# ETSI TR 103 229 V1.1.1 (2014-07)



Environmental Engineering (EE); Safety Extra Low Voltage (SELV) DC power supply network for ICT devices with energy storage and grid or renewable energy sources options

https://stantards.itelian

Reference DTR/EE-02042

Keywords energy management, power supply, renewable

#### ETSI



The present document can be downloaded from:

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services: <u>http://portal.etsi.org/chaircor/ETSI\_support.asp</u>

#### **Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI. The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2014. All rights reserved.

DECT<sup>™</sup>, PLUGTESTS<sup>™</sup>, UMTS<sup>™</sup> and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members. **3GPP**<sup>™</sup> and LTE<sup>™</sup> are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

**GSM**® and the GSM logo are Trade Marks registered and owned by the GSM Association.

# Contents

Foreword	Intell	ectual Property Rights	5		
Introduction       5         1       Scope       6         2       References       6         2.1       Normative references       6         2.2       Informative references       7         3       Abbreviations and symbols       9         3.1       Symbols       9         3.2       Abbreviations and symbols       9         3.4       Derver adjustion of fliciency and voltage choice considerations       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power suppty network solution       13         4.3       Modularity and Power expandability       14         4.3.1       Modularity and Power expandability       14         4.3.2       Transient power regulation       15         4.4       Reliability and maintenance       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement       17         4.6.1       EMC requirements       17         4.6.2       Voltage regulation, ripple, noise, insult current.       17         4.6.1       EMC requirements       17         4.7.1       Ecodesign.<	Forev	vord	5		
1       Scope       6         2       References       6         2.1       Normative references       6         2.2       Informative references       7         3       Abbreviations and symbols       9         3.1       Symbols       9         3.2       Abbreviations and symbols       9         3.3       Abbreviations       9         4       General architecture of a CPE SELV DC network       10         4.1       Power expendability, modularity and power regulation       14         4.3.1       Modularity and Power expandability       13         4.3.2       Transient power regulation, ripple, noise, inrush current.       15         4.3.3       Voltage regulation, ripple, noise, inrush current.       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement.       16         4.4.3       Transient ower regulation, ripple, noise, inrush current.       17         4.6.1       EMC requirements       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.1       EMC requirements       17         4.7       Eco-Environmental specification       18 <td< td=""><td>Moda</td><td>al verbs terminology</td><td>5</td></td<>	Moda	al verbs terminology	5		
2       References	Intro	luction	5		
2.1       Normative references       6         2.2       Informative references       7         3       Abbreviations and symbols       9         3.1       Symbols       9         3.2       Abbreviations       9         3.4       Symbols       9         3.2       Abbreviations       9         4.3       General architecture of a CPE SELV DC network       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power supply network solution       13         4.3.1       Modularity and Power regulation       14         4.3.2       Transient power regulation       15         4.3.3       Voltage regulation, ripple, noise, inrush current.       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement.       16         4.4.1       MTBF       16         4.5       SELV plugs discussion       17         4.6.1       EMC requirements.       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.1       EMC emission and immunity       17         4.6.2       <	1	Scope	6		
2.2       Informative references       7         3       Abbreviations and symbols       9         3.1       Symbols       9         3.2       Abbreviations       9         4       General architecture of a CPE SELV DC network       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power supply network solution       13         4.3.1       Modularity and Power expandability       14         4.3.2       Transient power regulation       15         4.3.3       Voltage regulation, ripple, noise, inrush current.       15         4.4       Reliability and maintenance       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement       16         4.4.2       Failure detection and replacement       17         4.6.1       EMC requirements       16         4.7.1       Eco-Environmental specification       18         4.7.2       Lifetime       19         4.7.3       Copper used in distribution and benergy efficiency       19         4.8       Safety aspects       20         4.9       Control/monitoring aspects       21	2	References	6		
3       Abbreviations and symbols       9         3.1       Symbols       9         3.2       Abbreviations       9         3.4       Abbreviations       9         3.2       Abbreviations       9         3.4       Abbreviations       9         3.4       General architecture of a CPE SELV DC network       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power supply network solution       13         4.3       Power expendability, modularity and power regulation       14         4.3.1       Modularity and Power expandability       14         4.3.2       Transient power regulation, ripple, noise, inrust currept.       15         4.3.3       Voltage regulation, ripple, noise, inrust currept.       16         4.4.1       MTBF       16         4.5       SELV plug discussion       16         4.6.1       EMC requirements       17         4.6.2       Voltage regulation, ripple, noise, inrust current.       17         4.6.1       EMC requirements       17         4.7.1       Ecodesign.       17         4.6.2       Voltage regulation, ripple, noise, inrust cur	2.1	Normative references	6		
3.1       Symbols       9         3.2       Abbreviations       9         3.2       Abbreviations       9         3.2       Abbreviations       9         3.2       Abbreviations       9         4       General architecture of a CPE SELV DC network       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power supply network solution       13         4.3       Power expendability, modularity and power regulation       14         4.3.1       Modularity and Power expandability       14         4.3.2       Transient power regulation       15         4.3.3       Voltage regulation, ripple, noise, inrush current.       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement.       16         4.5       SELV plug discussion       16         4.6.1       EMC requirements       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.1	2.2	Informative references	7		
3.1       Symbols       9         3.2       Abbreviations       9         3.2       Abbreviations       9         3.2       Abbreviations       9         3.2       Abbreviations       9         4       General architecture of a CPE SELV DC network       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power supply network solution       13         4.3       Power expendability, modularity and power regulation       14         4.3.1       Modularity and Power expandability       14         4.3.2       Transient power regulation       15         4.3.3       Voltage regulation, ripple, noise, inrush current.       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement.       16         4.5       SELV plug discussion       16         4.6.1       EMC requirements       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.6.1	3	Abbreviations and symbols	9		
4       General architecture of a CPE SELV DC network       10         4.1       Power distribution efficiency and voltage choice considerations       12         4.2       Efficiency targets for element of the DC power supply network solution       13         4.3       Power expendability, modularity and power regulation       14         4.3.1       Modularity and Power expandability       14         4.3.2       Transient power regulation       15         4.3.3       Voltage regulation, ripple, noise, inrush current.       15         4.4       Reliability and maintenance       16         4.4.1       MTBF       16         4.4.2       Failure detection and replacement       16         4.5       SELV plugs discussion       16         4.6       EMC requirements       17         4.6.1       EMC empironmental specification       17         4.6.2       Voltage regulation, ripple, noise, inrush current.       17         4.7.1       Eco-Environmental specification       18         4.7.2       Lifetime       19         4.7.3       Copper used in distribution and energy efficiency       19         4.8       Safety aspects       20         4.9       Control/monitoring aspects       20 <td>3.1</td> <td></td> <td></td>	3.1				
<ul> <li>4.1 Power distribution efficiency and voltage choice considerations</li></ul>	3.2	Abbreviations	9		
<ul> <li>4.1 Power distribution efficiency and voltage choice considerations</li></ul>	4	General architecture of a CPE SELV DC network	10		
<ul> <li>4.2 Efficiency targets for element of the DC power supply network solution.</li> <li>4.3 Power expendability, modularity and power regulation.</li> <li>14</li> <li>4.3.1 Modularity and Power expandability.</li> <li>4.3.2 Transient power regulation.</li> <li>4.3.3 Voltage regulation., ripple, noise, inrush current.</li> <li>4.4 Reliability and maintenance.</li> <li>4.4.1 MTBF</li> <li>16</li> <li>4.4.2 Failure detection and replacement.</li> <li>16</li> <li>4.4.2 Failure detection and replacement.</li> <li>16</li> <li>4.4.1 MTBF</li> <li>16</li> <li>4.4.2 Failure detection and replacement.</li> <li>16</li> <li>4.6 EMC requirements.</li> <li>17</li> <li>4.6.1 EMC emission and inmunity.</li> <li>17</li> <li>4.6.2 Voltage regulation, ripple, noise, inrush current.</li> <li>17</li> <li>4.7 Eco-Environmental specification.</li> <li>18</li> <li>4.7.2 Lifetime</li> <li>19</li> <li>4.7.3 Copper used in distribution and energy efficiency.</li> <li>19</li> <li>4.8 Safety aspects.</li> <li>20</li> <li>20</li> <li>21</li> <li>Annex A: Loss and section design for SELV DC network distribution and example</li></ul>	4.1				
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.2	Efficiency targets for element of the DC power supply network solution.	13		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.3	Power expendability, modularity and power regulation			
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.3.1	Modularity and Power expandability	14		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.3.2	Transient power regulation	15		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.3.3	Voltage regulation, ripple, noise, inrush current	15		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.4	Reliability and maintenance	16		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.4.1	MTBF	16		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.4.2	Failure detection and replacement	16		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.5	SELV plugs discussion	16		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.6	EMC requirements	17		
10.12       For Equation in protocommental specification       18         17       Eco-Environmental specification       18         17.1       Ecodesign       18         17.2       Lifetime       19         17.3       Copper used in distribution and energy efficiency       19         18       Safety aspects       20         4.9       Control/monitoring aspects       20         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.6.1	EMC emission and immunity	17		
4.7.3       Copper used in distribution and energy efficiency       19         4.8       Safety aspects       20         4.9       Control/monitoring aspects       21         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.6.2				
4.7.3       Copper used in distribution and energy efficiency       19         4.8       Safety aspects       20         4.9       Control/monitoring aspects       21         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.7	Eco-Environmental specification	18		
4.7.3       Copper used in distribution and energy efficiency       19         4.8       Safety aspects       20         4.9       Control/monitoring aspects       21         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27		Ecodesign	18		
4.8       Safety aspects       20         4.9       Control/monitoring aspects       21         Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27		Lifetime	19		
<ul> <li>4.9 Control/monitoring aspects</li></ul>		Copper used in distribution and energy efficiency	19		
Annex A:       Loss and section design for SELV DC network distribution and example       22         Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD™ P1823™ project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27					
Annex B:       Inputs for defining SELV DC network architecture and energy gain assessment compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	4.9	Control/monitoring aspects	21		
compared to individual adapters       26         B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	Anne	ex A: Loss and section design for SELV DC network distribution and example	22		
B.1       GGPAH home DC distribution architecture solution       26         B.2       Emerge Alliance 24 V ceiling distribution specification       26         B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project       26         Annex C:       Setting solution for DC/DC converter       27         C.1       UI setting solution       27         C.2       Cable setting solution       27         C.2.1       Passive solution example       27	Anne				
B.2    Emerge Alliance 24 V ceiling distribution specification    26      B.3    IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project.    26      Annex C:    Setting solution for DC/DC converter    27      C.1    UI setting solution    27      C.2    Cable setting solution    27      C.2.1    Passive solution example.    27					
B.3       IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project					
Annex C:       Setting solution for DC/DC converter	B.2	Emerge Alliance 24 V ceiling distribution specification			
C.1 UI setting solution	B.3	IEEE UPAMD <sup>TM</sup> P1823 <sup>TM</sup> project	26		
C.2 Cable setting solution	Anne	ex C: Setting solution for DC/DC converter	27		
C.2.1 Passive solution example	C.1	UI setting solution	27		
C.2.1 Passive solution example	C.2	Cable setting solution	27		
1		6			
		1			

Annex D:	Assessment of the benefit of the SELV DC network	
Annex E:	Bibliography	
History		

4

Hensistander of the standard s

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for ETSI members and non-members, and can be found in ETSI SR 000 314: "Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

### Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Environmental Engineering (EE).

### Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "may not", "need", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"must" and "must not" are NOT allowed in ETSI deliverables except when used in direct citation.

### Introduction

19070 With the massive development and convergence of Telecom and IT, there are more and more customer Premises Equipment such as ICT devices terminals and home network. Each of them requires an electric adapter and an AC plug to be powered. That creates a forest of cables and energy losses, so the need of mutualising power at the level of a room with a SELV DC network has appeared with the benefit of reducing the amount of adapters and plugs, reducing by the way quantity of material used (plastic, copper, electronic) and thus reducing electronic wastes.

ailea

In addition this will allow simpler reuse of the output of this common power supply for new ICT devices by using the universal power adapters for fixed devices as standardized by ETSI and recommended by ITU-T. There would also be a significant saving on power consumption from a better efficiency on a wide range of power and reduced no load power losses.

For each of USB-A charger avoided by connecting a USB-A detachable charging cable to the DC network, it has been roughly assessed for 1 Billion units, a potential saving of 100 000 tons of power supply material, and 2 TWh consumption, 1 million tons of CO2 emission each year.

Other benefits are offered to users in the zone or room where the SELV DC networks operate such as autonomy by the battery and grid energy cost reduction by using renewable energy sources, PV being the easiest to install having a very long lifetime.

Moreover, it is an enabler and extender of telecom service use in emerging countries where there is no electricity grid and it brings at the same time some additional electricity for other use such as lighting with LEDs.

Finally, the SELV distribution is the natural extension in rooms of the Building 400 VDC distribution when it will be widely spread as it seems to be a useful complement to distribution AC to offer more resilience to disaster and improve efficiency and use of renewable energy at building level in smart cities and micro grids.

#### 1 Scope

The present document specifies a Safety Extra Low Voltage DC power supply unit for powering at home or in public area (stores, hotels, railway stations, etc.) any ICT devices equipped with DC input or any ICT adapter with DC input compliant with EN 300 132-3-1 [i.17].

It gives information on:

- architecture with multi-outputs or DC network and powering area (room, zone);
- input and output voltage interface;
- configuration of interface voltage;
- optimization of efficiency and cost by mutualising several devices on the same DC power system;
- compatibility with future building using the up to 400 VDC power interface defined in EN 300 132-3-1 [i.17];
- integrated power shutdown management, to save energy as much as possible;
- reliability;
- EMC and resistibility;
- power autonomy to enable standalone power of ICT in case of crisis (electric grid failure, climatic crisis, earthquake, etc.);
- possibility to use renewable energy especially in emerging countries with no grid or of poor quality grid: which input interface, and how to make the sizing?
- possibility to power devices other than ICT such as low power light which highly increases life quality and sustainable development;
- some information on product safety;
- ecodesign principles with assessment of gains in mass of material use, energy and CO2 emission.

The present document also gives an overview of other existing standards in the field.

The detailed description of power generators and power converters or controllers are out of the scope.

### 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <a href="http://docbox.etsi.org/Reference">http://docbox.etsi.org/Reference</a>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

#### 2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

#### 2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Recommendation ITU-T L.1000: "Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices".
- [i.2] Recommendation ITU-T L.1001: "External universal power adapter solutions for stationary information and communication technology devices".
- [i.3] Recommendation ITU-T L.1002 "External universal power adapter solutions for portable information and communication technology devices".
- [i.4] "Code of Conduct on Energy Efficiency of External Power Supplies": European Commission Directorate-General JRC Joint Research Centre Institute for Energy and Transport Renewable Energy Unit.
- [i.5] ETSI EN 302 099: "Environmental Engineering (EE); Powering of equipment in access network".
- [i.6] Recommendation ITU-T K.74: "EMC, resistibility and safety requirements for home network devices".
- [i.7] IEC 61000-3-2: "Electromagnetic compatibility (EMC) -Part 3-2: Limits -Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase)".
- [i.8] IEC 60038: "IEC standard voltages
- [i.9] IEC 60950-1: "Information technology equipment Safety Part 1: General requirements".
- [i.10] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)".
- [i.11] IEC 60896 series."Stationary lead-acid batteries".
- [i.12] ETSI ES 202 336 (all parts): "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (Power, Cooling and environment systems used in telecommunication networks)".
- [i.13] IEC 60364-4-41: "Low-voltage electrical installations Part 4-41: Protection for safety -Protection against electric shock"
- [i.14] IEC 62430: "Environmentally conscious design for electrical and electronic products".
- [i.15] ETSI TS 103 199: "Environmental Engineering [EE]; Life Cycle Assessment (LCA) of ICT equipment, networks and services; General methodology and common requirements".
- [i.16] Recommendation ITU-T L.1410: "Environmental impact Assessment method for goods network and service".
- [i.17] ETSI EN 300 132-3-1 (V2.1.1): "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400 V; Sub-part 1: Direct current source up to 400 V".
- [i.18] IEEE UPAMD<sup>TM</sup> P1823<sup>TM</sup>: "Universal Power Adapter for Mobile Device".
- [i.19] IEC TC 100: "Project P1683 of Technical Specification of "Universal charger for PC".
- [i.20] Recommendation ITU-T K.66: "Protection of customer premises from overvoltages and overcurrents".
- [i.21] ISO 11898-3: "Road vehicles -- Controller area network (CAN) -- Part 3: Low-speed, faulttolerant, medium-dependent interface".

Recommendation ITU-T K.21: "Resistibility of telecommunication equipment installed in

[i.22]

- customer premises to overvoltages and overcurrents". [i.23] EU directive on charger efficiency and no load power Energy Star V2. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their [i.24] Disposal. IEC 60320-1: "Appliance couplers for household and similar general purposes - Part 1: General [i.25] requirements". [i.26] ISO 14040: "Environmental management -- Life cycle assessment -- Principles and framework". [i.27] ISO 14044: "Environmental management -- Life cycle assessment -- Requirements and guidelines". "The first thousand optimized solar BTS stations of Orange group, A very positive experience full [i.28] of learning", Didier Marquet Orange et alii., IEEE Intelec 2011 Amsterdam. [i.29] "Spread of DC power in telecom/data centres and homes/offices with renewable energy and energy autonomy" Didier Marquet (Orange), Toshimitsu Tanaka (NTT-f), Kensuke Murai, Tanaka Toru, Tadatoshi Babasaki (NTT), IEEE/Intelec 2013 Hamburg. [i.30] Darnel study, "External AC-DC Power Supplies: Economic Factors, Application Drivers, Architecture/Packaging Trends, Technology and Regulatory Developments", Tenth Edition, Feb 2011. GSMA 2010: "Green Power for Mobile", Bi-annual Report November 2010. [i.31] ITU-D: "ICT 2011 development outlook" [i.32] "New power supply optimiSed for new telecom networks and services Didier Marquet et alii, [i.33] France Telecom CNET, Jean Paul Gabillet et alii ALCATEL-CIT", IEEE Intelec 1999 Copenhagen. Recommendation ITU-T K.85: "Requirements for the mitigation of lightning effects on home [i.34] networks installed in customer premises". IEC 62619: "Secondary cells and batteries containing alkaline or other non-acid electrolytes -[i.35] Safety requirements for large format secondary lithium cells and batteries for use in industrial applications". Emerge Alliance® [i.36] NOTE: Available at: http://www.emergealliance.org/. [i.37] Green Grid Platform At Home voluntary organization in Japan. NOTE: Available at http://ggpah.org/. [i.38] GeSI-ITU-T Study 2012, An Energy-aware Survey on ICT Device Power Supplies. NOTE: Available at http://www.itu.int/ITU-T/climatechange/report-ict-device.html.
- [i.39] CENELEC EN 55022: "Information technology equipment Radio disturbance characteristics -Limits and methods of measurement".
- [i.40] CENELEC EN 55024: "Information technology equipment Immunity characteristics Limits and methods of measurement".

# 3 Abbreviations and symbols

# 3.1 Symbols

For the purposes of the present document, the following symbols apply:

Ι	current
Pu	Useful Power of the load
R	resistance
U	voltage

#### 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CANController Area NetworkCMOSComplementary Metal Oxyde SemiconductorCPECustomer Premises EquipmentCPSCommon Power SupplyDCDirect CurrentDINDeutsches Institut für NormungGGPAHGreen Grid Platform At HomeGHGGreen House GasHFHigh FrequencyICTInformation and communications technologyLCALife Cycle AssessmentMPPTMaximum Power Point TrackerMTBFMean Time Between FailureNTTNippon Telegraph and TelecomPCPersonal computerPOEPower over EthernetPSUPower Supply UnitPVPhotoVoltaïcPWMPulse-width modulationRHRelative HumiditySCCPShort Chain Chlorinated ParaffinsSELVSafety Extra Low VoltageUCPSUniversal Power AdapterUPAMD™Universal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct CurrentXMLeXtended Mark-up Language	AC ASCII CAN CMOS CPE	Alternating Current American Standard Code for Information Interchange Controller Area Network Complementary Metal Oxyde Semiconductor Customer Premises Equipment
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	CPS	Common Power Supply
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	DC	Direct Current
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	DIN	Deutsches Institut für Normung
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	GGPAH	Green Grid Platform At Home
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	GHG	Green House Gas
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	HF	High Frequency
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	ICT	Information and communications technology
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	LCA	Life Cycle Assessment
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	MPPT	Maximum Power Point Tracker
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	MTBF	Mean Time Between Failure
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	NTT	Nippon Telegraph and Telecom
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	PC	Personal computer
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	PoE	Power over Ethernet
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	PSU	Power Supply Unit
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	PV	PhotoVoltaïc
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	PWM	Pulse-width modulation
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	RH	Relative Humidity
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	SCCP	Short Chain Chlorinated Paraffins
UPAUniversal Power Adapter.UPAMDTMUniversal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	SELV	Safety Extra Low Voltage
UPAMD <sup>TM</sup> Universal Power Adapter for Mobile DevicesVACVolt in Alternating CurrentVDCVolt in Direct Current	UCPS	Universal Common Power Supply
VACVolt in Alternating CurrentVDCVolt in Direct Current	UPA	
VDC Volt in Direct Current	<b>UPAMD</b> <sup>TM</sup>	Universal Power Adapter for Mobile Devices
	VAC	Volt in Alternating Current
XML eXtended Mark-up Language	VDC	Volt in Direct Current
	XML	eXtended Mark-up Language

# 4 General architecture of a CPE SELV DC network

Many studies are showing the extension of the use of ICT terminals in Customer Premises all over the world. For example the ITU-D outlook [i.32] is showing that Telecom network and terminals are developing in Emerging countries faster than the electric grid.

For the mobile network a GSMA study [i.31] and for example an IEEE/intelec 2011 paper [i.28] have shown that the massive deployment would be more based on renewable energy and single legacy Diesel generator could be replaced by hybrid power system. As a consequence of this fast Telecom network development, there is an increased need of electricity in customer premises, that can bring at the same time more comfort and social benefit, such as low power consumption lighting for emerging countries. The universal adapter solution already promoted for powering ICT devices Recommendation ITU-T L.1000 [i.1], Recommendation ITU-T L.1001 [i.2] or Recommendation ITU-T L.1002 [i.3] ensures the compatibility with renewable energy systems such as those based on PV modules, either small system in SELV voltage and these Recommendations introduce compliance of the chargers with EN 300 132-3-1 [i.17] at building level. IEEE/intelec paper 2013 [i.29] is showing a possible start of wide spread of these solutions.

As in many homes there is not only one terminal but several, and because there is a need of shared charging points for users (public or private), it appears that a DC network solution could be an optimized solution. It was already stated as already presumed in IEEE/Intelec 1999 paper [i.33].

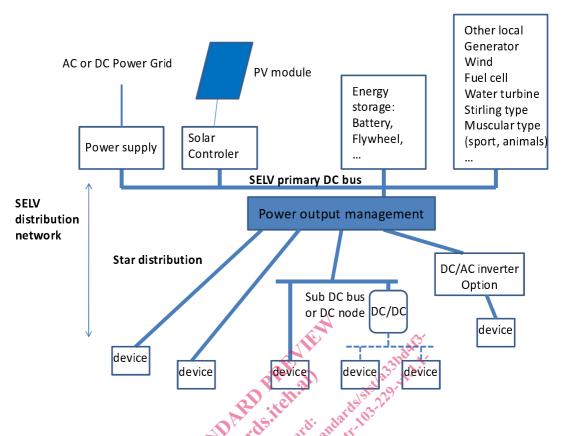
Other solutions based on AC inverter using for example DC from solar PV module or battery allow the use of AC adapter but the efficiency and reliability is poor. Even if the up to 400 VDC interface is possible for complete swap of the distribution inside buildings but it seems there is also a space for a more optimized and progressive zone or room lower voltage DC network. The best solution for safety is a SELV voltage lower than 60 VDC in compliance to IEC 60364-4-41 [i.13]. The DC voltage level, would depend on the environment where it is used (e.g. dry or wet). For maximal safety, it seems better to keep this limit for wet area not at the maximum value of 120 VDC. 30 VDC limit is even better for human safety if there is a serious risk of water ingress.

Considering the increasing need of security and availability of ICT, this solution can also in developed countries. Japan has an initiative on that in greengrid@home [i.37]. There will be compatibility with up to 400 VDC network.

In addition, a SELV DC network mainly for telecom, health and safety ICT can bring at the same time a back-up possibility for more autonomy and less failure of sensible ICT devices while reducing the use of fossil energy resources and the CO2 emission and other environmental or human tisks.

Figure 1 is presenting the general architecture of a home SELV DC grid able to power home CPE equipment. It can also be applied in other customer premises: small office, commercial or business building. Not all possible voltage converters are represented, refer to DC distribution network description list in this clause.

112.0



- NOTE 1: This architecture can include also an optional reverse power feeding module connected to the DC distribution network compliant with EN 302 099 [i.5].
- NOTE 2: DC/DC Converter on sub DC bus or DC nodes are called POL.

#### Figure 1: Architecture of a SELV DC power system and distribution grid solution in CPE

This architecture takes into account other studies and ongoing standardization:

- Darnel study on charger and power supply, [i.30]
- Emerge Alliance<sup>®</sup> 24 V distribution for lighting and ICT device in office or commercial building rooms [i-36]
- ITU-T SG5 L.1000 [i.1], L1001 [i.2], L.1002 [i.3]
- IEEE UPAMD<sup>TM</sup> P1823<sup>TM</sup> [i.18]
- IEC TC 100 P1683 [i.19] on universal interface for computers [i.19]
- SELV home power distribution in Japan Green Grid Platform At Home [i.37]

Refer to annex B for more details.

#### The power generating system includes:

- A primary SELV DC bus where are connected: energy storage, primary power supply using DC or AC grid, generators and output power distribution management system.
- A SELV DC distribution network feeding power to loads directly or through DC/DC and sub distribution.
- NOTE 1: The input liaison of the controller to the external sources (grid, PV, wind generator, etc.) is out of the scope of this CPE primary distribution.
- NOTE 2: The DC grid is compliant with EN 300 132-3-1 [i.17], and should be compliant with future standards for DC safety and DC plugs under definition by IEC.