ADSL 2+ (including ADSL2)	1,1	0,8

13 The DSL-Low Power State should allow a bit rate of a configurable value of 10-128 kBit/s (e.g. for keep-alive-signals, voice). The DSL-Low Power State-levels shall not hamper the quality of service. In order to solve the issues caused by non stationary cross talk, further investigations need to be done. They could be attenuated by the application of much longer time intervals between state transitions (15-30 minutes) than those defined today (1-255 sec.). This requirement comes into effect when the issues on the quality of service have been solved by the standardization bodies.

VDSL2 [14]	--	1,2

Start-up/Wake-up times from DSL-Low Power State to DSL Full Power State should be less than 1 second to guarantee a good quality of service (e.g. voice calls).

Table 12**: Broadband ports – DSL-Standby state** [15]

Equipment	**Tier 2009-2010** (01.01.2009) (W)	**Tier 2011** (01.01.2010) (W)
ADSL 2+ (including ADSL and ADSL2)	0,4	0,4
VDSL2	0,8	0,6

The above values for Low power and standby states are for fully equipped with maximum configuration for DSLAMs with more than 100 ports. For equipment up to 100 ports (and with maximum configuration) 0,3W per line may be added to the above values for the whole DSLAM, with a minimum value of 10W

Start-up/Wake-up times from DSL-Standby State to DSL Full Power State should be less than 3 seconds to guarantee a good quality of service (e.g. voice calls).

To minimize cost/dimensions/power consumption, the network equipments contain chips that control multiple xDSL lines (4-8-16) each. If special care is not taken, a single line in DSL-Full-power-state could result in a chip fully operational on the other lines also (in Low power or Standby), resulting in an unnecessary waste of energy. The Network systems (and their basic components) shall therefore be designed in order to tackle this issue, maximizing the energy savings also in mixed environments with lines in different power states, being this the typical situation found in the network.

B.2.2 Combined xDSL/Narrowband Network equipment

Power consumption limits for POTS interface implementation into an MSAN are defined in Table 13. The values defined apply to a testing condition where the line length is assumed to

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14 The Low Power state is not foreseen today in the standard for VDSL2. Operators and manufacturers are invited, through their representatives in the standardization bodies, to make effort towards low power states with corresponding values, which are indicated here as targets for future standard revisions. This requirement comes into effect when relevant standards will be available.

15 A short start up time of <1 second has to be realized to guarantee triple-play functions like VoIP and Video over IP (while the current value for this start up time is around 3 seconds). This requirement comes into effect when relevant standards will be available.

be 3km of 0,5mm gauge copper which equates to a loop resistance of approximately 510 Ω, and CPE termination resistance is assumed to be zero.

It is further assumed that power consumed by MSAN functionality which is common to both Broadband and POTS is split appropriately across the two functions.

Table 13**:** Per-port MSAN POTS power consumption limits

Port State	40mA line feed (W)	32mA line feed (W)	25mA line feed (W)
Not provisioned for POTS [16],[17]	0,7	0,7	0,7
Provisioned for POTS - on-hook[16],[18]	0,7	0,7	0,7
Provisioned for POTS - off-hook [16]	3,2	2,8	2,5
Provisioned for POTS – Ringing[16]	1,8	1,8	1,8

Power consumption limits for POTS interface implementation into an MSAN are defined in Table 15. The values defined apply to a testing condition where the line length is assumed to be 3km of 0,5mm gauge copper which equates to a loop resistance of approximately 510 Ω, and CPE termination resistance is assumed to be zero.

It is further assumed that power consumed by MSAN functionality which is common to both Broadband and POTS is split appropriately across the two functions.

[16] These figures are additive to those existing in the code of conduct section B.2 (network equipment) for Broadband to form the per port limit for combo operation.

[17] Note that this assumes that the port is equipped to supply POTS but has not been configured for use by an end customer.

[18] Note that this excludes any on-hook charging current, which may be drawn by the CPE (up to 3mA in some countries).

B.2.3 Optical Line Terminations (OLT) for PON- and P2P-networks

Table 14: **Optical Line Terminations**

Equipment	**Tier 2009** (01.01.09) (W)	**Tier 2010** (01.01.2010) (W)	**Tier 2011** (01.01.2011) (W)
OLT (GPON, fully equipped with maximum configuration)	11	9	TBD
OLT (Point to Point up to 1000Mbit/s, up to 100 ports, fully equipped with maximum configuration)	5	5	TBD
OLT (Point to Point up to 1000Mbit/s, from 100 and 300 ports, fully equipped with maximum configuration)	4	4	TBD
OLT (Point to Point up to 1000Mbit/s, with more than 300 ports, fully equipped with maximum configuration)	3	3	TBD
OLT (Point to Point at 10Gbit/s, up to 12 ports, fully equipped with maximum configuration)	38	38	TBD
OLT (Point to Point at 10Gbit/s, from 12 to 42 ports, fully equipped with maximum configuration)	28	28	TBD
OLT (Point to Point at 10Gbit/s, with more than 42 ports, fully equipped with maximum configuration)	18	18	TBD

The above values are for fully equipped with maximum configuration OLTs.
The additional allowance for the uplink interface is:

- **4,5W per equipment for each Point to Point 1000Mbit/s interface**
- **18W per equipment for each Point to Point 10Gbit/s interface**
- **6W per equipment for each Point to Multipoint (GPON) interface**

The above consumption for GPON OLT is per port and with ClassB+ (ITU-T G.984.2 amd1) optical modules whatever the number of ONU connected to it is.

The above consumption for point to point OLT is per user port.
The optical budget for the OLT P2P interfaces shall be in line with IEEE802.3 clause 58 for the 100Base-LX10 and 100Base-BX10 interfaces and IEEE802.3 clause 59 for the 1000Base-LX10 and 1000Base-BX10 interfaces. A 5 dB channel insertion loss shall be used
The Pt-Pt 10Gbit/s limits are applicable only to Point to Point at 10Gbit/s, fully equipped with maximum configuration that directly connect to Customer Premises Equipment associated with broadband distribution for residential customers and SOHO.

B.2.4 Wireless Broadband network equipment

Table 15: **Wireless Broadband network equipment**

Equipment	**Tier 2009** (01.01.09) (W)	**Tier 2010** (01.01.2010) (W)	**Tier 2011** (01.01.2011) (W)
Wi-Fi access points (Hotspot application) 802.11b/g/n or 802.11/b/g/a – ON state and Active Standby[19]	13	TBD	TBD
WiMax Macro Radio Base Station (3 sectors) – ON state	TBD	TBD	TBD
WiMax Micro Radio Base Station (1 sector)– ON state	TBD	TBD	TBD

B.2.5 Cable network equipment

Energy saving with this technology has a big importance since cable networks are widely distributed all over Europe.

Table 16: **Cable network equipment**

Equipment	**Tier 2009** (01.01.09) (W)	**Tier 2010** (01.01.2010) (W)	**Tier 2011** (01.01.2011) (W)
I-CMTS ≤12 DS (downstream) ports	65	65	65
I-CMTS >12 DS ports	50	50	50
EQAM < 100 DS ports	9	8	8
EQAM 100-300 DS ports	8	7	7

[19] The On-state is defined with no traffic on the Wi-Fi port. Therefore there is no difference in power consumption between the On-state and the Low-power-state (Active Standby) for this equipment.

EQAM > 300 DS ports	7	7	6,5

I-CMTS = Integrated Cable Modem Termination System
EQAM =Edge Quadrature Amplitude Modulator

The above values are for fully equipped with maximum configuration.
The additional allowance for the uplink interface is:

- **4,5W per equipment for each Point to Point 1000Mbit/s interface**
- **18W per equipment for each Point to Point 10Gbit/s interface**
- **6W per equipment for each Point to Multipoint (GPON) interface**

B.2.6 Powerline network equipment

Access powerline networks have not reached a high importance in Europe yet. When powerline networks will be developed, wider power targets for power line access equipment should be included in this Code of Conduct.

Annex C – Reporting Form

See Reporting Sheet on the homepage of the EU Standby Initiative [3].

Annex D – Test methods

Customer premises equipment

Customer premises equipment with an external power supply shall be measured 230 Vac input in the off state and the low power state (when existing) as they are described in Annex B1. In the future, standardization bodies like ETSI could provide a more detailed specification for the measurement of the power consumption in the CPE-on-state.

Network equipment

The values given above are indicating the averaged power consumption per port for a fully equipped system as delivered by the manufacturer.
Systems powered by DC Voltage shall comply with the standard ETSI ETS 300 132-2, "Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)". The method of power measurement shall comply with the Technical Specification ETSI TS 102 533 "Environmental Engineering (EE); Measurement Methods and limits for Energy Consumption in Broadband Telecommunication Networks Equipment" [8].
In case of systems powered directly by AC mains Voltage, the power consumption will have to be measured at the AC input. For such systems, the power limits stated in tables 10 trough 16, will be increased by 10%.
The power limits have to be fulfilled for the system operating in the complete operational temperature range of the system itself.

Annex E – List of abbreviations

ADSL	*Asymmetric Digital Subscriber Line*
ADSL2+	*Second generation ADSL with extended bandwidth*
ATA	*Analogue Terminal Adapter*
CoC	*Code of Conduct*
COP	*Coefficient of performance*
CPE	*Customer premises equipment*
DECT	*Digital Enhanced Cordless Telecommunications*
DSL	*Digital Subscriber Line*
DSLAM	*Digital Subscriber Line Access Multiplexer*
ETSI	*European Telecommunications Standards Institute*
FXO	*Foreign eXchange Office*
FXS	*Foreign eXchange Station*
GPON	*Gigabit Passive Optical Network*
IAD	*Integrated Access Device*
IEEE	*Institute of Electrical and Electronics Engineers*
IP	*Internet Protocol*
ITU	*International Telecommunication Union*
LAN	*Local Area Network*
LT	*Line Termination*
MSAN	*Multi Service Access Node*
NAT	*Network Address Translation*
NT	*Network Termination*
P2P	*Point-to-Point Optical Network*
PLC	*PowerLine Communication*
PoE	*Power over Ethernet*
POTS	*Plain old telephone service*
PSTN	*Public switched telephone network*
SLMD	*Subscriber Line Module Digital*
SOHO	*Small Office, Home Office*
USB	*Universal Serial Bus*
VDSL2	*Very High Speed Digital Subscriber Line 2nd generation*
VoIP	*Voice over IP*
WAN	*Wide Area Network*
Wi-Fi	*Wireless Fidelity; technology using 802.11 standards*
WLAN	*Wireless Local Access Network*
xDSL	*Any DSL-technology*

Annex E – List of references

[1] ITU-T recommendation I.113 Vocabulary of terms for broadband aspects of ISDN

[2] Code of Conduct for Digital TV Services (version 7 – 15 january 2008) , http://re.ec.europa.eu/energyefficiency/html/standby_initiative.htm

[3] Reporting sheet CoC BB equipment(2).xls, http://re.ec.europa.eu/energyefficiency/html/standby_initiative.htm

[4] EU Code of Conduct for External Power Supplies Version 3 of 28.11.2008, http://re.ec.europa.eu/energyefficiency/html/standby_initiative.htm

[5] ETSI Standard EN 300019-1-3 European Standard, Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations

[6] EU Code of Conduct on Energy Efficiency of Broadband Equipment Version 2 of July 17th 2007

[7]ETSI ETS 300 132-2 European Standard, Equipment Engineering (EE);Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)

[8] ETSI TS 102 533, Technical Specification, Environmental Engineering (EE), Measurement Methods and limits for Energy Consumption in Broadband Telecommunication Networks Equipment

Code of Conduct
On Energy Consumption of Broadband Equipment

SIGNING FORM

The organisation/company/

……..

signs the Code of Conduct on Energy Consumption of Broadband Equipment and commits itself to abide to the principles described in point 4 "Commitment" for the equipment it produces, buys, installs or specifies.

The organisation, through regular upgrade reports, will keep the European Commission informed on the implementation of the Code of Conduct of Broadband Equipment.

for the organisation

Director or person authorised to sign:

Name: …… . . . . . .
Managerial Function: …… . . . . . .
Address ……
Tel. / Fax. ……/ ……
Email: ……
Date: ……

Signature ……

Please send the signed form to:

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