

**COMMUNICATIONS  
ALLIANCE LTD**



**AUSTRALIAN STANDARD**

**AS/ACIF S043.2:2008**

**Requirements for Customer Equipment for  
connection to a metallic local loop interface of a  
Telecommunications Network—  
Part 2: Broadband**

**Adopted for  
regulatory purposes**



**Australian Standard — Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network— Part 2: Broadband**

This Standard was issued in draft form for public comment as DR AS/ACIF S043.2:2007

First published as AS/ACIF S043.2:2001

Second edition AS/ACIF S043.2:2003

Third edition AS/ACIF S043.2:2005

Fourth edition AS/ACIF S043.2:2006

ISBN: 1 74000 377 2

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## FOREWORD

### General

This Standard was prepared by Communications Alliance and most recently revised by the WC07 : VDSL2 Working Committee. It is one of a series of Telecommunication Standards developed under the Memorandum of Understanding between the Australian Communications Authority and the Australian Communications Industry Forum.

Note: On 1 July 2005 the ACA became the Australian Communications and Media Authority (ACMA) and the Memorandum of Understanding continues in effect as if the reference to the ACA were a reference to ACMA.

This Standard is a revision of AS/ACIF S043.2:2006 **Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network— Part 2: Broadband**.

This Standard is the result of a consensus among representatives on the Communications Alliance Working Committee to produce it as an Australian Standard.

The requirements in this Standard are consistent with the aims of s376 of the *Telecommunications Act 1997*. Specifically these aim are —

- (a) to protecting the integrity of a telecommunications network or facility;
- (b) protecting the health and safety of persons;
- (c) ensuring access to emergency services; and
- (d) ensuring interoperability with a standard telephone service.

It should be noted that some Customer Equipment (CE) may require demonstration of compliance with requirements in other Standards or other Parts of this Standard.

AS/ACIF S043 consists of the following parts under the general title **Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network**:

- Part 1: **General**
- Part 2: **Broadband**
- Part 3: **DC, low frequency AC and voiceband**

This Standard should be read in conjunction with AS/ACIF S043.1 [3] and the supporting arrangements document ACIF G563 [5].

Applicable electrical safety Standards and EMC Standards may apply under Commonwealth or State laws, or both.

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Equipment, which is manufactured to comply with this Standard, may require the use of technology, which is protected by patent rights in Australia. Questions about the availability of such technology, under licence or otherwise, should be directed to the patent holder or Australian licensee (if known) or through enquiry

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## Standards revision

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Milsons Point NSW 1565

## Regulatory notice

This document has been made by ACMA as Telecommunications Technical Standard AS/ACIF S043.2-2008 under s376 of the *Telecommunications Act 1997*.

ACMA is a Commonwealth authority with statutory powers to impose requirements concerning telecommunications Customer Equipment and Customer Cabling.

ACMA requires Australian manufacturers and importers of specified items of Customer Equipment and Customer Cabling to establish compliance with Standards such as this. Items are required to be labelled to the applicable labelling notices.

Details on current compliance arrangements can be obtained from the ACMA website at <http://www.acma.gov.au> or by contacting ACMA below at:

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## Introduction

This introduction for the DR AS/ACIF S043.2 **Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network— Part 2: Broadband** Standard is not an authoritative section of this draft Standard and is only provided as guidance for the user of the draft Standard to outline its objectives, the factors that have been taken into account in its development and to list the principle differences between the new and the previous edition.

The reader is directed to the clauses of this Standard for the specific requirements and to the Australian Communications and Media Authority (ACMA) for the applicable telecommunications labelling and compliance arrangements.

Note: Further information on the telecommunications labelling and compliance arrangements can be found in *The Telecommunications Labelling (Customer Equipment and Customer Cabling) Notice* (the TLN). The TLN can be obtained from the Australian Communications and Media Authority (ACMA) website at [www.acma.gov.au](http://www.acma.gov.au).

The objective of this Standard is to provide the requirements and test methods for customer equipment that is designed or intended for connection to a Telecommunications Network via a metallic local loop interface and has a broadband capability, in order to meet the regulatory arrangements for such equipment in Australia.

The objective of this revision is to update AS/ACIF S043.2 to introduce Equipment Classes for DSL modems that enable broadband services based on ITU-T Rec. G.993.2 [11].

The principal differences between this draft edition of AS/ACIF S043.2 and the previous edition are:

- (i) the addition of Equipment Classes 10h and 10j to 10n to enable the use of VDSL2 (based on ITU-T Rec. G.993.2 [11].
- (ii) Related changes to increase the upper frequency for the power spectral density mask of Equipment Classes from 12 MHz to 30 MHz.
- (iii) the deletion of Appendices for Equipment Classes 3a and 3b that have been moved to AS/ACIF S043.3 [4].

## TABLE OF CONTENTS

|          |                                                          |           |
|----------|----------------------------------------------------------|-----------|
| <b>1</b> | <b>INTERPRETATIVE GUIDELINES</b>                         | <b>5</b>  |
|          | <b>1.1 Categories of requirements</b>                    | <b>5</b>  |
|          | <b>1.2 Compliance statements</b>                         | <b>5</b>  |
|          | <b>1.3 Definitions, expressions and terms</b>            | <b>5</b>  |
|          | <b>1.4 Notes</b>                                         | <b>5</b>  |
|          | <b>1.5 References</b>                                    | <b>5</b>  |
|          | <b>1.6 Units and symbols</b>                             | <b>5</b>  |
| <b>2</b> | <b>SCOPE</b>                                             | <b>6</b>  |
| <b>3</b> | <b>REFERENCES</b>                                        | <b>7</b>  |
| <b>4</b> | <b>ABBREVIATIONS AND DEFINITIONS</b>                     | <b>9</b>  |
|          | <b>4.1 Abbreviations</b>                                 | <b>9</b>  |
|          | <b>4.2 Definitions</b>                                   | <b>9</b>  |
|          | 4.2.1 <i>Broadband capability</i>                        | 9         |
|          | 4.2.2 <i>Equipment Class</i>                             | 10        |
|          | 4.2.3 <i>Power Spectral Density (PSD)</i>                | 10        |
|          | 4.2.4 <i>Public Switched Telephone (PSTN)</i>            | 10        |
|          | 4.2.5 <i>Referenced Documents</i>                        | 10        |
| <b>5</b> | <b>REQUIREMENTS</b>                                      | <b>11</b> |
|          | <b>5.1 General</b>                                       | <b>11</b> |
|          | 5.1.1 <i>Applicable requirements</i>                     | 11        |
|          | 5.1.2 <i>Multiple Equipment Classes</i>                  | 11        |
|          | 5.1.3 <i>Group A and Group B requirements</i>            | 11        |
|          | 5.1.4 <i>Non-compliant line code</i>                     | 11        |
|          | <b>5.2 Total average power</b>                           | <b>11</b> |
|          | <b>5.3 Power Spectral Density (PSD)</b>                  | <b>12</b> |
|          | <b>5.4 Line code</b>                                     | <b>12</b> |
|          | <b>5.5 Longitudinal balance</b>                          | <b>12</b> |
|          | <b>5.6 Longitudinal output voltage</b>                   | <b>12</b> |
|          | <b>5.7 Customer Equipment for connection to the PSTN</b> | <b>13</b> |
| <b>6</b> | <b>TESTING</b>                                           | <b>17</b> |
|          | <b>6.1 General</b>                                       | <b>17</b> |
|          | 6.1.1 <i>Compliance verification</i>                     | 17        |
|          | 6.1.2 <i>Compliance demonstration methods</i>            | 17        |
|          | <b>6.2 Standard test conditions</b>                      | <b>17</b> |
|          | 6.2.1 <i>Conditions</i>                                  | 17        |
|          | 6.2.2 <i>Record keeping</i>                              | 17        |
|          | <b>6.3 Test configurations</b>                           | <b>17</b> |

|                     |                             |           |
|---------------------|-----------------------------|-----------|
| 6.3.1               | General                     | 17        |
| 6.3.2               | Termination impedance       | 18        |
| 6.3.3               | DC line current             | 18        |
| <b>6.4</b>          | <b>Measurements</b>         | <b>18</b> |
| 6.4.1               | Total average power         | 18        |
| 6.4.2               | Power Spectral Density      | 19        |
| 6.4.3               | Longitudinal balance        | 20        |
| 6.4.4               | Longitudinal output voltage | 21        |
| <b>PARTICIPANTS</b> |                             | <b>59</b> |

## APPENDICES

|          |                                            |           |
|----------|--------------------------------------------|-----------|
| <b>A</b> | <b>Equipment Class 4a</b>                  | <b>22</b> |
| <b>B</b> | <b>Equipment Class 5a</b>                  | <b>24</b> |
| <b>C</b> | <b>Equipment Class 5b</b>                  | <b>27</b> |
| <b>D</b> | <b>Equipment Classes 6a, 6d, 6e and 6f</b> | <b>30</b> |
| <b>E</b> | <b>Equipment Class 6c</b>                  | <b>32</b> |
| <b>F</b> | <b>Equipment Class 6g</b>                  | <b>34</b> |
| <b>G</b> | <b>Equipment Class 6h</b>                  | <b>36</b> |
| <b>H</b> | <b>Equipment Class 6i</b>                  | <b>38</b> |
| <b>I</b> | <b>Equipment Classes 6j to 6n</b>          | <b>40</b> |
| <b>J</b> | <b>Equipment Class 8b</b>                  | <b>44</b> |
| <b>K</b> | <b>Equipment Classes 9a to 9h</b>          | <b>46</b> |
| <b>L</b> | <b>Equipment Classes 9i to 9q</b>          | <b>50</b> |
| <b>M</b> | <b>Equipment Classes 10h</b>               | <b>54</b> |
| <b>N</b> | <b>Equipment Classes 10j to 10n</b>        | <b>57</b> |

## FIGURES

|          |                                                 |           |
|----------|-------------------------------------------------|-----------|
| <b>1</b> | <b>Average power and PSD test configuration</b> | <b>19</b> |
| <b>2</b> | <b>Longitudinal balance measurement</b>         | <b>20</b> |
| <b>3</b> | <b>Longitudinal output voltage measurement</b>  | <b>21</b> |

## TABLES

|           |                                                                           |           |
|-----------|---------------------------------------------------------------------------|-----------|
| <b>1</b>  | <b>Equipment classes and test criteria</b>                                | <b>13</b> |
| <b>A1</b> | <b>Test criteria and Referenced Documents for Equipment Class 4a</b>      | <b>22</b> |
| <b>A2</b> | <b>PSD mask for Equipment Class 4a (Group A)</b>                          | <b>23</b> |
| <b>B1</b> | <b>Test criteria for Equipment Class 5a</b>                               | <b>24</b> |
| <b>B2</b> | <b>PSD mask and testing requirements for Equipment Class 5a (Group A)</b> | <b>25</b> |

|           |                                                                                                                                             |           |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>B3</b> | <b>PSD mask for Equipment Class 5a (Group B)</b>                                                                                            | <b>26</b> |
| <b>C1</b> | <b>Test criteria for Equipment Class 5b</b>                                                                                                 | <b>27</b> |
| <b>C2</b> | <b>PSD mask and testing requirements for Equipment Class 5b (Group A)</b>                                                                   | <b>28</b> |
| <b>C3</b> | <b>PSD mask for Equipment Class 5b (Group B)</b>                                                                                            | <b>29</b> |
| <b>D1</b> | <b>Test criteria and Referenced Documents for Equipment Classes 6a, 6d, 6e and 6f</b>                                                       | <b>30</b> |
| <b>D2</b> | <b>PSD mask and testing requirements for Equipment Classes 6a, 6d, 6e and 6f</b>                                                            | <b>31</b> |
| <b>E1</b> | <b>Test criteria and Referenced Documents for Equipment Class 6c</b>                                                                        | <b>32</b> |
| <b>E2</b> | <b>PSD mask and testing requirements for Equipment Class 6c (Group A)</b>                                                                   | <b>33</b> |
| <b>F1</b> | <b>Test criteria and Reference Documents for Equipment Class 6g</b>                                                                         | <b>34</b> |
| <b>F2</b> | <b>PSD mask and testing requirements for Equipment Class 6g (Group A)</b>                                                                   | <b>35</b> |
| <b>G1</b> | <b>Test criteria and Reference Documents for Equipment Class 6h</b>                                                                         | <b>36</b> |
| <b>G2</b> | <b>PSD mask and testing requirements for Equipment Class 6h</b>                                                                             | <b>37</b> |
| <b>H1</b> | <b>Test criteria and Reference Documents for Equipment Class 6i</b>                                                                         | <b>38</b> |
| <b>H2</b> | <b>PSD mask and testing requirements for Equipment Class 6i (Group A)</b>                                                                   | <b>39</b> |
| <b>I1</b> | <b>Test criteria and Reference Documents for Equipment Classes 6j to 6n</b>                                                                 | <b>40</b> |
| <b>I2</b> | <b>Total Average Power frequency ranges for Equipment Classes 6j to 6n (Group A)</b>                                                        | <b>41</b> |
| <b>I3</b> | <b>Group A PSD mask and testing requirements for Equipment Class 6j to 6n</b>                                                               | <b>42</b> |
| <b>I4</b> | <b>Group A PSD Template Parameters for Equipment Classes 6j to 6n</b>                                                                       | <b>43</b> |
| <b>J1</b> | <b>Test criteria and Referenced Documents for Equipment Class 8b</b>                                                                        | <b>44</b> |
| <b>J2</b> | <b>PSD mask for Equipment Class 8b (Group A)</b>                                                                                            | <b>45</b> |
| <b>K1</b> | <b>Test criteria and Reference Documents for Equipment Classes 9a to 9h</b>                                                                 | <b>46</b> |
| <b>K2</b> | <b>List of Parameters for Equipment Classes 9a to 9h</b>                                                                                    | <b>47</b> |
| <b>K3</b> | <b>PSD mask and testing requirements for Equipment Classes 9a to 9h (Group A) using 16-TCPAM</b>                                            | <b>48</b> |
| <b>K4</b> | <b>PSD mask and testing requirements for Equipment Classes 9a to 9h (Group B) using 16-TCPAM</b>                                            | <b>49</b> |
| <b>L1</b> | <b>Test criteria and Reference Documents for Equipment Classes 9i to 9q</b>                                                                 | <b>50</b> |
| <b>L2</b> | <b>List of Parameters for Equipment Classes 9i to 9q</b>                                                                                    | <b>51</b> |
| <b>L3</b> | <b>PSD mask and testing requirements for: Equipment Classes 9i to 9q (Group A); and Equipment Classes 9a to 9h (Group A) using 32-TCPAM</b> | <b>52</b> |

|            |                                                                                                                                            |           |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>L4</b>  | <b>PSD mask and testing requirements for: Equipment Classes 9i to 9q (Group B) and Equipment Classes 9a to 9h (Group B) using 32-TCPAM</b> | <b>53</b> |
| <b>M-1</b> | <b>Test criteria and Reference Documents for Equipment Class 10h</b>                                                                       | <b>54</b> |
| <b>M-2</b> | <b>PSD mask and testing requirements for Equipment Class 10h.</b>                                                                          | <b>55</b> |
| <b>M-3</b> | <b>Frequency limits when notching is required for ham radio bands</b>                                                                      | <b>55</b> |
| <b>N-1</b> | <b>Test criteria and Reference Documents for Equipment Class 10j to n</b>                                                                  | <b>57</b> |

# 1 INTERPRETATIVE GUIDELINES

## 1.1 Categories of requirements

This Standard contains mandatory requirements as well as provisions that are recommendatory only. Mandatory requirements are designated by the words '**shall**' or '**shall not**'. All other provisions are voluntary.

## 1.2 Compliance statements

Compliance statements, in italics, suggest methodologies for demonstrating CE's compliance with the requirements.

## 1.3 Definitions, expressions and terms

If there is any conflict between the definitions used in this Standard and the definitions used in the Telecommunications Act 1997, the definitions in the Act take precedence.

## 1.4 Notes

Text denoted as 'Note' is for guidance in interpretation and is shown in smaller size type.

## 1.5 References

1.5.1 Applicable editions (or versions) of other documents referred to in this Standard are specified in Section 3: REFERENCES.

1.5.2 If a document refers to another document, the other document is a sub-referenced document.

1.5.3 Where the edition (or version) of the sub-referenced document is uniquely identified in the reference document, then that edition (or version) applies.

1.5.4 Where the edition (or version) of the sub-referenced document is not uniquely identified in the reference document, then the applicable edition (or version) is that which is current at the date the reference document is legislated under the applicable regulatory framework, or for a non- legislated document, the date upon which the document is published by the relevant standards organisation.

1.5.5 A number in square brackets '[ ]' refers to a document listed in Section 3: REFERENCES.

## 1.6 Units and symbols

In this Standard the International System (SI) of units and symbols is used in accordance with Australian Standard AS ISO 1000 [1].

## 2 SCOPE

- 2.1 This Standard applies to Customer Equipment (CE) that—
- (a) is designed or intended for connection to a Telecommunications Network via a metallic local loop interface; and
  - (b) has a broadband capability.
- 2.2 CE is not excluded from the scope of this Standard by reason only that it is capable of performing functions additional to those listed in this Standard.

### 3 REFERENCES

|      | Publication                                   | Title                                                                                                                 |
|------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|      | <b>Australian Standards</b>                   |                                                                                                                       |
| [1]  | AS ISO 1000—1998                              | The International System of Units (SI) and its application                                                            |
|      | <b>Australian/ACIF Standards</b>              |                                                                                                                       |
| [2]  | AS/ACIF S041:2005                             | Requirements for DSL Customer Equipment for connection to the Public Switched Telephone Network                       |
|      | AS/ACIF S043                                  | Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network |
| [3]  | AS/ACIF S043.1:2001                           | Part 1: General                                                                                                       |
| [4]  | AS/ACIF S043.3:2008                           | Part 3: DC, low frequency AC and voiceband                                                                            |
|      | <b>Australian/ACIF Publications</b>           |                                                                                                                       |
| [5]  | ACIF G563:2001                                | Supporting arrangements for the supply of Digital Subscriber Line (DSL) Customer Equipment                            |
|      | <b>International Telecommunications Union</b> |                                                                                                                       |
| [6]  | G.991.1 (10/98)                               | High bit rate Digital Subscriber Line (HDSL) transceivers                                                             |
| [7]  | G.991.2 (12/03)                               | Single-pair high-speed digital subscriber line (SHDSL) transceivers                                                   |
| [8]  | G.992.1 (07/99)                               | Asymmetrical Digital Subscriber Line (ADSL) Transceivers                                                              |
| [9]  | G.992.3 (01/05)                               | Asymmetric Digital Subscriber Line Transceivers-2 (ADSL2)                                                             |
| [10] | G.992.5 (01/05)                               | Asymmetrical Digital Subscriber Line (ADSL) Transceivers - Extended bandwidth ADSL2 (ADSL2+)                          |
| [11] | G.993.2 (02/06)                               | Very high speed Digital Subscriber Line transceivers 2 (VDSL2)                                                        |
| [12] | G.993.2 Amdt 1 (04/07)                        | Recommendation G.993.2 (2006) Amendment 1 (04/07)                                                                     |
| [13] | O.151 (10/92)                                 | Error performance measuring equipment operating at the primary rate and above                                         |

|                                                        |                                |                                                                                                                                                       |
|--------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| [14]                                                   | O.152 (10/92)                  | Error performance measuring equipment for bit rates of 64 kbit/s and N x 64 kbit/s                                                                    |
| [15]                                                   | O.153 (10/92)                  | Basic parameters for the measurement of error performance at bit rates below the primary rate                                                         |
| <b>European Telecommunications Standards Institute</b> |                                |                                                                                                                                                       |
| [16]                                                   | TS 102 080 V1.3.1<br>(1998-11) | Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines |

## 4 ABBREVIATIONS AND DEFINITIONS

For the purposes of this Standard, the following abbreviations and definitions and those of Part 1 apply:

### 4.1 Abbreviations

|        |                                                                 |
|--------|-----------------------------------------------------------------|
| ACA    | Australian Communications Authority                             |
| ACMA   | Australian Communications and Media Authority                   |
| ACIF   | Australian Communications Industry Forum                        |
| ADSL   | Asymmetric Digital Subscriber Line                              |
| ADSL2  | Asymmetric Digital Subscriber Line version 2                    |
| ADSL2+ | Extended bandwidth ADSL2                                        |
| AC     | Alternating Current                                             |
| AS     | Australian Standard                                             |
| BR     | Basic Rate                                                      |
| CE     | Customer Equipment                                              |
| DC     | Direct Current                                                  |
| DSL    | Digital Subscriber Line                                         |
| EC     | Echo Cancelling                                                 |
| ESHDSL | Single-Pair High-Speed Digital Subscriber Line<br>Extended rate |
| ETSI   | European Telecommunications Standards Institute                 |
| FD     | Frequency Division                                              |
| FFS    | For Further Study                                               |
| HDSL   | High bit rate Digital Subscriber Line                           |
| ISDN   | Integrated Services Digital Network                             |
| PR     | Payload Rate                                                    |
| PSD    | Power Spectral Density                                          |
| PSTN   | Public Switched Telephone Network                               |
| RBW    | Resolution BandWidth                                            |
| ReADSL | Reach extended ADSL2                                            |
| SDSL   | Symmetric Digital Subscriber Line                               |
| SHDSL  | Single-Pair High Speed Digital Subscriber Line                  |
| TCPAM  | Trellis Coded Pulse Amplitude Modulation                        |
| VDSL2  | Very high speed Digital Subscriber Line                         |

### 4.2 Definitions

#### 4.2.1 Broadband capability

A means of transmission of signals that uses frequencies above 20 kHz.

#### 4.2.2 Equipment Class

A classification of CE used in this Standard to identify applicable requirements for CE designed or intended for connection to a metallic local loop interface.

Note: Table 1 lists the Equipment Classes and test criteria used in this Standard. Each Equipment Class has a related Appendix which lists the requirements for the class. The Equipment Class and test criteria do not relate to the class types of any other regime or country.

#### 4.2.3 Power Spectral Density (PSD)

The power level and frequency content of a transmitted signal.

#### 4.2.4 Public Switched Telephone (PSTN)

That part of the Telecommunications Network which enables any customer to establish a connection for voice frequency communication with any other customer either automatically or with operator assistance.

Note: The PSTN has a nominal transmission bandwidth of 3 kHz.

#### 4.2.5 Referenced Documents

Those documents set out in the column titled 'Group B' in the tables in the Appendices.

## 5 REQUIREMENTS

### 5.1 General

#### 5.1.1 Applicable requirements

CE **shall** comply with the requirements of an Equipment Class as specified in Clauses 5.2 to 5.6. The Appendix detailing the test criteria and Referenced Documents for each Equipment Class is specified in Table 1.

#### 5.1.2 Multiple Equipment Classes

Where more than one Equipment Class applies to the CE, the CE **shall** comply with each Equipment Class requirement.

#### 5.1.3 Group A and Group B requirements

CE **shall** comply with all the requirements of either:

- (a) Group A which specifies the parameter values and testing requirements; or
- (b) Group B which specifies either the test criteria or the requirements in the Referenced Documents

for the applicable Equipment Class.

Note: It is expected that most equipment which complies with international standards will comply under the relevant Group B requirements in this Standard. Group A requirements, which correspond to tighter (i.e. lower) PSD masks than the Group B requirements, are available as an alternative path for compliance of systems which cannot comply with the line code aspect of the Group B requirements.

#### 5.1.4 Non-compliant line code

CE that does not comply with a line code specified in Group B for the applicable Equipment Class **shall** use the Group A requirements.

### 5.2 Total average power

The total average power transmitted by CE **shall not** exceed the total average power limit over the specified frequency range, measured when the CE is transmitting maximum power, excluding any transient startup or initialisation phases.

#### 5.2.1 Total Average Power in Voiceband

For each equipment class, the total average transmitted power in the voiceband **shall** be less than or equal to -10dBm measured in 0 to 4 kHz, with 600  $\Omega$  measuring impedance.

Note: This requirement is intended to limit pair to pair crosstalk into voice services to acceptable levels. For systems such as ADSL that

coexist with voice services on the same line, tighter requirements exist - refer to AS/ACIF S041 [2].

*Compliance with Clause 5.2 should be demonstrated using the methodology specified in Clause 6.4.1.*

### 5.3 Power Spectral Density (PSD)

The PSD transmitted by CE **shall not** exceed the PSD mask, at any frequency, measured when the CE is transmitting maximum power, excluding any transient startup or initialisation phases.

*Compliance with Clause 5.3 should be demonstrated using the methodology specified in Clause 6.4.2.*

### 5.4 Line code

Where Group B requirements are used, the CE **shall** comply with the requirements for line code.

*Compliance with Clause 5.4 should be by attestation by the supplier of the equipment.*

### 5.5 Longitudinal balance

The longitudinal balance of the CE **shall** be greater than or equal to the longitudinal balance limit over the specified frequency range, when the longitudinal termination is 1/4 of the termination impedance for the Equipment Class.

Longitudinal balance is defined as:

$$\text{Longitudinal balance (dB)} = 20 \times \log_{10} \left( \frac{V_l}{V_m} \right)$$

where:  $V_l$  is the longitudinal or common mode voltage

$V_m$  is the metallic or differential voltage

*Compliance with Clause 5.5 should be demonstrated using the methodology specified in Clause 6.4.3.*

### 5.6 Longitudinal output voltage

The longitudinal output voltage **shall not** exceed the longitudinal output voltage limit over the specified frequency range, when measured across a load (consisting of 100  $\Omega$  in series with 0.15  $\mu\text{F}$ ) when CE is transmitting maximum power. Any transient startup or initialisation phases should be excluded.

*Compliance with Clause 5.6 should be demonstrated using the methodology specified in Clause 6.4.4.*

## 5.7 Customer Equipment for connection to the PSTN

AS/ACIF S041:2005 [2] contains separate requirements for CE that is designed or intended for connection to a DSL service that shares the metallic local loop with an analogue PSTN Ring-In/ Loop-Out two-wire service.

**Table 1**  
**Equipment classes and test criteria**

| <b>Equipment Class</b><br>(Note 1) | <b>Appendix specifying the test criteria and Referenced Documents</b> | <b>Typical technology (informative)</b><br>(Notes 2, 3, 5, 6)                                     |
|------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1a                                 | Not used in this Standard                                             | –                                                                                                 |
| 1b                                 | Not used in this Standard                                             | -                                                                                                 |
| 2a                                 | Not used in this Standard                                             | –                                                                                                 |
| 3a                                 | Not used in this Standard<br>(Note 4) See also<br>AS/ACIF S043.3 [4]  | Low Band (DC to 3.4 kHz)                                                                          |
| 3b                                 | Not used in this Standard<br>(Note 4) See also<br>AS/ACIF S043.3 [4]  | Low Band (DC to 20 kHz)                                                                           |
| 4a                                 | Appendix A                                                            | ISDN BR 2B1Q                                                                                      |
| 5a                                 | Appendix B                                                            | –                                                                                                 |
| 5b                                 | Appendix C                                                            | –                                                                                                 |
| 6a, 6d, 6e, 6f                     | Appendix D                                                            | ADSL FD, ADSL EC or ADSL2 EC                                                                      |
| 6b                                 | Not used in this Standard                                             | ADSL Lite                                                                                         |
| 6c                                 | Appendix E                                                            | ADSL over ISDN or ADSL2 over ISDN                                                                 |
| 6g                                 | Appendix F                                                            | Reach Extended ADSL2 non-overlapped spectrum with mask 1                                          |
| 6h                                 | Appendix G                                                            | ADSL2 non-overlapped spectrum or ADSL2+ non-overlapped spectrum                                   |
| 6i                                 | Appendix H                                                            | All Digital Mode ADSL2 non-overlapped spectrum or All Digital Mode ADSL2+ non overlapped spectrum |
| 6j                                 | Appendix I                                                            | ADSL2 or ADSL2+ with extended upstream bandwidth (Annex M) Mask EU-40                             |
| 6k                                 | Appendix I                                                            | ADSL2 or ADSL2+ with extended upstream bandwidth (Annex M) Mask EU-52                             |

| <b>Equipment Class</b><br>(Note 1) | <b>Appendix specifying the test criteria and Referenced Documents</b> | <b>Typical technology (informative)</b><br>(Notes 2, 3, 5, 6)            |
|------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------|
| 6l                                 | Appendix I                                                            | ADSL2 or ADSL2+ with extended upstream bandwidth (Annex M)<br>Mask EU-56 |
| 6m                                 | Appendix I                                                            | ADSL2 or ADSL2+ with extended upstream bandwidth (Annex M)<br>Mask EU-60 |
| 6n                                 | Appendix I                                                            | ADSL2 or ADSL2+ with extended upstream bandwidth (Annex M)<br>Mask EU-64 |
| 7a to 7j                           | Not used in this Standard                                             | SDSL                                                                     |
| 8a                                 | Not used in this Standard                                             | HDSL 2B1Q (768 kbit/s)                                                   |
| 8b                                 | Appendix J                                                            | HDSL 2B1Q (1168 kbit/s)                                                  |
| 8c, 8d                             | Not used in this Standard                                             | HDSL 2B1Q (2320 kbit/s)                                                  |
| 9a                                 | Appendix K                                                            | SHDSL (up to 576 kbit/s)                                                 |
| 9b, 9c                             | Appendix K                                                            | SHDSL (up to 776 kbit/s)                                                 |
| 9d                                 | Appendix K                                                            | SHDSL (up to 1160 kbit/s)                                                |
| 9e                                 | Appendix K                                                            | SHDSL (up to 1544 kbit/s)                                                |
| 9h                                 | Appendix K                                                            | SHDSL (up to 1800 kbit/s)                                                |
| 9f                                 | Appendix K                                                            | SHDSL (up to 2056 kbit/s)                                                |
| 9g                                 | Appendix K                                                            | SHDSL (up to 2312 kbit/s)                                                |
| 9i                                 | Appendix L                                                            | ESHDSL (up to 2624(C-16) or 3496(C-32) kbit/s)                           |
| 9j                                 | Appendix L                                                            | ESHDSL (up to 2880(C-16) or 3840(C-32) kbit/s)                           |
| 9k                                 | Appendix L                                                            | ESHDSL (up to 3072(C-16) or 4096(C-32) kbit/s)                           |
| 9l                                 | Appendix L                                                            | ESHDSL (up to 3264(C-16) or 4352(C-32) kbit/s)                           |
| 9m                                 | Appendix L                                                            | ESHDSL (up to 3456(C-16) or 4608(C-32) kbit/s)                           |
| 9n                                 | Appendix L                                                            | ESHDSL (up to 3648(C-16) or 4864(C-32) kbit/s)                           |
| 9o                                 | Appendix L                                                            | ESHDSL (up to 3840(C-16) or 5120(C-32) kbit/s)                           |
| 9p                                 | Appendix L                                                            | ESHDSL (up to 5376(C-32) kbit/s)                                         |
| 9q                                 | Appendix L                                                            | ESHDSL (up to 5696(C-32) kbit/s)                                         |
| 10a to 10g                         | Not used in this Standard                                             | -                                                                        |

| <b>Equipment Class</b><br>(Note 1) | <b>Appendix specifying the test criteria and Referenced Documents</b> | <b>Typical technology (informative)</b><br>(Notes 2, 3, 5, 6)                      |
|------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 10h                                | Appendix M                                                            | VDSL2 non-overlapped spectrum                                                      |
| 10i                                | Not used in this Standard                                             | -                                                                                  |
| 10j                                | Appendix N                                                            | VDSL2 with extended upstream ADSL2 bandwidth (Annex M)<br>Mask EU-40 below 1104kHz |
| 10k                                | Appendix N                                                            | VDSL2 with extended upstream ADSL2 bandwidth (Annex M)<br>Mask EU-52 below 1104kHz |
| 10l                                | Appendix N                                                            | VDSL2 with extended upstream ADSL2 bandwidth (Annex M)<br>Mask EU-56 below 1104kHz |
| 10m                                | Appendix N                                                            | VDSL2 with extended upstream ADSL2 bandwidth (Annex M)<br>Mask EU-60 below 1104kHz |
| 10n                                | Appendix N                                                            | VDSL2 with extended upstream ADSL2 bandwidth (Annex M)<br>Mask EU-64 below 1104kHz |

Note 1: Some CE may have more than one Equipment Class.

Note 2: The individual technologies listed in this column are examples only.

Note 3: The bit rate upper limits under the column titled 'Typical technology' represent line rates (total payload plus overhead bits carried), except for SHDSL and ESHDSL where they represent payload rates only, without the 8kbps line overhead. For Classes 9a to 9h the SHDSL system maximum payload rates shown are based on 3 bits per symbol (C-16 line-code) as per the default in G.991.2 [7]. For these Classes systems that operate at the same symbol rates using the alternative option of 4 bits per symbol (C-32) have maximum payload rates corresponding to the 32-TCPAM column of Table K2. Classes 9i to 9o are for ESHDSL systems for which G.991.2 [7] specifies two line-code options (C-16 or C-32). Maximum payload rates are shown for both options for these Classes. Classes 9p and 9q show maximum payload rates for the C-32 line-code only, because G.991.2 [7] specifies no C-16 alternatives for these cases.

Note 4: Subject to other Standards or Parts of this Standard.

Note 5: SHDSL and ESHDSL system Equipment Class is determined by the Symbol Rate – which may correspond to different system bit-rates depending on whether 16-TCPAM (3 bits per symbol) or 32-TCPAM (4 bits/symbol) coding is being used, as defined in G.991.2 Annex K [7]. Example payload bitrates are denoted with a suffix (C-16) for 16-TCPAM (3 bits/symbol) values, and (C-32) for 32-TCPAM (4 bits/symbol) values. Refer to Appendix K for details on SHDSL and Appendix L for details on ESHDSL.

Note 6: The Equipment Classes (with corresponding “Typical technology”) listed below were in earlier version(s) of this Standard but have been removed as options for deployment of a new service in the future because:

- (i) doing so will improve the overall performance of services on an access network by reducing the risk of interference between services and
- (ii) the number of existing services for the Equipment Classes listed below are zero in most examples or few enough to be managed on a case-by-case basis:

- 1a and 1b (E1 HDB3) – redeployment of existing E1 services and pair rearrangement might still occur;

- 2a (listed in the original planning of Equipment Classes but never used in publication);

- 6b (ADSL.lite);

- 7a to 7j (SDSL at various data rates);

- 8a, 8c and 8d (HDSL at 784kbps and 2320kbps).