140 BT - Item 7.5.1

SUBJECT

M/462 'EFFICIENT ENERGY USE IN FIXED AND MOBILE INFORMATION AND COMMUNICATION NETWORKS' - PHASE 1

Report of CEN-CENELEC-ETSI Coordination Group on M/462

BACKGROUND

See Annex 1.

An identical proposal is being submitted to the CEN Technical Board.

PROPOSED DECISION(S)

BT approved the report produced by the CEN-CENELEC-ETSI Coordination Group on EC Mandate M/462 in the field of ICT to enable efficient energy use in fixed and mobile information and communication networks, as a reply to the first phase of M/462.

CV/2011-09-29

CEN Reference: Annex 1 to BT N 8742

CENELEC Reference: Annex 1 to BT140/DG8546/DV

BACKGROUND

Reference is made to BT137/DG8154/DV and BT137/DG8228/INF, which refer to the acceptance of M/462 in the field of ICT to enable efficient energy use in fixed and mobile information and communication networks and to the setting-up of a joint CEN-CENELEC-ETSI Coordination Group to reply to Phase 1 of M/462.

The CEN-CENELEC-ETSI Coordination Group is composed of the relevant CEN, CENELEC and ETSI Technical Bodies and relevant organizations mentioned in M/462. Mr Beniamino Gorini (Chairman of ETSI/TC "Environmental Engineering") and Mr Dominique Roche (Chairman of CLC/TC 215 "Electrotechnical aspects of telecommunication equipment") have been appointed Co-Chairs of the coordination group.

M/462 Phase 1 requested the ESOs, in cooperation with other relevant standards organizations to:

- analyse the economic environment and the political context for efficient energy use, with a focus on communication networks and associated services and applications/domains, while ensuring an adequate level of interoperability;
- identify the potential role of ICT standardisation in achieving efficient energy use;
- identify existing and/or ongoing standardisation and consensus-building activities on the issue within national, regional and international standardisation organisations, formal or otherwise, and to assess their relevance for achieving European policy objectives in this domain;
- identify consistencies, relations, dependencies, hierarchy (taxonomy), overlaps and gaps in ICT standardisation work related to efficient energy use;
- establish a standardisation work programme with a view to filling the gaps, taking into account relevant regulatory initiatives, R&D projects or standardisation activities carried out by relevant fora and consortia.

In this context, the joint CEN-CENELEC-ETSI Coordination Group on M/462 developed the document in Annex 2, which replies to the above-mentioned requests. In accordance with BT137/DG8228/INF, BT is invited to approve the report.

FRAMEWORK DOCUMENT

FOR

ESO RESPONSE TO EU MANDATE M/462

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Contents

Intellectual Property Rights

This section may not be appropriate for this document

Foreword

The Joint Coordination Group established between CEN, CENELEC and ETSI has produced this report in response to Mandate M/462 on "Standardisation mandate addressed to CEN, CENELEC and ETSI in the field of ICT to enable efficient energy use in fixed and mobile information and communication networks". In this activity have been involved the parties listed in clause 3 and 4 of mandate M/462.

The structure of clause 4 and the associated clauses 3 and 5) is based upon the "Standardisation Landscape" document [1] developed by the Standardisation Branch of the GeSI (Global e-Sustainability Initiative).

1 GeSI EEIOCG Standardization Landscape document (www.gesi.org/LinkClick.aspx?fileticket=Lmkk%2fMfiZ9Q%3d&tabid=72)

Introduction

1.1 Overview

Fixed and mobile information and communication networks taking into account not only the transmission systems but also their associated applications and the facilities and infrastructures at both the network and subscriber level represent an enormously complex entity. This is reviewed in Clause 3.

The achievement of energy efficiency in such an entity has to be addressed on a number of levels and has to be treated holistically. The first task is to identify the boundaries of the entity and then to determine the constituent parts of the entity within those boundaries. To concentrate standardisation efforts in one area only would risk significant savings that may be possible in others.

The constituent parts may range from items of transmission equipment, which have a defined function within the network and over which the user has little influence in terms of energy usage, to buildings and other structures containing equipment where the way in which that equipment is used is the predominant factor in the overall energy consumption. Moreover, such buildings may contain items of equipment which are necessary for, but not specific to, the delivery of information and communication networks and which could be made more energy efficient.

As a result, the application of standardisation as a route to energy efficiency cannot be handled as a series of isolated projects but instead requires coordinated activities across a number of standards organisations, each working according to an agreed strategy: some standards would address the definition of architectures maximizing efficiency, others would define metrics or Key Performance Indicators (KPIs) for energy efficiency, others would address the measurement of parameters necessary to support those metrics/KPIs, some would address infrastructures necessary to enable those measurements to be made, others would address the specification of components and equipments with improved energy efficiency leaving a final group of standards to define recommended best practices including technical means that maximise the gains in energy efficiency in both new and legacy systems.

While it is recognised that some work has already started in all three European Standards Organisations (ESOs), it is universally recognised that wider coordination is required in order to render such work fully effective. Such coordination goes far beyond the remit of any one of the ESOs and will also involve ITU-T. The early work undertaken by ETSI, particularly in relation to network operators' data centres, together with the recommendations of the CENELEC Technical Board report addressing general data centres described in section 1 indicate that such coordinated activity between CEN, CENELEC and ETSI is critical to the success of any objectives in the field of energy efficiency.

The authority provided under Phase 1 of Mandate M/462 is a necessary instrument to initiate and fund the establishment of the management structures necessary to enable such coordination. The necessary collaboration goes beyond that typically operated between the individual ESOs.

The principal objective of this technical proposal is, through the establishment of a jointly agreed document by the three ESOs, to fulfil the actions required in reply to the 5 tasks outlined in Phase 1 of M/462 (section 5.1). This proposed action deliberately focuses upon the mandate's objectives in order to provide clear recommendations and to maintain the mandate's required timelines by the provision of a detailed work programme for Phase 2 of the mandate.

1.2 Scope

This proposed action is in response to domain 8 of the European Commission's Information Communication Technology (ICT) Standardisation Work Programme 2010-2013 (ICT for sustainable growth) and Mandate M/462. The European Commission has addressed this standardisation Mandate to the ESOs and this proposal reflects the tasks required by Phase 1 of the mandate.

Mandate M/462 is a European Commission request, backed by the member states, requesting the ESOs to deliver standards to enable efficient energy use in fixed and mobile information and communication networks and their associated applications, facilities and infrastructures at both the network and subscriber level. The mandated work is described in two phases. This technical proposal refers to proposed actions required in order to fulfil the tasks requested for Phase 1 only.

This document begins by providing an overview of the relevant fixed and mobile information and communication networks, presents an economic analysis and reviews the political context that underpins the need to provide standardisation in relation to energy efficiency.

Subsequently this document explains the role of ICT standardization in relation to energy efficiency measurement methods, metrics and indicators, reviews the relevant existing and ongoing standardization activities and identifies the gaps in ICT standardization work in each of the following areas:

- the core network;
- network operators sites i.e. data centres and Central Offices;
- the fixed access network;
- the mobile access network;
- non-"IT end-use" equipment within customer premises.

The review of existing and ongoing standardization activities includes the work undertaken by the three ESOs (CEN, CENELEC and ETSI) and that by other standards organisations, fora and consortia that have produced documentation of interest and relevance.

The standardisation gaps identified in each area are analysed with respect to the objectives of the M/462 and the agreed priorities to produce an overall standardisation work programme (clause 5), partitioned between the ESOs, which may require either original work or collaboration with other standards bodies, fora or consortia.

1.3 Definitions, abbreviations and schematic assistance

1.3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

access network the part of the network that is deemed to include the last active component at the relevant operator site and the first active element at the subscriber's premises.

Core network the functional elements (that is equipment and infrastructure) that enable communication between operator sites and/or network data centres

distribution network	the sub-part of a fixed access network comprising the functional elements that enable communication between the last operator node and a customer network
last operator node (LON)	location(s) in a given access network topology, furthest from the operator site, that enables distribution of services to multiple subscribers and which contains network-specific equipment NOTE: the network-specific equipment at a LON may be active or passive. NOTE: the LON may be found in a number of different locations e.g. street cabinets, common spaces within multi-subscriber premises.
non-"IT end-use" equipment	any equipment directly connected to a fixed access network and for which the power consumption of that connection is defined or controlled by the service provider
transport network	the sub-part of a fixed access network comprising the functional elements that enable communication between the operator site and the last operator node

1.3.2 Abbreviations

For the purposes of the present document, the following terms and definitions apply:

ACRONYMS: TECHNICAL TERMINOLOGY

ADSL	Asymmetrical Digital Subscribers Line
ADSL2	Second generation ADSL with extended upstream bandwidth
ADSL2+	Second generation ADSL with extended downstream bandwidth
BSC	Base Station Controller
BTS	Base Transceiver Station
CAPEX	CAPital EXpenditure
COP	Conference of the Parties
CPE	Customer Premises Equipment
CPS	Common Power Supply
CSCF	Call Session Control Function
DWDM	Dense Wavelength Division Multiplexing
EE	Energy Efficiency
EER	Energy Efficiency Ratio
EGPRS	Enhanced GPRS
EMC	Electromagnetic Compatibility
EPC	Evolved Packet Core
GGSN	Gateway GPRS Support Node
GHG	Greenhouse Gas
GMSC	Gateway Mobile Switching Centre
GPON	Gigabit Passive Optical Network
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications (Groupe Spécial Mobile)
HLR	Home Location Register
HNID	Home Network Infrastructure Device
HSS	Home Subscriber Server
ICT	Information & Communications Technology
IMS	Internet & Multimedia Subsystem
KPI	Key Performance Indicator
LON	Last Operator Node
MGW	Media GateWay
MSC	Mobile Switching Centre
MSAN	Multi-service access Node
MSTP	Multi-Spanning Tree Protocol

NGN	Next Generation Network
OPEX	OPerational EXpenditure
OLT	Optical Line Termination
ONT	Optical Network Termination
PCU	Packet Control Unit
PON	Passive Optical Network
PTP	Point-To-Point optical network
PTP	Point-To-Multipoint optical network
RAN	Radio Access Network
RNC	Radio Network Controller
ROADM	Reconfigurable Optical Add-Drop Multiplexer
SNE	Small Network Equipment
SGSN	Serving GPRS Support Node
STB	Set Top Box
TD-SCDMA	Time Division - Synchronous Code Division Multiple Access
TEEER	Telecommunications Equipment Energy Efficiency Ratio
TEER	Telecommunications Energy Efficiency Ratio
TV	Television
VDSL2	Second generation Very high-speed Digital Subscriber Line
VDSL3	Third generation VDSL
WCDMA	Wideband Code Division Multiple Access/Time Domain

ACRONYMS: RELEVANT STANDARDS DEVELOPMENT AND OTHER ORGANISATIONS

3GPP	3rd Generation Partnership Project	http://www.3gpp.org/
ANSI	American National Standards Institute	www.ansi.org
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	www.ashrae.org/
ATIS	Alliance for Telecommunications Industry Solutions	www.atis.org
ATTM	Access, Terminals, Transmission and Multiplexing (ETSI Technical Committee)	
BBF	Broadband Forum	www.broadband-forum.org/
CCSA	China Communications Standards Association	www.ccsa.org.cn
CEN	European Committee for Standardization (Comité Européen for Normalisation)	www.cen.eu
CENELEC	European Committee for Electrotechnical Standardization (Comité Européen for Normalisation Electrotechnique)	www.cenelec.eu
CLC	CENELEC	
CMCC	China Mobile Communications Corporation	
DIF	Digital Interoperability Forum	www.difgroup.eu/
Ecma International		www.ecma-international.org/
EE	Environmental Engineering (ETSI Technical Committee)	
EPA	Environmental Protection Agency (US)	
ESO	European Standards Organisation (CEN, CENELEC and ETSI)	
ETSI	European Telecommunications Standards Institute	www.etsi.org
ETNO	European Telecommunications Networks Operators Association	www.etno.be/
EU	European Union	
GeSI	Global e-Sustainability Initiative	ww.gesi.org
GREEN GRID	The Green Grid	www.thegreengrid.org/
HGI	Home Gateway Initiative	www.homegatewayinitiative.org
IEC	International Electrotechnical Committee	www.iec.ch
IEEE		www.ieee.org
ITU-T	International Telecommunications Union (Telecommunication Standardization Sector)	http://www.itu.int/ITU-T/
SPEC	Standard Performance Evaluation Corporation	www.spec.org/

2 Economic environment and the political context for efficient energy use

ICT can be used in a number of ways to meet the requirements of the three main pillars of the Bali Action Plan[1] arising from COP-13 in December 2007: enhanced action on adaptation, cooperative action to reduce greenhouse gas (GHG) emissions, and actions on mitigation of climate change.

The fixed and mobile networks that deliver ICT provide an indispensable infrastructure that can dramatically improve the efficiency of economic activities such as production, distribution and consumption. The ICT solutions provided by these networks not only improve the efficiency of existing tasks but enable the provision of new services (such as government administration, medical care etc), applications and content.

Having accessibility to information always, and everywhere, as an integral part in our daily lives can also play a significant role in reducing our environmental burden, or the negative impacts our activities have on the environment. When comparing the impact on the environment from specific services carried out "the traditional way" with the same service obtained through innovative use of ICT the reduction of the environmental burden can be considerable (by factors of between 10-100, depending on the service). Thus the use of ICT is very important in combating climate change.

However, as a consequence of the increased use of ICT in all walks of life, and an associated increase in demand for bandwidth, reliability, quality and performance, there is a potential consequential increase in the demand for power which has implications for cost and, in some cases, availability. This will potentially emit more GHG, carbon dioxide (CO_2), and create a greater environmental burden. However, GHG emissions do not automatically follow these percentage figures (dependent upon the power generation policies of national and regional governments). Actions are already in place to address the standardisation activities to address this issue (Mandate M/478[2]) and are not separately addressed in this document.

The total power consumption of information and communication networks and infrastructures is typically reported as being in the region of 8%[3] of total power consumption in society. The power consumption of "IT end-use equipment" within commercial and residential premises typically constitutes three-quarters of this figure and the power consumption in this area is expected to rise (as networks extend and proliferate into homes and as IT demands increase in commercial subscribers premises). Actions are already in place to address the standardisation activities to address the power consumption of IT end-use equipment, e.g. set-top boxes and personal computers, and are not addressed in this document.

This document is restricted by the scope of the Mandate M/462 to exclude consideration of "IT end-use equipment" and instead focuses upon standardisation activities to maximise the energy efficiency of all the fixed and mobile network elements necessary to deliver the required services to the end-user. New technologies and infrastructure strategies are expected to enable operators to decrease the energy consumption, for a given level of service, of their existing and future infrastructures. This requires a common understanding among market participants that standards can produce most effectively.

1 Decision 1 of UNFCCC Report of the Conference of the Parties on its thirteenth session, Bali, 3 to 15 December 2007.

2 Standardisation mandate to CEN, CENELEC and ETSI for the development of EU technical standards in the field of greenhouse gas emissions

3 http://ec.europa.eu/information_society/activities/sustainable_growth/docs/studies/2008/2008_impact-of-ict_on_ee.pdf

3 Potential role of ICT standardisation in achieving efficient energy use

3.1 General

Standardisation is a well-recognized tool to support policy objectives, both regulatory and non-regulatory. The regulatory use is supported by the WTO Agreement on Technical Barriers to Trade (TBT)**4** which asks its members to base their regulation on (international) standards.

The European standardisation system provides the structure and competence to fully respond to the needs of the market stakeholders in relation to standards covering requirements and measurement methods for environmental aspects such as energy efficiency. While such standards are available in other policy areas like safety, electromagnetic compatibility and radio aspects, in the environmental area there are still gaps to be filled, particularly regarding the setting of technical requirements in standards.

The role of standardisation in "fixed and mobile information and communications networks to enable energy use" (i.e., Mandate M/462) is all-encompassing. This standardisation is performed in standardisation organisations, such as ETSI for telecommunications networks, which enable involvement of all relevant stakeholders, responding to both policy measures and business needs.

3.2 Elements of energy consumption

Figure 1 is a schematic representation of the infrastructures supporting the fixed and mobile information and communication networks in the provision of ICT that lie within the scope of the Mandate M/462.

The core network provides support for both the fixed and mobile access networks. The principal elements responsible for energy consumption are the operators sites (sometimes termed central offices) and operator data centres together with certain aspects of the transmission equipment and infrastructure linking those locations.

The fixed access network comprises the transmission equipment within the operator sites that serves the customer premises, the last operator nodes (or last cabinets) and the non-"IT end use" equipment in the customers premises. These elements are the principal elements responsible for energy consumption in the fixed access network.

The satellite mobile access network comprises the transmission equipment within the operator sites that serves the satellites. This is the principal element responsible for energy consumption in the satellite mobile access network.

The terrestrial mobile access network comprises the transmission equipment within the operator sites that serves the backhaul network and the base transceiver stations. These elements are the principal elements responsible for energy consumption in the terrestrial mobile access network.

4 WTO TBT Agreement, article 2.4: "Where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations except when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfilment of the legitimate objectives pursued"

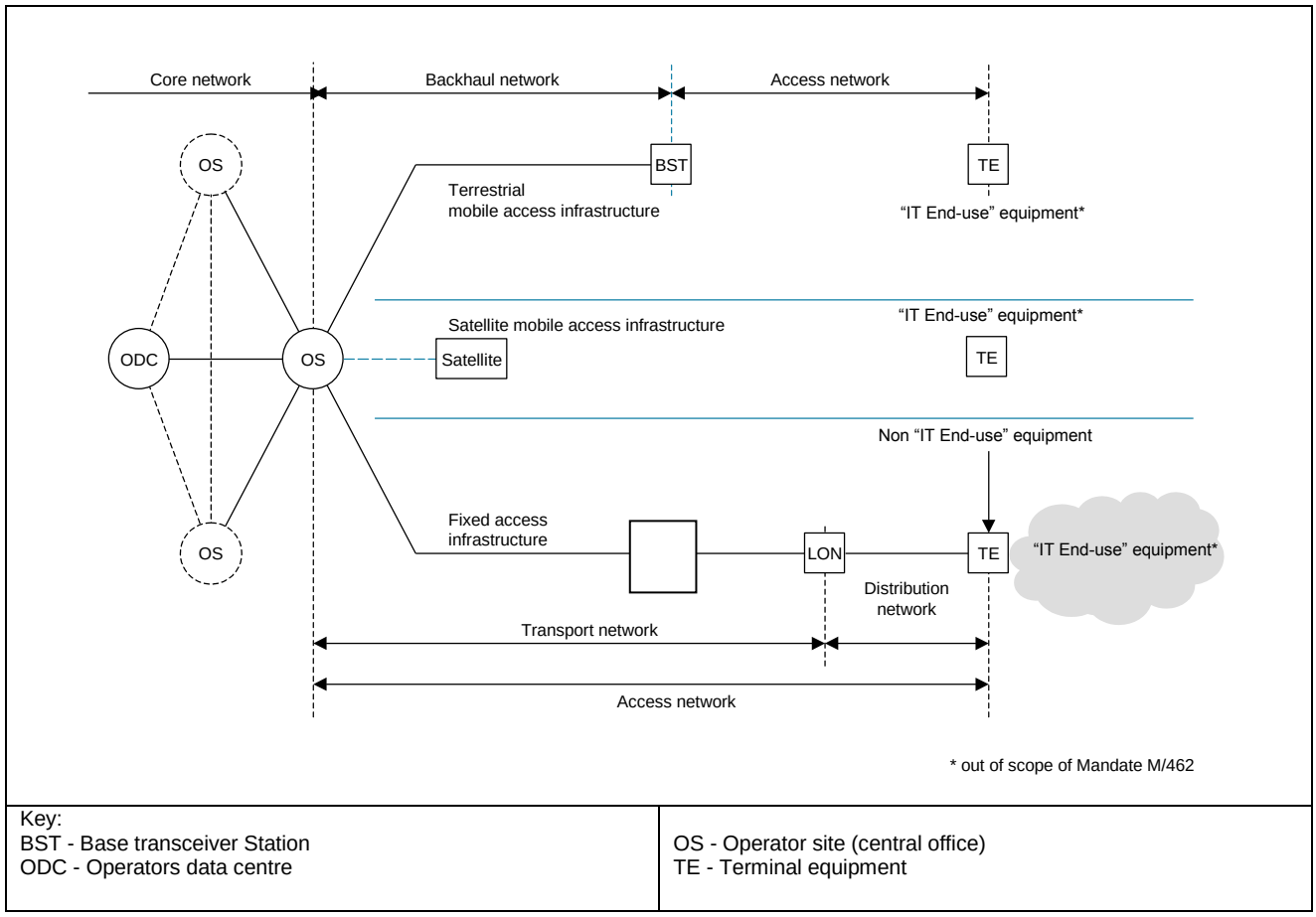

Figure 1 - Schematic of fixed and mobile infrastructures

3.3 Standardisation to support energy efficiency

Each of the elements responsible for energy consumption features multiple sub-systems together with their associated facilities and infrastructures, each of which containing many sub-assemblies.

Some of the sub-systems are directly related to transmission within or from a given element while others such as power distribution and environmental control serve to provide the required conditions to ensure the function of the individual sub-systems.

Therefore, standardisation in support of energy efficiency has to address:

- each sub-assembly;
- the use of each sub-assembly within each sub-system;
- the use of each sub-system within the overall system;
- the selection of network solutions and the appropriate sub-systems such that the energy efficiency of the overall delivery system improves;

Example 1: Modern fixed and mobile telecommunications networks are much more efficient than their predecessors. For example, the Next Generation Network (NGN) uses 40% less energy than previous networks through reductions in the number of switching centres, more tolerant climatic range for NGN equipment, and the use of more advanced technologies such as VDSL2 and passive optical networks (PONs).

Example 2: The switch from analogue to digital broadcasting is currently being implemented which has enabled an almost ten-fold reduction in the power consumption of broadcasting transmitters, due to the use of digital modulation instead of analogue. The number of transmitters can also be reduced by transmitting several TV and sound programmes in one frequency channel, instead of transmitting only one TV programme per channel.

Example 3: Sharing of mobile network infrastructure and re-use of core networks can cut CO_2 emissions by 25%. Network infrastructure can be shared between operators, between technologies (e.g. LTE, UMTS and GSM), or between multiple RF modules for capacity upgrades. Sharing can occur at several different levels, e.g. Location only, Mast, Antenna system or Base Transceiver Station (BTS).

- gradual inclusion of "always available" (stand-by modes) rather than "always-on" system concepts in node design and management.

Each of these five areas has to be subjected to a comprehensive and interlocking range of standards that define Key Performance Indicators, measurement methods by which to determine performance against the relevant KPI and operational procedures that support the attainment of the desired performance against any limits defined for the KPIs (either internally within the Operation standards or externally by Code of Practice, regulation or legislation).

There are a number of different types of documents produced by the three ESOs. Each ESO is able to produce European Standards (ENs) which form the highest level of standards-based direction.

For the purposes of this report, there are three other levels as follows:

- ETSI ES (ETSI Standard)
- ETSI or CEN/CLC TS (Technical Specification)
- ETSI or CEN/CLC TR (Technical Report)

Clause 5 of this report summarises the current coverage of ESO activity in relation to the elements/sub-systems structure detailed in clause 4.

4 Ongoing standardisation activities

NOTE: The structure of clause 4 and the associated clauses 3 and 5) is based upon the "Standardisation Landscape" document[5] developed by the Standardisation Branch of GeSI (Global e-Sustainability Initiative).

4.1 Core network

4.1.1 Transmission equipment

4.1.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TS 105 174-3	Broadband deployment: Energy efficiency and Key Performance Indicators - Core, regional and metropolitan networks	In development
.2	TEST	ETSI EE	DES/EE-EEPS00001	Measurement method for Energy efficiency of Core network equipment This defines core network energy efficiency metrics, efficiency parameters and measurement methods. Energy efficiency metrics and measurement methods should model the traffic behaviour. This ES is applicable to IMS core functions (HSS, CSCF, etc), Fixed core functions (softswitch), Mobile core functions (HLR, MSC, GGSN, SGSN, EPC, etc) and Radio access control nodes (RNC, BSC).	In development
		ETSI EE	DES/EE-00023	Measurement Methods for Power Consumption of Transport Networks Equipment	In development
.3	KPI	ETSI EE	DES/EE-EEPS00001	Measurement method for Energy efficiency of Core network equipment This defines core network energy efficiency metrics, efficiency parameters and measurement methods. Energy efficiency metrics and measurement methods should model the traffic behaviour. This ES is applicable to IMS core functions (HSS, CSCF, etc), Fixed core functions (softswitch), Mobile core functions (HLR, MSC, GGSN, SGSN, EPC, etc) and Radio access control nodes (RNC, BSC).	In development
		ETSI EE	DES/EE-00023	Measurement Methods for Power Consumption of Transport Networks Equipment	In development

4.1.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION	ITU-T SG5 Q17	L.metric_infra	Energy efficiency metrics for telecom infrastructure	In development
.2	TEST	ANSI ATIS	060015.02. 2009	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Transport requirements This standard specifies the methodology to measure the	Published

[5] GeSI EEIOCG Standardization Landscape document (www.gesi.org/LinkClick.aspx?fileticket=Lmkk%2fMfiZ9Q%3d&tabid=72)

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
				energy efficiency of transport equipment and to calculate their Telecommunications Energy Efficiency Ratio (TEER). The standard also provides requirements for how equipment vendors shall respond to a TEER request based on a specific application description by making use of relevant data from internal and independent test reports. Testing methodologies and conditions to define TEER at the system level for all transport equipment including DWDM, ROADM, radio backhaul transport	
		ITU-T SG5 Q17	L. measr _infra	Energy efficiency measurement for telecom infrastructure	In development
		ANSI ATIS		Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Wireless core network This standard includes HLR, MSC, MGW, SGSN, GGSN	In development
.3	KPI	ITU-T SG5 Q17	L. metric_infra	Energy efficiency metrics for telecom infrastructure	In development
		ANSI ATIS	060015.02. 2009	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Transport requirements This standard specifies the methodology to measure the energy efficiency of transport equipment and to calculate their Telecommunications Energy Efficiency Ratio (TEER). The standard also provides requirements for how equipment vendors shall respond to a TEER request based on a specific application description by making use of relevant data from internal and independent test reports. Testing methodologies and conditions to define TEER at the system level for all transport equipment including DWDM, ROADM, radio backhaul transport	Published

4.1.2 Switching equipment

4.1.2.1 Ethernet routers and switches

4.1.2.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TS 105 174-3	Broadband deployment: Energy efficiency and Key Performance Indicators - Core, regional and metropolitan networks	In development
.2	TEST	ETSI EE	DES/EE-00024	Measurement Methods for Power Consumption of Router and switching Networks Equipment	In development
.3	KPI	ETSI EE	DES/EE-00024	Measurement Methods for Power Consumption of Router and switching Networks Equipment	In development

4.1.2.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			No activity	
.2	TEST	ANSI ATIS	060015.03. 2009	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - router and Ethernet switch products This standard specifies the definition of router and Ethernet switch products based on their position in a	Published

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
				network and a methodology to calculate their Telecommunications Energy Efficiency Ratio (TEER). The standard also provides requirements for how equipment vendors shall respond to a TEER request based on a specific application description by making use of relevant data from internal and independent test reports.	
		CCSA TC1		Energy efficiency parameter and test method for Ethernet switch This document defines EER (Energy Efficiency Ratio) and a test method	In development
		CCSA TC1		Energy efficiency parameter and test method for router This document defines EER (Energy Efficiency Ratio) and a test method	In development
.3	KPI	CCSA TC1		Energy efficiency parameter and test method for Ethernet switch This document defines EER (Energy Efficiency Ratio) and a test method	In development
		CCSA TC1		Energy efficiency parameter and test method for router This document defines EER (Energy Efficiency Ratio) and a test method	In development

311 ## 4.1.3 Transmission infrastructure

312 ### 4.1.3.1 Closures and cabinets

313 #### 4.1.3.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION			NOTE: no references will be provided for this section since the "operational" energy efficiency is a combination of the closure/cabinet and the equipment contained within it.	
.2	TEST	ETSI EE	EN 300 119-5	Environmental Engineering (EE); European telecommunication standard for equipment practice; Part 5: Thermal management This standard can be revised to include KPIs	Published
		ETSI EE	EE1 WI DES/EE-0100027	Thermal management of outdoor cabinets	In development
.3	KPI	ETSI EE	EE1 WI DES/EE-0100027	Thermal management of outdoor cabinets	In development

314 #### 4.1.3.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			NOTE: no references will be provided for this section since the "operational" energy efficiency is a combination of the closure/cabinet and the equipment contained within it.	
.2	TEST			No activity	

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.3	KPI			No activity	

4.2 Network operator sites

4.2.1 Facilities

4.2.1.1 Data centres

4.2.1.1.1 ESO

CEN-CLC- ETSI has established a Coordination Group to develop standards for Energy Efficiency within Data Centres and associated infrastructure. This proposal resulted from a CLC Technical Board review (CLC BT WG132-3) of standardisation in this area unrelated to M/462.

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	CLC TC 215	Series EN 50600	Data centres facilities and infrastructures The series of standards supports effective design, installation and operation of the data processing, storage and transport equipment in data centres. They specify measurement methodologies to measure the characteristics of the power supplied to the various facilities enabling the calculation of energy efficiency.	In development
		ETSI ATTM	TS 105 174-2-2	Broadband deployment: Energy efficiency and Key Performance Indicators - Network sites: Data centres	Published
		ETSI EE	TR 102 489	European telecommunications standard for equipment practice; Thermal management guidance for equipment and its deployment	Published
		ETSI EE	TR 102 530	The reduction of energy consumption in telecommunications equipment and related infrastructure	Published
		ETSI EE	EN 300 019-1 series	Environmental conditions and environmental tests for telecommunications equipment: Classification of environmental conditions This standard also contains objectives for extended temperature range for equipment to be used in data centres (servers, storage …).	Published
.2	TEST	ETSI EE	EN 300 019-2 series	Environmental conditions and environmental tests for telecommunications equipment: Specification of environmental tests	Published
.3	KPI	ETSI ATTM	TS 105 174-2-2	Broadband deployment: Energy efficiency and Key Performance Indicators - Network sites: Data centres	Published
.4	POWERING	ETSI EE	TR 102 532	The use of alternative energy sources in telecommunication installations	Published Undergoing revision
		ETSI EE2	EN 300 132-3	Power supply interface at the input to telecommunications equipment: Operated by rectified current source, alternating current source or direct current source up to 400 V	Published Undergoing revision

4.2.1.1.2 Non-ESO

IEC SMB Strategy Group LVDC is producing roadmaps for future standardisation for “LVDC Distribution Systems up to 1500V”.

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	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION	ITU-T SG5 Q17	L.DC	Data centre best practice	In development
		ITU-T SG5 Q19	L.architecture	System configuration, architecture, and cable distribution including feeding, lightning protection, EMC, earthing, and bonding of the power feeding system	In development
		ITU-T SG5 Q19	L.performance	Methodologies for evaluating the performance of energy feeding and its environmental impact	In development
2	TEST	ANSI ATIS	0600015.04. 2010.	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Direct current power systems - Rectifier requirements This standard develops representative life cycle efficiency versus reported peak efficiency	Published
.3	KPI	ANSI ATIS	0600015.04. 2010.	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Direct current power systems - Rectifier requirements This standard develops representative life cycle efficiency versus reported peak efficiency	Published
.4	POWERING	ITU-T SG15 Q19	L.specDC	Characterizations and specifications of power feeding system, especially for xxxV DC system	In development

327 #### 4.2.1.2 Central Offices

328 ##### 4.2.1.2.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 105 174-2-1	Broadband deployment: Energy efficiency and Key Performance Indicators - Network sites: Operator sites	Published
		ETSI EE	TR 102 489	European telecommunications standard for equipment practice; Thermal management guidance for equipment and its deployment	Published
		ETSI EE	TR 102 530	The reduction of energy consumption in telecommunications equipment and related infrastructure	Published
		ETSI EE	EN 300 019-1 series	Environmental conditions and environmental tests for telecommunications equipment: Classification of environmental conditions This standard also contains objectives for extended temperature range for equipment to be used in data centres (servers, storage …).	Published
.2	TEST	ETSI EE	EN 300 019-2 series	Environmental conditions and environmental tests for telecommunications equipment: Specification of environmental tests	Published
.3	KPI	ETSI ATTM	TR 105 174-2-1	Broadband deployment: Energy efficiency and Key Performance Indicators - Network sites: Operator sites	Published
.4	POWERING	ETSI EE2	EN 300 132-3	Power supply interface at the input to telecommunications equipment: Operated by rectified current source, alternating current source or direct current source up to 400 V	Published Undergoing revision

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4.2.1.2.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			No activity	
.2	TEST	ANSI ATIS	060015.XX.XXXX	Facility TEER Testing: Methodology for assessing Central Offices site efficiency:	In development
		ANSI ATIS	0600015.04.2010.	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Direct current power systems - Rectifier requirements This standard develops representative life cycle efficiency versus reported peak efficiency	Published
.3	KPI	ANSI ATIS	060015.XX.XXXX	Facility TEER Testing: Methodology for assessing Central Offices site efficiency:	In development
		ANSI ATIS	0600015.04.2010.	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Direct current power systems - Rectifier requirements This standard develops representative life cycle efficiency versus reported peak efficiency	Published
.4	POWERING	ITU-T SG15 Q19	L.specDC	Characterizations and specifications of power feeding system, especially for xxxV DC system	In development

4.2.2 IT equipment

4.2.2.1 Servers and storage

4.2.2.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	CLC TC108	EN 62075	Audio/video, information and communication technology equipment – Environmentally conscious design	Published
.2	TEST	CLC TC108	EN 62018	Power consumption of information technology equipment, measurement method	Published
.3	KPI	CLC TC108	EN 62075	Audio/video, information and communication technology equipment – Environmentally conscious design	Published
.4	POWERING	ETSI EE	EN 300 132-3	Power supply interface at the input to telecommunications equipment: Operated by rectified current source, alternating current source or direct current source up to 400 V	Published Undergoing revision

4.2.2.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION	IEC TC108	IEC 62075	Audio/video, information and communication technology equipment – Environmentally conscious design	Published
		ITU-T SG5 Q17	L.metrics	Energy efficiency metrics for telecommunication equipment	In development
.2	TEST	ANSI ATIS	060015.01.2009	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Server requirements This standard references SPEC	Published

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
		IEC TC108	IEC 62018	Power consumption of information technology equipment, measurement method	Published
		ITU-T SG5 Q17	L.measure	Energy efficiency measurement for telecom equipment	In development
.3	KPI	IEC TC108	IEC 62075	Audio/video, information and communication technology equipment – Environmentally conscious design	Published

4.3 Fixed access delivery

4.3.1 Network side

4.3.1.1 ADSL, ADSL2/2+, VDSL2 and VDSL3

4.3.1.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 105 174-4	Broadband deployment: Energy efficiency and Key Performance Indicators - Access networks	Published
.2	TEST	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.3	KPI	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.4	POWERING	ETSI EE	TR 102 629	Reverse power feed for remote nodes	Published
		ETSI EE	EN 302 099	Powering of equipment in access network	Published Under revision
		ETSI EE	TR 102 614	Reverse powering of small access network node by end-user equipment : A4 interface This standard specifies power feed to the network operator's remote transmission system from the customers premises	Published

4.3.1.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION	ITU-T SG15 Q4		Development of “low power” implementation	In development
.2	TEST	ANSI ATIS	060015.XX.XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products	In development
.3	KPI	ANSI ATIS	060015.XX.XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products	In development

4.3.1.2 Cable networks

4.3.1.2.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 102 877	Energy Efficiency of Energy Using Products (EuPs) with regards to their Ecodesign Requirements; Network Apparatus and Customer Premises Equipment relating to Cable Network Operator's Services	Published
.2	TEST			No Activity	
.3	KPI			No Activity	

4.3.1.2.2 Non-ESO

No activity.

4.3.1.3 Passive optical networks (PON)

4.3.1.3.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 105 174-4	Broadband deployment: Energy efficiency and Key Performance Indicators - Access networks	Published
.2	TEST	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.3	KPI	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.4	POWERING	ETSI EE	TR 102 614	Reverse powering of small access network node by end-user equipment : A4 interface This standard specifies power feed to the network operator's remote transmission system from the customers premises	Published
		ETSI EE	EN 302 099	Powering of equipment in access network	Published Under revision

4.3.1.3.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			No activity	
.2	TEST	ANSI ATIS	060015.XX.XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products	In development
.3	KPI	ANSI ATIS	060015.XX.XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products	In development

4.3.1.4 Point-to-point optical networks (PTP)

4.3.1.4.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 105 174-4	Broadband deployment: Energy efficiency and Key Performance Indicators - Access networks	Published
.2	TEST	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.3	KPI	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.4	POWERING	ETSI EE	TR 102 614	Reverse powering of small access network node by end-user equipment : A4 interface This standard specifies power feed to the network operator's remote transmission system from the customers premises	Published

4.3.1.4.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			No activity	
.2	TEST	ANSI ATIS	060015.XX. XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products	In development
.3	KPI	ANSI ATIS	060015.XX. XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products	In development
.4	POWERING			No activity	

4.3.2 Transmission infrastructure

See 4.1.3.

4.4 Mobile access delivery

4.4.1 Network side

4.4.1.1 Network access equipment

4.4.1.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TS 105 174-6	Broadband deployment: Energy efficiency and Key Performance Indicators - Mobile access network This standard will include target limits for energy consumption, volume, weight and footprint of BTS, BSC, PCU	In development

	TOPIC	ESO	STANDARD	TITLE	STATUS
.2	TEST	ETSI EE	TS 102 706	Energy efficiency of wireless access network equipment This standard adopts a “static” measurement method. A “dynamic” measurement method is under development	Published
.3	KPI	ETSI EE	TS 102 706	Energy efficiency of wireless access network equipment This standard adopts a “static” measurement method. A “dynamic” measurement method is under development This standard does not define target limits.	Published

4.4.1.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			No activity	
.2	TEST	ANSI ATIS		Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Wireless base station equipment	Under development
		CCSA TC5		Energy efficiency parameter and test method for base station in mobile network: EE metrics and test method CCSA has finalized a static method which is to large extent aligned with ETSI TS 102 706 V1.1.1 and is currently studying the dynamic aspects.	Translation from Chinese required
.3	KPI	ANSI ATIS		Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Wireless base station equipment	Under development
		CCSA TC5		Energy efficiency parameter and test method for base station in mobile network: EE metrics and test method CCSA has finalized a static method which is to large extent aligned with ETSI TS 102 706 V1.1.1 and is currently studying the dynamic aspects.	Translation from Chinese required

4.4.2 Satellite

4.4.2.1 ESO

No activity.

4.4.2.2 Non-ESO

No activity.

4.5 Customer premises (excluding “IT-end use” equipment)

4.5.1 Building and home networking

4.5.1.1 General

4.5.1.1.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 105 174-5-1	Broadband deployment: Energy efficiency and Key Performance Indicators - Customer network infrastructures: Homes (single-tenant)	Published
		ETSI ATTM	TR 105 174-5-2	Broadband deployment: Energy efficiency and Key Performance Indicators - Customer network infrastructures: Office premises (single-tenant)	Published
		ETSI ATTM	TS 105 174-5-4	Broadband deployment: Energy efficiency and Key Performance Indicators - Customer network infrastructures: Data centres	Published
		ETSI EE	TR 102 629	Reverse power feed for remote nodes	Published
.2	TEST	ETSI EE	DEN/EE-00021	Measurement methods for Energy consumption of End-user Broadband equipment (CPE)	In development
		ETSI EE	ES 203 215	Measurement methods and limits for power consumption in broadband telecommunication networks equipment	In development
.3	KPI	ETSI EE	DEN/EE-00018	Measurement methods and limits for Energy consumption of End-user Broadband equipment (CPE)	In development
.4	POWERING	ETSI EE	TR 102 614	Reverse powering of small access network node by end-user equipment : A4 interface This standard specifies power feed to the network operator's remote transmission system from the customers premises	Published
		ETSI EE	EN 302 099	Powering of equipment in access network	Published Under revision

4.5.1.1.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION	IEEE	802.3az	Energy Efficient Ethernet This standard defines a mechanism to reduce power consumption during periods of low link utilization for the following physical interfaces: 100BASE-TX (Full Duplex) 1000BASE-T (Full Duplex); 10GBASE-T; 10GBASE-KR; 10GBASE-KX4 and 1000BASE-KX This standard defines a protocol to coordinate transitions to or from a lower level of power consumption	Published
.2	TEST	CCSA ST2		Energy efficiency parameter and test method for cordless phone: EE metrics and test method	In development
.3	KPI			No activity	

4.5.1.2 Optical customer premises equipment (PON and PTP ONT)

4.5.1.2.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	TR 105 174-4	Broadband deployment: Energy efficiency and Key Performance Indicators - Access networks	Published
		ETSI ATTM	TR 105 174-5-1	Broadband deployment: Energy efficiency and Key Performance Indicators - Customer network infrastructures: Homes (single-tenant)	Published
		ETSI ATTM	TR 105 174-5-2	Broadband deployment: Energy efficiency and Key Performance Indicators - Customer network infrastructures: Office premises (single-tenant)	Published
		ETSI EE	TR 102 614	Reverse powering of small access network node by end-user equipment : A4 interface This standard specifies power feed to the network operator's remote transmission system from the customers premises	Published
.2	TEST	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.3	KPI	ETSI EE	ES 203 215	Measurement method and limits for energy consumption in broadband telecommunications equipment Previously published as TS 102 533	Under approval
.4	POWERING	ETSI EE	EN 302 099	Powering of equipment in access network	Published Under revision

4.5.1.2.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION			No activity	
.2	TEST	CCSA ST2		Energy efficiency parameter and test method for cordless phone: EE metrics and test method	In development
.3	KPI	ANSI ATIS	060015.XX.XXXX	Energy efficiency for telecommunication equipment: Methodology for measurement and reporting - Access network products ATIS is considering alignment with ETSI 102 533 focusing towards overall system performance rather than the port performance method of ETSI	In development

4.5.1.3 External power supplies

4.5.1.3.1 ESO

	TOPIC	ESO	STANDARD	TITLE	STATUS
.1	OPERATION	ETSI ATTM	ES 202 874-1	External Common Power Supply for Customer Premises Network and Access Equipment; Functional requirements This document forms part of a series together with: • TS 102874-2: CPS Type 2.a • TS 102874-3: CPS Type 1 • TS 102874-4: CPS Type 2.b	Published Published

	TOPIC	ESO	STANDARD	TITLE	STATUS
				• TS 102874-5: CPS Type 2.c	
		CLC BTTF-135-1	EN 50558	Interoperability specifications of common external power supply (EPS) for use with data-enabled mobile telephones	Published
.2	TEST	CLC TC108	EN 50563	External a.c. - d.c. and a.c. - a.c. power supplies – Determination of no-load power and average efficiency of active modes	Under approval

4.5.1.3.2 Non-ESO

	TOPIC	PUBLISHER	STANDARD	TITLE	STATUS
.1	OPERATION	ITU-T	Rec L.1000	Universal power adapter and charger solution for mobile terminals and other handheld ICT Devices	Published
		ITU-T	L.Adapter Phase 2	Universal power adapter and charger solution for ICT devices that require an external power adapter	In development
		IEC TC100	IEC 62637-1	Battery charging interface for small hand held multimedia devices - Part 1: 2mm Barrel interface specification	Published
		IEC TC100	IEC 62680	Micro USB battery charging interface for small hand-held multimedia devices	In development
		IEC TC100	IEC 62700	DC Power Supply for Portable Personal Computer	In development
.2	TEST			No activity	
.3	KPI			No activity	

4.6 Overall network design

4.6.1 ESO

No activity.

4.6.2 Non-ESO

No activity.

4.7 Life cycle assessment

4.7.1 ESO

ESO	STANDARD	TITLE	STATUS
ETSI EE	TR 102 530	The reduction of energy consumption in telecommunications equipment and related infrastructure	Published
ETSI EE	TR 102 532	The use of alternative energy sources in telecommunication installations	Published
ETSI EE	TS 103 199	LCA assessment of telecommunication equipment and service: General definition and common requirement	In development

4.7.2 Non-ESO

PUBLISHER	STANDARD	TITLE	STATUS
ISO	ISO 14040	Environmental management - Life cycle assessment - Principles and framework	Published
ISO	ISO 14044	Environmental management - Life cycle assessment - Requirement and guidelines	Published
ITU-T SG5	L.1400	Overview and general principles of methodologies for assessing the environmental impact of ICT	Published
ITU-T SG5 Q18	L. methodology	ICT goods, networks and services - Methodology for environmental impact assessment of ICT goods, networks and services	In development
ITU-T SG5 Q18	L. methodology	ICT projects - Methodology for environmental impact assessment of ICT projects	In development
ITU-T SG5 Q18	L. methodology	ICT in organisations - Methodology for environmental impact assessment of ICT within organisations	In development
ITU-T SG5 Q18	L. methodology	ICT sector in countries - Methodology for environmental impact assessment of ICT within countries	In development
ITU-T SG5 Q18	L. methodology	ICT in cities - Methodology to evaluate the GHG Impact of ICT in Cities	In development
CCSA		Calculation Method for Recycle/Reuse/Recover Rate of Telecom terminal products	In development

5 Overlaps and gaps in ICT standardisation work related to efficient energy use

In order to provide a comprehensive and interlocking range of standards that can effect energy efficiency there is a need to define Key Performance Indicators, measurement (testing) methods by which to determine performance against the relevant KPI and operational procedures that support the attainment of the desired performance against any limits defined for the relevant KPI (either internally within the Operation standards or externally by Code of Practice, regulation or legislation).

Table 1 summarises the current ESO standardisation work described in clause 4 by recording the most hierarchically significant standardisation activity in a given area.

			Operation	Testing	KPI
4.1.1	Core network	Transmission equipment	◒	◔	◔
4.1.2	Core network	Switching equipment (Ethernet switches and routers)	◒	◔	◔
4.1.3	Core network	Transmission infrastructure		●	◔
4.2.1.1	Network operator sites	Data centres	●	●	◕
4.2.1.2	Network operator sites	Central offices	●	●	
4.2.2.1	Network operator sites	Servers and storage	●	●	●
4.3.1.1	Fixed access delivery	Network side – ADSL, ADSL2/2+, VDSL and VDSL3	◔	◒	◒
4.3.1.2	Fixed access delivery	Network side - Cable networks	◔		
4.3.1.3	Fixed access delivery	Network side - Passive optical networks	◔	◒	◒
4.3.1.4	Fixed access delivery	Network side - Point-to-point optical networks	◔	◒	◒
4.3.2	Fixed access delivery	Transmission infrastructure		●	◔
4.4.1.1	Mobile access delivery	Network side - Network access equipment	◒	◕	◕
4.4.1.2	Mobile access delivery	Network side - Satellite			
4.5.1.1	Customer premises	Building and home networking - General	◕	◔	◒
4.5.1.2	Customer premises	Building and home networking - Optical CPE	◔	◒	◒
4.5.1.3	Customer premises	Building and home networking - External power supplies	●	○	
4.6.1	Overall network design				
4.7.1	Life cycle assessment			◔	

Key	
Published standards	Documents in development
● EN	○ EN
◕ ETSI ES	◔ ETSI ES
◓ ETSI TS or CEN/CLC TS	◒ ETSI TS or CEN/CLC TS
◔ ETSI TR or CEN/CLC TR	◔ ETSI TR or CEN/CLC TR

Table 1 – Standards activity overview

The resulting picture is mixed with some areas being served by published European standards (ENs) while others have lower forms of standards either published or in development. There are certain areas in which no ESO standardisation activity exists.

Fortunately there seems little evidence of overlaps resulting in duplication or contradicting standardisation work.

6 Standardisation Work Programme

6.1 Required deliverables

6.1.1 Standardisation work in technology areas of clauses 4.1 to 4.5

Each of the areas identified in clauses 4.1 to 4.5 addresses the elements of energy consumption described in clause 3.2 for the different fixed and mobile communications networks. The work of standardisation as a means of attaining more energy efficient implementation of such networks has to address the use of those sub-systems and components within legacy networks and also in future implementations of such networks.

To support effective implementation of energy efficiency policy, the ideal coverage within Table 1 requires a published European Standard (EN) in each of the columns "Operation", "Test" and "KPI" for each of the rows. Clearly, even at a summary level, there is a considerable amount of activity required to be undertaken. The gaps identified in the analysis of Table 1 indicate the minimum work to be completed. Work identified as being "under development" has to be completed and ideally the standards published in each area should be a European Standard (EN). However, the pictorial approach adopted by Table 1 does not necessarily provide the full analysis of what is required. The key only indicates the status of the most hierarchically significant standardisation activity in a given area. It may be that additional standardisation required even if one, or a number, of European standards already exist in that area.

6.1.2 Standardisation work in technology area of clause 4.6

As pointed out in clause 1.1, "the application of standardisation as a route to energy efficiency cannot be handled as a series of isolated projects" and "some standards would address the definition of architectures maximizing efficiency".

The completion of the standardisation work identified in clause 6.1.1does not address "architectures maximizing efficiency" but aims to assure that network architectures using those standards are as energy efficient as they can be.

Clause 4.6 clearly shows that no activity has been identified in relation to "overall network design". This is considered to be a critical area for the long-term implementation of energy efficiency within the scope of the Mandate M/462.

European standards (ENs) are necessary to define the most energy efficient implementation of fixed and mobile communication networks, together with the methods by which efficiency is measured and appropriate KPI targets that should be achieved.

6.2 Proposed/agreed responsibilities

6.2.1 The role of ETSI

6.2.1.1 General

The detailed analysis of clause 4 indicates that the primary responsibility for development of standards under Mandate M/462 lies with ETSI Technical Committees ATTM and EE.

In the current worldwide context, it is vital that the main telecommunication actors implement effective general engineering of fixed and mobile broadband networks and the associated operator sites in order to respond to critical

issues of energy consumption while proposing essential solutions to true broadband deployment. To guide this process, it is essential that metrics are defined, termed Global Key Performance Indicators (Global KPIs) that enable energy efficiency to be monitored.

6.2.1.2 ETSI Technical Committee ATTM

In order to address the objective described in 6.2.1.1, ETSI Technical Committee ATTM will, with the support of a Specialist Task Force (STF):

- improve and supplement the existing TS 105 174 series by describing the most energy efficient infrastructure architectures for the delivery of broadband solutions and defining general engineering to support those solutions in relation to operator sites, equipment, systems and networks;
- produce a TS series (e.g. TS 105 200):
  - TS 105 200-1: containing generic requirements for Global KPIs of operational infrastructures;
  - a sub-series TS 105 200-2 that defines the Global KPIs, and drives energy consumption targets, for specific operational networks and sites and which describes how the Global KPIs are to be applied (which may be used to support future regulatory objectives);
- produce a TR 105 200-1-1 which acts as a guidance document that explains the purpose of the TS 105 200 series to non-experts;
- produce a TR 105 200-3 that will act as a placeholder for the future development of a framework of documents defining actions for monitoring sustainability of broadband solutions including management of carbon footprint (greenhouse gas emission equivalence) in coordination with, in particular, the work of ITU-T SG5.

These documents will accelerate:

- standardisation of the broadband world;
- availability of energy efficient infrastructure architectures and network implementations;
- the definition and attainment of sustainability objectives for operational broadband networks.

6.2.1.3 ETSI Technical Committee EE

ETSI's Technical Committee “Environmental Engineering” (TC EE) is responsible for defining the environmental and infrastructural aspects for telecommunication equipment in various types of installations.

The engineering aspects managed by TC EE include:

- environmental conditions (climatic, thermal, acoustic, etc);
- equipment (physical requirements of racks, sub-racks and cabinets including thermal matters);
- power supply and grounding requirements;
- eco-environmental matters (energy efficiency, environmental impact analysis, alternative energy sources).

The current main activities in this technical body which address eco-environmental matters are:

- reduction of power consumption of telecommunication equipment and related infrastructure;
- determination of the environmental impact of telecommunication equipment.

A set of standards to determine the energy efficiency of fixed and wireless access telecommunications equipment is already published and being maintained. Other related standards are in preparation, covering transport, switching, core network and customer premises equipment. These standards include the test methods and the performance indicator for the energy efficiency improvement and will be promoted to EN level.

TC EE is also producing a Technical Specification (TS 103 199) for the Life Cycle Assessment of telecommunications equipment, networks and services, in order to determine their environmental impact and evaluate carbon emissions. The specification is based on ISO 14040 and ISO 14044 with customization appropriate to the telecommunications field. This deliverable is applicable under the frame of Mandate M/462 but also for the Mandate M/478 on "EU technical standards in the field of greenhouse gas emissions". It is intended that TS 103 199 will be promoted to EN level after a "test" period on the applicability of this publication.

Other deliverables related to energy efficiency improvements include the standards of the EN 300 132-3 series, currently under revision, that define a new power architecture with improved energy efficiency. These publications are in the frae of power networking in telecommunication infrastructures.

As the work program of TC EE touches different aspects of telecommunications equipment and infrastructure, cooperation with other Technical Bodies and with external organizations is fundamental. Co-ordination within ETSI is managed through the Operational Co-ordination Group (OCG) and several external liaisons have been established with standardization bodies including IEC, CENELEC, ANSI-ATIS and the ITU-T, and other organizations such as fora and research projects.

6.2.2 The role of CENELEC

The detailed analysis of clause 4 indicates that CENELEC is able to support the ETSI standardisation activity detailed in 6.2.1 by producing standards in the field of energy efficiency for components, infrastructure designs and infrastructure installation which are applicable to the delivery of ICT within customer premises. It is probable that such standards will also be wholly, or in part, applicable to the needs of operator's sites.

An example of this is the development of the EN 50600 series which, in part, addresses the installation of appropriate infrastructure to enable the energy efficiency of data centres to be measured and monitored. This standardisation activity supports the objectives of ETSI Technical Committee ATTM as outlined in 6.2.1.2.

In addition, CENELEC produces standards for customer premises equipment, albeit of a wider scope than that defined in the terms of this report, which may align the objectives of ETSI Technical Committee EE as outlined in 6.2.1.3.

6.2.3 Coordination between CEN, CENELEC and ETSI

The Joint Coordination Group established between CEN, CENELEC and ETSI in response to Mandate M/462 will also coordinate the standardization work for this mandate and will monitor the progress of the standardization program through the ESO's.

Two additional levels of coordination also exist in specific areas which the Joint Coordination Group will take into account:

- the recently established Coordination Group established between CEN, CENELEC and ETSI to address "Green Data Centres" (CG GDC), which as a first step is focussing on energy efficiency;
- the long-standing CENELEC-ETSI Installations and Cabling Coordination Group (I&C CG) which acts to prevent duplication of activity in the two ESOs, specifically in relation to ETSI TC ATTM, and which allows a coordinated approach to common standardisations needs.

6.2.4 The role of CEN

The detailed analysis of clause 4, indicates that CEN has little direct involvement at the operational energy efficiency level although they are involved both with the International Standards Organisation (ISO) and independently in the development of standards addressing life cycle assessment. This lies outside the direct focus of operational energy efficiency defined by the Mandate M.462.

7 Conclusions

This review of specifications and standards within the scope of Mandate M/462, both available and under development, in the field of ICT energy efficiency highlights the availability of several deliverables but also identifies some gaps that have yet to be filled.

The analysis performed for this report considered the ICT domain from the operators' networks sites to the network transmission equipment within the customer's premises e.g. home gateway, or router, or transmission unit for specific service (e.g. lift safety line). The areas addressed were the core network, network operator sites (data centres and central offices), access networks (fixed and mobile including satellite) and the non-"IT end-use" equipment within customer premises.

The following aspects have been considered for the analysis in respect to Mandate M/462:

- **Equipment and system standards:**

  Equipment and system standards have to take into account the most efficient solutions in order to minimize energy consumption and to optimize life cycle assessment

- **Simple methodologies to determine energy efficiency:**

  Standardized, simple, test procedures to determine the power consumption of each equipment, site or network

- **Standardized global indicators (ratios):**

  To monitor improvement of overall efficiency of operational networks - these ratios provide recognized energy efficiency trends for sites and networks in order to define the efficiency level of each ICT network segment

- **Methodologies based upon the life cycle assessment (LCA) for ICT Goods, Networks and Services:**

  To provide tools in order to define carbon emission value for each ICT actor e.g. network operator

The objective of ESO's is to produce the required standards for the Mandate M/462 within 3 years from the approval of the standardization program proposed in clause 6 of this report. The target is to publish the identified European Norms for the ICT segments mapped in clause 5 of this report.

The standardization work program for the Mandate M/462 addresses different aspects of telecommunications equipment and infrastructure and cooperation with other in European Standardization Organizations, non-ESO's and other external organizations is fundamental and will be ensured by the Technical Bodies involved.

Annex A: Other documents and initiatives

A.1 Documents

The information in the following table is not automatically maintained and if required for use in the final document would have to be re-checked.

BODY	REFERENCE	TITLE	STATUS	RELEVANCE IN CLAUSE 4
3GPP	UID_430044	Study on Telecommunication Management; Energy Savings Management (ESM)	Published	4.4.1.1.2
3GPP	UID_470037	OAM aspects of Energy Saving in Radio Networks	In development	4.4.1.1.2
3GPP	UID_460016	Study on Solutions for energy saving within UTRA Node B	In development	4.4.1.1.2
3GPP	UID_470015	Study on Network Energy Saving for E-UTRAN	In development	4.4.1.1.2
3GPP	UID_480015	Study on impacts on UE-Core Network signalling from Energy Saving	In development	4.4.1.1.2
BBF	TR-100	ADSL2/ADSL2plus Performance Test Plan This document describes performance and interoperability test cases required for ADSL2/ADSL2plus systems consisting of DSLAMs and CPE modems.		4.3.1.1.2
BBF	TR-202	ADSL2/ADSL2plus Low-Power Mode Guidelines In order to make significant savings in the electrical energy demand required to operate the network by enabling the ADSL2/ADSL2plus L2 mode, this report provides a set of guidelines for the deployment of the power saving feature for the central office ATU with the L2 low power state defined in ITU-T Recommendation G.992.3 and G.992.5.		4.3.1.1.2
BBF	TR-114	VDSL2 Performance Test Plan In order to verify performance such that network operators may deploy consistent and successful VDSL2 services in their networks, this report provides a set of region specific performance requirements and test methods for VDSL2 modems implemented in accordance with ITU-T G.993.2 (Very high speed Digital Subscriber Line transceivers 2).		4.3.1.2.2
BBF	TR-115	VDSL2 Functionality Test Plan In order to verify transceiver functionalities and management parameters such that network operators may deploy interoperable and successful VDSL2 services in their networks, this report provides a set of test methods to verify a significant subset of the transceiver functional requirements of VDSL2 modems implemented in accordance with ITU-T G.993.2 (Very high speed Digital Subscriber Line transceivers 2) as well as physical layer OAM configuration and performance monitoring parameters defined in ITU-T G.997.1.		4.3.1.2.2
BBF	TR-069 Amendment 3	CPE WAN Management Protocol A protocol for communication between a CPE and Auto-Configuration Server (ACS) that encompasses secure auto-configuration as well as other CPE management functions within a common framework. There are other related specifications and working documents that are used to manage specific devices – for example, Set Top Boxes (TR-135).		4.5.1.1.2
BBF	PD-174	Remote Management of Non TR-069 Devices	In development	4.5.1.1.2

BODY	REFERENCE	TITLE	STATUS	RELEVANCE IN CLAUSE 4
		This document defines full remote management, including extensions to the data models and to the TR-069 protocol, of non TR-069 devices- IP based and for those that are not.		
BBF	TR-124i2	Functional Requirements for Broadband Residential Gateway Devices This document specifies a superset of requirements for broadband Residential Gateway devices that are capable of supporting a full suite of voice, data, broadcast video, video on demand and two-way video applications in broadband networks.		4.5.1.2.2
Ecma International	TC32-TG21	Proxying support for sleep modes A proxy is an entity that maintains network presence for a sleeping higher-power ICT device	Published	4.5.1.1.2.1
HGI	RD015-R3	Energy efficiency and Ecodesign requirements for a common power supply (CPS) for home gateway, home networking equipment and end device This document addresses the specification of a common solution for power supplies in the home network environment, to be used with different devices and using standardised connectors	Published	4.5.1.3.2.1
SPEC	SPECpower_ ssj2008	SPEC benchmark: power and performance characteristics of volume server class computers The initial benchmark addresses the performance of server-side Java, and additional workloads are planned.	Published	4.2.2.1.2.2

A.2 Initiatives

BODY	TITLE	STATUS	RELEVANCE IN CLAUSE 4
EPA	ENERGY STAR® rating for data centre infrastructure This document aims to assist data centre operators in capturing the financial and environmental benefits of improved energy efficiency in their facilities	In development	4.2.1.1.2.2
EPA	ENERGY STAR® rating for data centre storage The specification will contain definitions, eligible product categories, energy efficiency criteria, test procedures together with information and management requirements.	In development	4.2.1.1.2.2 4.2.1.1.2.3
EPA	ENERGY STAR® specification for Small Network Equipment (SNE) The specification will contain definitions of products covered, modes of operation, eligible product types, energy efficiency factors, features and test procedures.	First stakeholders meeting on November, 19 2009.	4.5.1.1.2.2 4.5.1.1.2.3
EPA	ENERGY STAR® eligibility criteria for power supply Linked to the usage of the specific ENERGY STAR® label Valid for the US market		4.5.1.3.2.2 4.5.1.3.2.3
EU (voluntary)	2010 Best Practices for the EU Code of Conduct on Data Centres The CoC contains no specific targets for servers. The CoC indicates a demand that IT equipment, by 2012, to comply to extended temperature ranges (similar to those used in Central Offices). This would enable great savings both on OPEX and CAPEX on the cooling sector.	Published V2	4.2.2.1.2.3
EU	Code of Conduct on Energy Consumption of Broadband Communication Equipment	Published V4	4.3.1.1.2.2 4.3.1.1.2.3

BODY	TITLE	STATUS	RELEVANCE IN CLAUSE 4
	This is already endorsed by a wide range of operators and equipment suppliers. A current list is to be found at re.jrc.ec.europa.eu/energyefficiency/html/Broadband%20communication-ParticipantsCoC.htm		4.3.1.3.2.3 4.3.1.4.2.3 4.5.1.1.2.3 4.5.1.2.2.3
EU	Code of Conduct on Efficiency of External Power Supplies Good level of alignment with US ENERGY STAR® The PS CoC is sometimes more challenging than the corresponding EU Directive (278/2009) and the US ENERGY STAR®	Published V4	4.5.1.3.2.2 4.5.1.3.2.3

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Annex B: Bibliography

For the purposes of this document the following references apply:

GeSI EEIOCG Standardization Landscape document
(www.gesi.org/LinkClick.aspx?fileticket=Lmkk%2fMfiZ9Q%3d&tabid=72)

552 # History

Document history		
V0.0.1	January 2011	First draft
V0.0.2	February 2011	Incorporating resolution of comments and other changes from confcall 28/01/2011
V0.0.3	March 2011	Incorporating resolution of comments and other changes from 2nd CG meeting 15/03/2011
V1.0.0	April 2011	Incorporating comments received from Rapporteurs Group and others before CG circulation
V2.0.0	May 2011	Incorporating resolution of comments and other changes from 3rd CG meeting 10/05/2011
V2.0.1	June 2011	Incorporating resolution of comments and other changes from Rapporteurs Group (up to 31st May 2011)
V2.0.2	June 2011	Incorporating resolution of comments and other changes from 4th CG meeting
V2.0.3	September 2011	Incorporating Chairmen's final edits
V3.0.0	September 2011	Incorporating reference to GeSI and ITU-T

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