



Australian Communications Industry Forum  
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## **DR ACIF C559:2004 PART 3**

# **REQUIREMENTS FOR DEPLOYMENT CLASS SYSTEMS**

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## 1 DEPLOYMENT CLASSES

- 1.1 This Part sets out the Deployment Classes and Deployment Rules for operation of Deployment Class Systems using ULLS. Deployment Classes are based on technologies that are common or expected to be used in the network. The Deployment Rules are the requirements and constraints on the operation of systems that correspond to a Deployment Class. A system that corresponds to a Deployment Class is referred to as a Deployment Class System.
- 1.2 This Part provides only one of the two ways of demonstrating compliance with the code obligation described in section 8.2 of Part 1 of this Code. Throughout this Part the requirements expressed as "shall" or "must" apply only to the case in which compliance with the performance requirements of Part 1 of this Code is through satisfying the Deployment Classes and Deployment Rules as in Clause 8.3 of Part 1 of this Code, and do not apply when the alternative method of compliance in Clause 8.4 of Part 1 of this Code is used.
- 1.3 The Deployment Classes and Deployment Rules:
- (a) list the technologies that have been taken into account in determining the PSD mask(s) that systems must meet under the code;
  - (b) specify requirements for operation of particular systems that are intended to ensure that systems corresponding to Basis Systems are afforded some measure of protection;
  - (c) correspond to Equipment Classes used in the AS/ACIF S043.2 Customer Equipment standard;
  - (d) will only have the desired effect of limiting interference to an acceptable level and will only be complied with if the customer equipment used in the supply of the system meets the requirements of the corresponding Equipment Class in AS/ACIF S043.2.
- 1.4 Not all available technologies are represented in the Deployment Classes.  
**Note:** A Carrier or Carriage Service Provider that proposes to operate a system that does not fall within a Deployment Class is subject to the requirements in Clause 8.4 of Part 1.
- 1.5 The use of a Deployment Class for other technology types is not restricted, provided the operation of the system complies with the requirements for the Deployment Class.
- 1.6 Table A-1 sets out the required reference frequencies and attenuation limits (including equivalent distances) for each Deployment Class.
- 1.7 A party wishing to deploy a Rate Adaptive system shall use service qualification and deployment limits appropriate to the maximum possible rate of the system on that ULLS.
- 1.8 The ACIF Approved Deployment Classes may be amended in the future as part of a code review. A party wishing to include a new Deployment Class or Basis System in the Code must approach ACIF for a review of the Code.

## 2 DEPLOYMENT CLASSES AND ASSOCIATED DEPLOYMENT RULES

### 2.1 General

- 2.1.1 The requirements for operation of Deployment Class Systems comprises three broad categories of requirements:
- (a) requirements that apply to the operation of network equipment;
  - (b) requirements that apply to the operation of customer equipment; and
  - (c) Deployment Limits for the Deployment Class system and rules for pair separation.

**Note:** The requirements in (c) above are collectively referred to as Deployment Rules. The Deployment Limit is expressed as an attenuation limit with a corresponding cable length limit for 0.4 PIUT cable.

- 2.1.2 The operation of Deployment Class Systems shall comply with the requirements for the applicable Deployment Class in respect of network equipment, customer equipment and attenuation limit and pair separation in order to comply with the obligation in 8.2 of Part 1 of this Code.

**Note:** Clause 8.2 prohibits a carrier or carriage service provider from operating a system that would cause Unacceptable Interference to a Basis System or Unacceptable Excess Power. Clause 8.3 provides that a carrier or carriage service provider that operates a Deployment Class System in accordance with the requirements for the applicable Deployment Class is taken to comply with the obligation in Clause 8.2.

- 2.1.3 The performance requirements for network equipment, customer equipment and attenuation limits and pair separation are described in Clauses 2.2 through 2.8 of this Part. The substantive requirements for each Deployment Class are contained in the document(s) corresponding to the applicable Deployment Class. The Deployment Rules for each Deployment Class are contained in Table A-1.

**Note:** See Clause 2.2 below for a description of 'Group A' and 'Group B' requirements for each applicable Deployment Class.

- 2.1.4 For Spectrally Symmetric Systems the performance requirements for network equipment and customer equipment are identical. For Spectrally Asymmetric Systems the requirements for network equipment are set out in appendices to this Part.

### 2.2 Group A and Group B Requirements

- 2.2.1 For each Deployment Class, there are two alternative means of operating a system in accordance with the Deployment Class requirements. The operation of a Deployment Class System shall comply with the requirements of either:

- (a) Group A which specifies the requirements for operation of the Deployment Class system; or

- (b) Group B which specifies either the requirements for the operation of the Deployment Class system or the references to the referenced documents of the applicable Deployment Class.

**Note 1:** A carrier or carriage service provider that operates a Deployment Class System in accordance with either Group A requirements or Group B requirements and complies with the Deployment Rules for that Deployment Class is taken to comply with the obligation in Part 1 of this Code.

**Note 2:** The requirements contained in Group B are taken from the ITU-T Recommendation that corresponds to the indicative technology for the relevant Deployment Class.

**Note 3:** It is expected that most Deployment Class Systems that comply with international standards will comply under the relevant Group B requirements in this Industry Code. 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.

## **2.3 Total Average Power**

- 2.3.1 The total average power at the ULLS-NRP **shall** be less than or equal to the limit for the applicable Deployment Class, measured while the equipment is transmitting maximum power, excluding any transient startup or initialisation phases.
- 2.3.2 The methodology for the measurement of the total average power is as specified in Appendix B in Part 1.

## **2.4 Power Spectral Density (PSD)**

- 2.4.1 The PSD at the ULLS-NRP **shall** be less than or equal to the PSD mask for the applicable Deployment Class over the nominated frequency range when the equipment is transmitting maximum power, excluding any transient startup or initialisation phases. For Group A compliance, the testing requirements indicate the tests required to comply with the nominal PSD mask.
- 2.4.2 The methodology for the measurement of the PSD is as specified in Appendix B in Part 1.

## **2.5 Line Code**

- 2.5.1 For Group B, the system line code **shall** comply with the requirements of the applicable Deployment Class.

## **2.6 Longitudinal Balance**

- 2.6.1 The longitudinal balance of the system towards the AS network, shall be greater than or equal to the longitudinal balance level specified for the applicable Deployment Class when the longitudinal termination is one quarter (1/4) of the termination impedance for the Deployment Class.

Longitudinal Balance is defined as

Longitudinal Balance (dB) =  $20\log |V_l/V_m|$

where:  $V_m$  is the metallic or differential voltage  
 $V_l$  is the longitudinal or common mode voltage.

- 2.6.2 The methodology for the measurement of the longitudinal balance is as specified in Clause B.3.3 of Appendix B of Part 1.

## 2.7 Longitudinal Output Voltage

- 2.7.1 The Power Spectral Density of the longitudinal output voltage shall be less than or equal to the level for the applicable Deployment Class over the frequency range specified. The longitudinal output voltage is measured across a load (consisting of  $100\Omega$  in series with  $0.15\mu\text{F}$ ) when the equipment under test is transmitting maximum power, excluding any transient startup or initialisation phases.
- 2.7.2 The methodology for the measurement of the longitudinal output voltage is as specified in Clause B.3.4 of Appendix B of Part 1.

## 2.8 Deployment Rules

- 2.8.1 A Deployment Class System is only taken to be operated in accordance with the Deployment Rules for the applicable Deployment Class if the operation of the system complies with the Deployment Rules in Table A-1 for the applicable Deployment Class.
- 2.8.2 The Calculated Attenuation shall be less than or equal to the Deployment Limit, specified at the reference frequency for the Deployment Class, calculated with respect to the Deployment Reference Point for the applicable Deployment Class.
- 2.8.3 The Calculated Attenuation of a ULLS shall be calculated using the formulae of Appendix A to Part 1 of this Code.
- 2.8.4 A system belonging to a Spectrally Asymmetric Deployment Class shall not be fed from a ULLS-NRP which is lower than the Deployment Reference Point for that Deployment Class.
- Note 1:** In Deployment State A the Deployment Reference Point for all Deployment Classes is at the Highest NRP. Deployment Reference Points for Deployment State B are given in Table 1 as Highest if at the Highest NRP or Lower if at the Nominated Lower NRP.
- Note 2:** A carrier or carriage service provider proposing to operate a system from a ULLS-NRP lower than the Deployment Reference Point for that Deployment Class must use the alternative means of compliance prescribed for Non-Deployment Class systems.
- 2.8.5 Any Pair Separation rules applicable to a ULLS shall only apply with respect to the NRP at which the ULLS originates.
- 2.8.6 Where Pair Separation is required under a Deployment Rule, the cable pair used for the ULLS shall be in a different Cable Unit from the pair used by a system or part of a system of a Deployment Class which requires the

separation (e.g. a Deployment Class 1b, E1 customer to exchange pair).

## **2.9 Operation of Spectrally Asymmetric Systems in Reverse Mode**

- 2.9.1 Reverse ADSL is a case where the network end (ATU-C) equipment as defined in the relevant Recommendations (ITU G.992.1 and G992.2) is used to transmit in the reverse direction, that is towards the network.
- 2.9.2 The operation of any of the Spectrally Asymmetric systems listed in Table A-1 in reverse mode will cause Unacceptable Interference into a Basis System in contravention of this Code.

## **2.10 Use of Two System Types on a single ULLS**

- 2.10.1 This Code does not provide any protection from interference between the operation of two types of system that use the same ULLS (i.e. as part of a composite service). This is a design issue for the AS.
- 2.10.2 Where two types of system use the same ULLS, the operation of the systems is taken to comply with the obligation in Clause 8.2 in Part 1 of this Code if the two systems operate only in separate time intervals (e.g., a transmission system and a testing system which only tests when the transmission is off) and each system complies separately with the obligations of Clause 8.2 in Part 1 of this Code (i.e. with the other turned off)

## APPENDIX A Summary of Network Deployment Classes

**Table A-1**  
Table of Network Deployment Classes

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Refer-ence frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
1a	Removed while revising ACIF C559:2003		<i>Symmetric Highest</i>	<i>E1 HDB3 ≤18.2 dB</i>	<i>Deployment Limit 18.2 dB (equivalent to 0.7km 0.4 mm PIUT)</i>	<i>1024</i>
1b	Appendix B	Appendix B	Symmetric Highest	E1 HDB3	Unlimited. Only for pair rearrangement and deployment of Deployment Class 1b systems on existing routes, provided there is no incursion of "return" pairs into cable units or quad cable layers not previously containing "return" pairs of Deployment Class 1b systems	1024
2a	Not For Use In This Industry Code					



Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
3a	Deployment of Class 3a services shall not cause unacceptable interference into a basis system. The required specification is for further study	Customer Equipment used in connection with Class 3a systems is subject to labelling and compliance requirements contained in the ACA Telecommunications Labelling Notice.	N/A	Low Band	Unlimited	
4a	AS/ACIF S043.2 Appendix A	AS/ACIF S043.2 Appendix A	Symmetric Lower	ISDN BR 2B1Q	Unlimited	40
5a	AS/ACIF S043.2 Appendix B	AS/ACIF S043.2 Appendix B	Symmetric Lower	Similar to SHDSL with modified roll-off (up to 584 kbit/s line rate)	Unlimited	96

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
5b	Appendix O	AS/ACIF S043.2 Appendix C	Symmetric Lower	Similar to SHDSL with modified roll-off (up to 784 kbit/s line rate, reduced power)	Unlimited	131
6a	Appendix C	AS/ACIF S043.2 Appendix D	Asymmetric Lower	ADSL FD with Reduced NEXT	Unlimited. Pair Separation at the Highest NRP from Deployment Class 1b is required. Deployment Class 3a systems may be used in conjunction with this Deployment Class.	300
6b	Removed while revising ACIF C559:2003		<i>Asymmetric Lower</i>	<i>ADSL Lite</i>	<i>Unlimited. Deployment Class 3a systems may be used in conjunction with this Deployment Class.</i>	<i>300</i>

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
6c	Appendix E	AS/ACIF S043.2 Appendix F	Asymmetric Lower	ADSL over ISDN	<p>Pair Separation at the Highest NRP from Deployment Class 1b is required.</p> <p>Deployment limit 18.2 dB (equivalent to 1.3 km 0.4 mm PIUT)</p> <p>Deployment Class 3a systems may be used in conjunction with this Deployment Class.</p> <p>Deployment Class 4a systems may be used in conjunction with this Deployment Class.</p>	300
6d	Appendix F	AS/ACIF S043.2 Appendix D	Asymmetric Lower	ADSL EC	<p>Pair Separation at the Highest NRP from Deployment Class 1b is required.</p> <p>Deployment limit 30.8 dB (equivalent to 2.2 km 0.4 mm PIUT).</p> <p>Deployment Class 3a systems may be used in conjunction with this Deployment Class.</p>	300

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
6e	Appendix G	AS/ACIF S043.2 Appendix D	Asymmetric Lower	ADSL FD Low Power	Unlimited  Deployment Class 3a systems may be used in conjunction with this Deployment Class.	300
6f	Appendix H	AS/ACIF S043.2 Appendix D	Asymmetric Lower	ADSL FD Limited carriers	Unlimited  Deployment Class 3a systems may be used in conjunction with this Deployment Class.	300
6g	Appendix L	AS/ACIF S043.2 Appendix W	Asymmetric Lower	Reach Extended ADSL2 non overlapped spectrum	<b>MIMINUM</b> deployment limit 35.9 dB (equivalent to 2.5 km 0.4 mm PIUT) – <b>not to be deployed on shorter loops.</b>  Pair Separation at the Highest NRP from Deployment Class 1b is required.  Deployment Class 3a systems may be used in conjunction with this Deployment Class.	300

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
6h	Appendix M	AS/ACIF S043.2 Appendix X	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum	Unlimited  Pair Separation at the Highest NRP from Deployment Class 1b is required.  Deployment Class 3a systems may be used in conjunction with this Deployment Class.	300
6i	Appendix N	AS/ACIF S043.2 Appendix Y	Asymmetric Lower	All Digital Mode ADSL2+ non-overlapped spectrum	Unlimited  Pair Separation at the Highest NRP from Deployment Class 1b is required.	300
7a to 7j	Removed while revising ACIF C559:2003		<i>Symmetric Highest</i>	<i>SDSL (all speeds)</i>	<i>Varies</i>	
8a	Removed while revising ACIF C559:2003		<i>Symmetric Highest</i>	<i>HDSL 2B1Q 784 kbit/s</i>	<i>Deployment Limit 30.1 dB (equivalent to 2.5 km 0.4 mm PIUT)</i>	<i>196</i>
8b	AS/ACIF S043.2 Appendix O	AS/ACIF S043.2 Appendix O	Symmetric Highest	HDSL 2B1Q 1168 kbit/s	Deployment Limit 22.2 dB (equivalent to 1.6 km 0.4 mm PIUT).	292

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
8c	Removed while revising ACIF C559:2003		<i>Symmetric Highest</i>	<i>HDSL 2B1Q 2320 kbit/s</i>	<i>Deployment Limit 13.5 dB (equivalent to 0.7 km 0.4 mm PIUT).</i>	580
8d	Removed while revising ACIF C559:2003		<i>Symmetric Highest</i>	<i>HDSL 2B1Q 2320 kbit/s</i>	<i>Attenuation shall be between 13.5 dB and Deployment Limit of 19.3dB (equivalent to 0.7 km to 1.0 km of 0.4 mm PIUT). After 30 September 2002 services shall not operate using Deployment Class 8d, and shall either operate using equipment under an alternative Deployment Class or be withdrawn.</i>	580
9a	AS/ACIF S043.2 Appendix Q where the PSD shall be measured with a resolution bandwidth less than or equal to 10kHz	AS/ACIF S043.2 Appendix Q where the PSD shall be measured with a resolution bandwidth less than or equal to 10kHz	Symmetric Lower	SHDSL (192 to 576 kbit/s)	Unlimited.	96

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
9b	Appendix J	AS/ACIF S043.2 Appendix Q	Symmetric Lower	SHDSL (192 to 776 kbit/s, reduced power)	Unlimited.	132
9c	AS/ACIF S043.2 Appendix Q	AS/ACIF S043.2 Appendix Q	Symmetric Lower	SHDSL (192 to 776 kbit/s)	Deployment Limit 30.2 dB (equivalent to 2.8 km 0.4 mm PIUT).	132
9d	AS/ACIF S043.2 Appendix Q	AS/ACIF S043.2 Appendix Q	Symmetric Highest	SHDSL (192 to 1160 kbit/s)	Deployment Limit 32.1 dB (equivalent to 2.7 km 0.4 mm PIUT).	196
9e	AS/ACIF S043.2 Appendix Q	AS/ACIF S043.2 Appendix Q	Symmetric Highest	SHDSL (192 to 1544 kbit/s)	Deployment Limit 33.9 dB (equivalent to 2.6 km 0.4 mm PIUT).	259
9h	AS/ACIF S043.2 Appendix Q	AS/ACIF S043.2 Appendix Q	Symmetric Highest	SHDSL (192 to 1800 kbit/s)	Deployment Limit 31.8 dB (equivalent to 2.3 km 0.4 mm PIUT).	300
9f	AS/ACIF S043.2 Appendix Q	AS/ACIF S043.2 Appendix Q	Symmetric Highest	SHDSL (192 to 2056 kbit/s)	Deployment Limit 29.2 dB (equivalent to 2.0 km 0.4 mm PIUT).	344
9g	AS/ACIF S043.2 Appendix Q	AS/ACIF S043.2 Appendix Q	Symmetric Highest	SHDSL (192 to 2312 kbit/s)	Deployment Limit 29.3 dB (equivalent to 1.9 km 0.4 mm PIUT).	388

Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
9i	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 2624(C-16) kbit/s) or (768(C-32) to 3496(C-32) kbit/s)	Deployment Limit 27.8 dB (equivalent to 1.7 km 0.4 mm PIUT).	439
9j	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 2880(C-16) kbit/s) or (768(C-32) to 3840(C-32) kbit/s)	Deployment Limit 27.4 dB (equivalent to 1.6 km 0.4 mm PIUT).	481
9k	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 3072(C-16) kbit/s) or (768(C-32) to 4096(C-32) kbit/s)	Deployment Limit 26.6 dB (equivalent to 1.5 km 0.4 mm PIUT).	513
9l	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 3264(C-16) kbit/s) or (768(C-32) to 4352(C-32) kbit/s)	Deployment Limit 25.6 dB (equivalent to 1.4 km 0.4 mm PIUT).	545
9m	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 3456(C-16) kbit/s) or (768(C-32) to 4608(C-32) kbit/s)	Deployment Limit 24.6 dB (equivalent to 1.3 km 0.4 mm PIUT).	577



Deploy-ment Class	Appendix or Reference document specifying the Deployment Class requirements (Note 1)		Symmetric or Asymmetric & State B DRP (Note 3)	Typical Technology (informative) (Note 5) (Note 6)	Deployment Rules (Note 11)	Reference frequency for class (kHz) (Note 10)
	Network equipment	Customer equipment (Note 2)				
9n	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 3648(C-16) kbit/s) or (768(C-32) to 4864(C-32) kbit/s)	Deployment Limit 25.2 dB (equivalent to 1.3 km 0.4 mm PIUT).	609
9o	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (192(C-16) to 3840(C-16) kbit/s) or (768(C-32) to 5120(C-32) kbit/s)	Deployment Limit 23.8 dB (equivalent to 1.2 km 0.4 mm PIUT).	641
9p	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (768(C-32) to 5376(C-32) kbit/s)	Deployment Limit 23.9 dB (equivalent to 1.2 km 0.4 mm PIUT).	649
9q	AS/ACIF S043.2 Appendix Z	AS/ACIF S043.2 Appendix Z	Symmetric Highest	ESHDSL (768(C-32) to 5696(C-32) kbit/s)	Deployment Limit 22.7 dB (equivalent to 1.1 km 0.4 mm PIUT).	713

- Note 1:** Unless otherwise indicated, the appendices referred to under 'Network Equipment' and 'Customer Equipment' are contained in Part 3 of this Code.
- Note 2:** Customer Equipment used in connection with Deployment Class Systems may also be subject to additional compliance and labelling requirements contained in the Telecommunications Labelling Notice.
- Note 3:** 'Highest' and 'Lower' refer to the Highest NRP and Nominated Lower NRP respectively.
- Note 4:** For Deployment Class Systems the Deployment Reference Point in Deployment State B may be at the Highest NRP (designated Highest) or at the Nominated Lower NRP (designated Lower). Note that for Deployment Class Systems, Spectrally the Lowest Asymmetric System Feed Point is the Deployment Reference Point.
- Note 5:** 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. 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 Q 2. Classes 9i to 9o are for ESHDSL systems for which G.991.2 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 specifies no C-16 alternatives for these cases.

- Note 6:** SHDSL and ESHDSL system Deployment 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. 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 J for details on SHDSL and Appendix K for details on ESHDSL.
- Note 7:** A number of Deployment Classes are labeled "Removed while revising C559:200x". These are usually Deployment Classes with a "typical technology" that has been superseded by at least one other technology covered by the remaining Deployment Classes that causes less spectral interference.
- Note 8:** The typical technology ADSL2 overlapped is not included because of the risk of interference into other systems. A Service Provider may propose it as a Non-Deployment Class System – refer to ACIF G618:2004 for more information.
- Note 9:** If a Service Provider is intending to deploy a Rate Adaptive system, the service qualification for that technology must be performed at the **maximum** line rate of the system.
- Note 10:** The Reference Frequency is always derived from the upper rate of the deployment class, and may not match exactly with a column in Table A-2 of Part 1.
- Note 11:** As per clause 2.8.5, where Pair Separation is required this is located at the Lowest NRP

## APPENDIX B DEPLOYMENT CLASS 1b

Table B-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 1b. The termination impedance for Deployment Class 1b is 120 Ω. A typical technology is E1 HDB3.

**TABLE B-1**  
**Test criteria for Deployment Class 1b**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	+14 dBm	+14 dBm
	Frequency range	0 to 4 MHz	0 to 4 MHz
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		Table B-2	Table B-3
Line code		Not Applicable	G.703 Clause 9.1, 9.2, Annex A

**Note 1:** Because Deployment Class 1b systems are not directly deployable in this code, the Group A mask is only used for spectral compatibility assessment of the E1 Basis System.

**TABLE B-2**  
**Group A PSD mask for Deployment Class 1b**

Frequency (kHz)	PSD (dBm/Hz)
$0 < f \leq 30000$	$\frac{2 \times 3.1^2}{120 \times 2048} \left[ \frac{\sin\left(\frac{\pi f}{2048}\right) \sin\left(\frac{\pi f}{2 \times 2048}\right)}{\frac{\pi f}{2048}} \right]^2$

**TABLE B-3**  
**Group B PSD mask for Deployment Class 1b**

Frequency (kHz)	PSD (dBm/Hz)
$0 < f \leq 1024$	-44.5
$1024 < f \leq 30000$	$-44.5 - 20 \times \log_{10}(f / 1024)$

## APPENDIX C DEPLOYMENT CLASS 6a

Table C-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6a network systems. The termination impedance for Deployment Class 6a is 100  $\Omega$ . A typical technology is ADSL FD with reduced NEXT.

**TABLE C-1**

**Test criteria and Reference Documents for Deployment Class 6a**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	19.9 dBm with Power Cutback in accordance with Table C-2	G.992.1 Clause.A.1.2.3.3 and Power Cutback in accordance with G.992.1 Clause 10.4.5.1 and A.3.1
	Frequency range	25.875 to 1104 kHz	G.992.1 Clause.A.1.2.3.3
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table C-3 with a flat power cutback in accordance with Table C-2.	G.992.1 Clause A.1.3. Maximum power in the 0 to 4kHz band is relaxed to $-10\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.1 Clause 7.7, 7.8 or 7.9, 7.10, 7.11
Longitudinal balance	Level	40dB	G.992.1 Clause A 4.3.1
	Frequency range	30kHz to 1104kHz	G.992.1 Clause A 4.3.1
Longitudinal output voltage	Level	-50dBv in any 4kHz band	-50dBv in any 4kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE C-2**

**Power Cutback for downstream signal of Deployment Classes 6a, 6c, 6d, 6f, 6h and 6i as a function of loop attenuation at 50 kHz.**

Equivalent km of 0.4 mm PIUT	Attenuation of loop (dB at 50 kHz)	Minimum Power Cut-back(dB)
< 0.131	< 1.13	12
< 0.246	< 2.13	10
< 0.361	< 3.13	8
< 0.476	< 4.13	6
< 0.592	< 5.13	4
< 0.707	< 6.13	2

**TABLE C-3**

**PSD mask and Testing Requirements for Deployment Class 6a (Group A)**

Frequency band $f$ (kHz)	PSD (dBm/Hz) (Note 2)	Testing Requirements
$0 < f \leq 4$	-97.5	PSD and Wideband power < -10dBm <sub>600Ω</sub> Note 1
$4 < f \leq 80$	$-96 + 4.63 \times \log_2(f / 4)$	PSD
$80 < f \leq 138$	$-76 + 36 \times \log_2(f / 80)$	PSD
$138 < f \leq 1\ 104$	-40	PSD
$1\ 104 < f \leq 3093$	$-40 - 36 \times \log_2(f / 1\ 104)$	PSD
$3093 < f \leq 4\ 545$	-93.5	-93.5 peak and Max power in the $[f, f + 1\ \text{MHz}]$ window of $(-36.5 - 36 \times \log_2(f / 1\ 104) + 60)$ dBm <sub>100</sub> Note 3
$4\ 545 < f \leq 11\ 040$	-93.5	-93.5 peak and Max power in the $[f, f + 1\ \text{MHz}]$ window of - 50 dBm <sub>100</sub> Note 3
$11\ 040 < f \leq 12040$	-93.5	-93.5 peak

**Note 1:** The 0 to 4kHz band total power measurement is in 600 Ω.  
**Note 2:** Above 25.875 kHz, the peak PSD shall be measured with a 10 kHz resolution bandwidth.  
**Note 3:** The power in a 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.

**APPENDIX D DEPLOYMENT CLASS 6b**

Deployment Class removed in revising ACIF C559:2003.  
A typical technology was ADSL.lite.

## APPENDIX E DEPLOYMENT CLASS 6c

Table E-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6c network systems. The termination impedance for Deployment Class 6c is 100  $\Omega$ .

A typical technology is ADSL over ISDN.

**TABLE E-1**

### Test criteria and Reference Documents for Deployment Class 6c

Parameter	Sub-parameter	Group A	Group B
Total average power	Level	19.9 dBm with power cutback in accordance with Table C-2	G.992.1 Clause B.1.3.2.2 and power cutback in accordance with G.992.1 Clauses 10.4.5.1 and B3.3
	Frequency range	138 to 1104 kHz	G.992.1 Clause. B.1.3.2.2
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table E-2 with a flat power cutback in accordance with Table C-2	G.992.1 Clause. B.1.3
Line code		Not applicable	G.992.1 Clause. 7.7 , 7.8 or 7.9, 7.10, 7.11
Longitudinal balance	Level	40dB	G.992.1 Clause A.4.3.1
	Frequency range	30kHz to 1104kHz	G.992.1 Clause A.4.3.1
Longitudinal output voltage	Level	-50dBv in any 4kHz band	-50dBv in any 4kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE E-2**  
**PSD mask and Testing Requirements for Deployment Class 6c (Group A)**

Frequency band $f$ (kHz)	PSD (dBm/Hz)	Testing Requirements
$0 < f < 50$	-90	PSD
$50 \leq f < 80$	$-90 + 12 \times \log_2(f / 50)$	PSD
$80 \leq f < 138$	$-82 + 54 \times \log_2(f / 80)$	PSD
$138 \leq f < 1104$	-40	PSD
$1104 \leq f < 3093$	$-40 - 36 \times \log_2(f / 1104)$	PSD
$3093 \leq f < 4545$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1 \text{ MHz}]$ window of $(-36.5 - 36 \times \log_2(f / 1104) + 60)$ dBm <sub>100</sub>
$4545 \leq f < 11040$	-93.5	-93.5 dBm/Hz peak and with max power in the $[f, f + 1 \text{ MHz}]$ window of -50 dBm <sub>100</sub>
$11040 \leq f < 12040$	-93.5	-93.5 dBm/Hz peak
<p><b>Note 1:</b> Above 25.875 kHz, the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p> <p><b>Note 2:</b> The power in a 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.</p>		



## APPENDIX F DEPLOYMENT CLASS 6d

Table F-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6d network systems. A typical technology is ADSL Echo Cancelled. The termination impedance for Deployment Class 6d is 100  $\Omega$ .

**TABLE F-1**

**Test criteria and Reference Documents for Deployment Class 6d**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	20.4 dBm with power cutback in accordance with Table C-2	G.992.1 Clause A.1.2.3.3 and power cutback in accordance with G.992.1 Clauses 10.4.5.1 and A.3.1
	Frequency range	25.875 to 1104 kHz	G.992.1 Clause.A.1.2.3.3
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table F-2 with flat power cutback in accordance with Table C-2	G.992.1 Clause. A.1.2 Maximum power in the 0 to 4kHz band is relaxed to $-10\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.1 Clause 7.7, 7.8 or 7.9, 7.10, 7.11
Longitudinal balance	Level	40dB	G.992.1 Clause A 4.3.1
	Frequency range	30kHz to 1104kHz	G.992.1 Clause A 4.3.1
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50 dBV in any 4 kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE F-2**  
**PSD mask and Testing Requirements for Deployment**  
**Class 6d (Group A)**

Frequency band $f$ (kHz)	PSD (dBm/Hz) Note 2	Testing Requirements
$0 < f < 4$	-97.5	PSD and Wideband power < -10dBm <sub>600Ω</sub> Note 1
$4 < f < 25.875$	$-96 + 21 \times \log_2 (f / 4)$	PSD
$25.875 < f < 1104$	-40	PSD
$1104 < f < 3093$	$-40 - 36 \times \log_2 (f / 1104)$	PSD
$3093 < f < 4545$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1 \text{ MHz}]$ window of $(-36.5 - 36 \times \log_2 (f / 1104) + 60)$ dBm <sub>100</sub> Note 3
$4545 < f < 11040$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1 \text{ MHz}]$ window of -50 dBm <sub>100</sub> Note 3
$11040 < f < 12040$	-93.5	-93.5 dBm/Hz peak
<p><b>Note 1:</b> The 0 to 4 kHz band total power measurement is in 600 Ω.</p> <p><b>Note 1:</b> Above 25.875 kHz, the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p> <p><b>Note 3:</b> The power in a 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.</p>		

## APPENDIX G DEPLOYMENT CLASS 6e

Table G-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6e network systems. The termination impedance for Deployment Class 6e is 100  $\Omega$ . A typical technology is ADSL FD Low Power.

**TABLE G-1**

**Test criteria and Reference Documents for Deployment Class 6e**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	9.9 dBm (has 10dB attenuation)	G.992.1 Clause A.1.2.3.3 reduced by 10dB
	Frequency range	25.875 to 1104 kHz	G.992.1 Clause A.1.2.3.3
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table G-2	G.992.1 Clause A.1.3 reduced by 10 dB  Maximum power in the 0 to 4kHz band is relaxed to $-10\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.1 Clause 7.7, 7.8 or 7.9, 7.10, 7.11
Longitudinal balance	Level	40dB	G.992.1 Clause A 4.3.1
	Frequency range	30kHz to 1104kHz	G.992.1 Clause A 4.3.1
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50dBV in any 4 kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE G-2**

**PSD mask and Testing Requirements for Deployment Class 6e  
(Group A)**

Frequency band $f$ (kHz)	PSD (dBm/Hz) Note 2	Testing Requirements
$0 < f < 4$	-97.5	PSD and Wideband Power < -10 dBm <sub>600Ω</sub> Note 1
$4 < f < 100$	$-96 + 4.63 \times \log_2(f/4)$	PSD
$100 < f < 138$	$-86 + 36 \times \log_2(f/80)$	PSD
$138 < f < 1\ 104$	-50	PSD
$1\ 104 < f < 2551$	$-50 - 36 \times \log_2(f/1\ 104)$	PSD
$2551 < f < 4\ 545$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1\ \text{MHz}]$ window of $(-36.5 - 36 \times \log_2(f/1\ 104) + 60)$ dBm <sub>100</sub> Note 3
$4\ 545 < f < 11\ 040$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1\ \text{MHz}]$ window of - 50 dBm <sub>100</sub> Note 3
$11\ 040 < f < 12\ 040$	-93.5	-93.5 dBm/Hz peak
<p><b>Note 1:</b> The 0 to 4 kHz band total power measurement is in 600 Ω.</p> <p><b>Note 2:</b> Above 25.875 kHz, the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p> <p><b>Note 3:</b> The power in a 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.</p>		

## APPENDIX H DEPLOYMENT CLASS 6f

Table H-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6f network systems. The termination impedance for Deployment Class 6f is 100 Ω. A typical technology is ADSL FD Limited Carriers.

**TABLE H-1**

**Test criteria and Reference Documents for Deployment Class 6f**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	16.7 dBm with power cutback in accordance with Table C-2	G.992.1 Clause A.1.2.3.3 and power cutback in accordance with G.992.1 Clauses 10.4.5.1 and A.3.1
	Frequency range	25.875 to 610 kHz	G.992.1 Clause.A.1.2.3.3 Note1
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		Table H-2 with a flat power cutback in accordance with Table C-2	G.992.1 Clause. A.1.3 with maximum tone of 140 (610kHz) Maximum power in the 0 to 4kHz band is relaxed to -10dBm <sub>600Ω</sub>
Line code		Not applicable	G.992.1 Clause 7.7, 7.8 or 7.9, 7.10, 7.11
Longitudinal balance	Level	40dB	G.992.1 Clause A 4.3.1
	Frequency range	30kHz to 1104kHz	G.992.1 Clause A 4.3.1
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50 dBV in any 4 kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE H-2**  
**PSD mask and Testing Requirements for Deployment Class 6f (Group A)**

Frequency band $f$ (kHz)	PSD (dBm/Hz) Note 2	Testing Requirements
$0 < f < 4$	-97.5	PSD and Wideband Power < -10 dBm <sub>600Ω</sub> Note 1
$4 \leq f < 80$	$-96 + 4.63 \times \log_2 ( f / 4 )$	PSD
$80 \leq f < 138$	$-76 + 36 \times \log_2 ( f / 80 )$	PSD
$138 \leq f < 610$	-40	PSD
$610 < f < 1709$	$-40 - 36 \times \log_2 ( f / 610 )$	PSD
$1709 \leq f < 4545$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1 \text{ MHz}]$ window of $(-36.5 - 36 \times \log_2 ( f / 11040 ) + 60)$ dBm <sub>100</sub> Note 3
$4545 \leq f < 11040$	-93.5	-93.5 dBm/Hz peak and max power in the $[f, f + 1 \text{ MHz}]$ window of -50 dBm <sub>100</sub> Note 3
$11040 \leq f < 12040$	-93.5	-93.5 dBm/Hz peak
<p><b>Note 1:</b> The 0 to 4 kHz band total power measurement is in 600 Ω.</p> <p><b>Note 2:</b> Above 25.875 kHz, the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p> <p><b>Note 3:</b> The power in a 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.</p>		

**APPENDIX I DEPLOYMENT CLASS 7b**

Deployment Class Removed in revising ACIF C559:2003.  
A typical technology was SDSL.

## APPENDIX J DEPLOYMENT CLASSES 9a to 9h

Table J-1 provides the Group A and Group B test criteria for Deployment Classes 9a, 9b, 9c, 9d, 9e, 9f, 9g and 9h. The termination impedance for Deployment Classes 9a to 9h is 135 Ω. A typical technology is SHDSL for the 16-TCPAM rates and ESHDSL for the 32-TCPAM rates.

**TABLE J-1**  
**Test criteria and Reference Documents for**  
**Deployment Classes 9a to 9h**

Parameter	Sub-parameter	Group A	Group B
Total average power	Level	see Table J-2.	see Table J-2
	Frequency range	0 Hz to 1.5 MHz	0 Hz to 1.5 MHz
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		Table J-3.	For Deployment Class 9b see Table J-4.  For Deployment Classes 9a, 9c, 9d, 9e, 9f, 9g and 9h, see ITU-T G.991.2 Section B.4. (Table J-4 lists the testing requirements)
Line code		Not applicable	Trellis Coded Pulse Amplitude Modulation
Longitudinal balance	Level	40 dB from 20 kHz to $f_{sym}/2$ kHz, with a slope of 20 dB/decade below 20 kHz and -20dB/decade above $f_{sym}/2$ .	40 dB from 20 kHz to $f_{sym}/2$ kHz, with a slope of 20 dB/decade below 20 kHz and -20 dB/decade above $f_{sym}/2$ kHz.  Note: $f_{sym}$ is the symbol rate on the line.
	Frequency Range	20 kHz to 2000 kHz	20 kHz to 2000 kHz
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50 dBV in any 4 kHz band
	Frequency Range	20 kHz to 450 kHz	20 kHz to 450 kHz



**TABLE J-2**  
**List of Parameters for Deployment Classes 9a to 9h**

Class	$f_{sym}$ (k symbols/sec)	Power (dBm)	K	16-TCPAM Payload Rate (kbps)	32-TCPAM Payload Rate (kbps) see Note 1
9a	$66.6 \leq f_{sym} \leq 194.7$	14.0	7.86	$192 \leq PR \leq 576$	N/A
9b	$66.6 < f_{sym} < 194.7$	14.0	7.86	$192 \leq PR \leq 576$	N/A
	$194 \leq f_{sym} < 261.4$	10.5	3.51	$576 < PR \leq 776$	$768 \leq PR \leq 1032$
9c	$66.6 < f_{sym} < 261.4$	14.0	7.86	$192 \leq PR \leq 776$	$768 \leq PR \leq 1032$
9d	$66.6 < f_{sym} < 389.4$	14.0	7.86	$192 \leq PR \leq 1160$	$768 \leq PR \leq 1544$
9e	$66.6 < f_{sym} < 517.4$	14.0	7.86	$192 \leq PR \leq 1544$	$768 \leq PR \leq 2056$
9f	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} \leq 688$	15.0	9.9	$2048 < PR \leq 2056$	$2728 < PR \leq 2744$
9g	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 773.4$	15.0	9.9	$2048 < PR \leq 2312$	$2728 < PR \leq 3080$
9h	$66.6 < f_{sym} < 602.6$	14.0	7.86	$192 \leq PR \leq 1800$	$768 \leq PR \leq 2400$

**Note 1:** For Group A testing requirements for equipment using 32-TCPAM line code refer to Table K-3.

**TABLE J-3**

**PSD mask and Testing Requirements for Deployment Classes 9a to 9h (Group A) using 16-TCPAM**

Frequency	PSDMASK (f) in dBm/Hz	Testing Requirements
$f < f_{int}$	$10 \times \log_{10} \left[ \frac{K}{135} \times \frac{1}{f_{sym}} \times \frac{\left[ \sin \left( \frac{\pi f}{N f_{sym}} \right) \right]^2}{\left( \frac{\pi f}{N f_{sym}} \right)^2} \times \frac{1}{1 + \left( \frac{f}{f_{3dB}} \right)^{2 \times \text{Order}}} \right]$	PSD
$f_{int} \leq f \leq 1500 \text{ kHz}$	$10 \times \log_{10} [1.7971 \times 10^{-6} \times f^{-1.5}]$	PSD
$1500 \text{ kHz} < f \leq 11040 \text{ kHz}$	-110	-90 dBm/Hz peak; and Maximum power in the [f, f + 1 MHz] window of -50 dBm
$11040 \text{ kHz} < f \leq 12040 \text{ kHz}$	-110	-90 dBm/Hz peak

where:

Order = 6      N = 1      K is defined in Table J-2 above       $f_{3dB} = f_{sym}/2$

PSDMASK(f) is in dBm/Hz, f is in kHz

$f_{int}$  is the frequency where the two equations governing PSDMASK(f) intersect, in kHz.

For each data rate at which the equipment can operate, it shall not exceed the PSDMASK generated by choosing a value of  $f_{sym}$  which need not be related to the actual CE parameters but may be any value in the range listed in Table J-2 for the relevant Deployment Class. Because the Group A requirement permits such wide freedom to choose any  $f_{sym}$  value in the prescribed range, a party submitting equipment for test under Group A should provide to the test laboratory a detailed list of operating modes and corresponding  $f_{sym}$  values to use in generating the compliance masks.

The PSD shall be measured with a resolution bandwidth less than or equal to 10kHz. Large PSD variations over narrow frequency intervals (for example near the junction of the main lobe with the noise floor) might require a smaller resolution bandwidth (RBW) to be used. An appropriate way would be to choose RBW such that there is no more than 1 dB change in the signal PSD across the RBW.

The power in the 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.

**TABLE J-4**

**PSD mask for Deployment Class 9b (Group B)**

**Note:** For systems tested under Group B for Deployment Classes 9a, 9c, 9d, 9e, 9f, 9g and 9h:

- (i) this table is informative only, and
- (ii) refer to ITU-T Recommendation G.991.2 Section B.4

$$\text{PSDMASK}(f) = 10 \times \log_{10} \begin{cases} \frac{K}{135} \times \frac{1}{f_{\text{sym}}} \times \frac{\left[ \sin\left(\frac{\pi f}{N f_{\text{sym}}}\right) \right]^2}{\left(\frac{\pi f}{N f_{\text{sym}}}\right)^2} \times \frac{1}{1 + \left(\frac{f}{f_{3\text{dB}}}\right)^{2 \times \text{Order}}} \times 10^{\frac{\text{MaskOffsetdB}(f)}{10}}, & f < f_{\text{int}} \\ 1.7971 \times 10^{-6} \times f^{-1.5} & , f_{\text{int}} \leq f \leq 1500 \text{ kHz} \end{cases}$$

PSDMASK (f) = -90 peak (Max power in the [f, f + 1 MHz] window of -50 dBm) , 1500 kHz < f ≤ 11040 kHz

PSDMASK (f) = -90 peak, 11040 kHz < f ≤ 12040 kHz

where:

$$\text{MaskOffsetdB}(f) = \begin{cases} 1 + 0.4 \times \frac{f_{3\text{dB}} - f}{f_{3\text{dB}}}, & f < f_{3\text{dB}} \\ 1 & , f \geq f_{3\text{dB}} \end{cases}$$

Order = 6

N = 1

K is defined in Table J-2 above

$$f_{3\text{dB}} = f_{\text{sym}}/2$$

PSDMASK(f) is in dBm/Hz, f is in kHz.

$f_{\text{int}}$  is the frequency where the two equations governing PSDMASK(f) intersect, in kHz.

$$f_{\text{sym}} = (\text{payload kbit rate} + \text{overhead kbit rate}) / (\text{number of bits per symbol})$$

The 16-TCPAM constellation has 3 bits per symbol while the 32-TCPAM constellation has 4 bits per symbol.

The PSD shall be measured with a resolution bandwidth less than or equal to 10kHz. Large PSD variations over narrow frequency intervals (for example near the junction of the main lobe with the noise floor) might require a smaller resolution bandwidth (RBW) to be used. An appropriate way would be to choose RBW such that there is no more than 1 dB change in the signal PSD across the RBW.

The power in the 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.

## APPENDIX K DEPLOYMENT CLASSES 9i to 9q

Table K-1 provides the Group A and Group B test criteria for Deployment Classes 9i, 9j, 9k, 9l, 9m, 9n, 9o, 9p and 9q. The termination impedance for Deployment Classes 9i to 9q is 135 Ω. A typical technology is ESHDSL.

**TABLE K-1**  
**Test criteria and Reference Documents for**  
**Deployment Classes 9i to 9q**

Parameter	Sub-parameter	Group A	Group B
Total average power	Level	see Table K-2	see Table K-2
	Frequency range	0 Hz to 2.0 MHz	0 Hz to 2.0 MHz
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		Table K-3.	G.992.2 Clause G.4 Note: Refer to Table K-4 for information on the PSD mask parameters for Group B.
Line code		Not applicable	Trellis Coded Pulse Amplitude Modulation
Longitudinal balance	Level	40 dB from 20 kHz to $f_{sym}/2$ kHz, with a slope of 20 dB/decade below 20 kHz and -20dB/decade above $f_{sym}/2$ .	40 dB from 20 kHz to $f_{sym}/2$ kHz, with a slope of 20 dB/decade below 20 kHz and -20 dB/decade above $f_{sym}/2$ kHz. Note: $f_{sym}$ is the symbol rate on the line.
	Frequency Range	20 kHz to 2000 kHz	20 kHz to 2000 kHz
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50 dBV in any 4 kHz band
	Frequency Range	20 kHz to 450 kHz	20 kHz to 450 kHz

**TABLE K-2**  
**List of Parameters for Deployment Classes 9i to 9q**

Class	$f_{sym}$ (k symbols/sec)	Power (dBm)	$K_{SHDSL}$	16-TCPAM Payload Rate (kbps)	32-TCPAM Payload Rate (kbps)
9i	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 877.3$	15.0	9.9	$2048 < PR \leq 2624$	$2728 < PR \leq 3496$
9j	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 962.7$	15.0	9.9	$2048 < PR \leq 2880$	$2728 < PR \leq 3840$
9k	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 1026.7$	15.0	9.9	$2048 < PR \leq 3072$	$2728 < PR \leq 4096$
9l	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 1090.7$	15.0	9.9	$2048 < PR \leq 3264$	$2728 < PR \leq 4352$
9m	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 1154.7$	15.0	9.9	$2048 < PR \leq 3456$	$2728 < PR \leq 4608$
9n	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 1218.7$	15.0	9.9	$2048 < PR \leq 3648$	$2728 < PR \leq 4864$
9o	$66.6 < f_{sym} < 685.4$	14.0	7.86	$192 \leq PR \leq 2048$	$768 \leq PR \leq 2728$
	$685.4 < f_{sym} < 1282.7$	15.0	9.9	$2048 < PR \leq 3840$	$2728 < PR \leq 5120$
9p	$194 \leq f_{sym} \leq 684$	14.0	7.86	N/A	$768 \leq PR \leq 2728$
	$684 < f_{sym} \leq 1346$	15.0	9.9	N/A	$2728 < PR \leq 5376$
9q	$194 \leq f_{sym} \leq 684$	14.0	7.86	N/A	$768 \leq PR \leq 2728$
	$684 < f_{sym} \leq 1426$	15.0	9.9	N/A	$2728 < PR \leq 5696$

**TABLE K-3**

**PSD mask and Testing Requirements for:  
Deployment Classes 9i to 9q (Group A) and  
for Deployment Classes 9a to 9h (Group A) using 32-TCPAM**

**Note 1: Refer to Table J-3 for Group A testing requirements at 16-TCPAM line rates below 2312kbps.**

Frequency	PSDMASK (f) in dBm/Hz	Testing Requirements
$f < f_{int}$	$10 \times \log_{10} \left[ \frac{K_{SHDSL}}{R_s} \times \frac{1}{f_{sym}} \times \frac{\left[ \sin\left(\frac{\pi f}{f_{sym}}\right) \right]^2}{\left(\frac{\pi f}{f_{sym}}\right)^2} \times \frac{1}{1 + \left(\frac{f}{f_{3dB}}\right)^{2 \times Order}} \times \frac{f^2}{f^2 + f_c^2} \right]$	PSD
$f_{int} \leq f \leq 3184 \text{ kHz}$	$10 \times \log_{10} [1.7971 \times 10^{-6} \times f^{-1.5}]$	PSD
$3184 \text{ kHz} < f \leq 11040 \text{ kHz}$	-110	-90 dBm/Hz peak; and Maximum power in the [f, f + 1 MHz] window of -50 dBm
$11040 \text{ kHz} < f \leq 12040 \text{ kHz}$	-110	-90 dBm/Hz peak

where:

$K_{shdsl}$  and  $f_{sym}$  are defined in Table K-2  $R_s = 135 \Omega$

$f_c$  is the transformer cut-off frequency, assumed to be 5 kHz

$f_{int}$  = lowest frequency above f3dB where the expressions for P1 (f) and P2(f) intersect

$f_{max} = 11040 \text{ MHz}$     Order = 6    N = 1    K is defined in Table K-2 above     $f_{3dB} = f_{sym}/2$

PSDMASK(f) is in dBm/Hz, f is in kHz.

$f_{int}$  is the frequency where the two equations governing PSDMASK(f) intersect, in kHz.

For each data rate at which the equipment can operate, it shall not exceed the PSDMASK generated by choosing a value of  $f_{sym}$  which need not be related to the actual CE parameters but may be any value in the range listed in Table K-2 for the relevant Deployment Class. Because the Group A requirement permits such wide freedom to choose any  $f_{sym}$  value in the prescribed range, a party submitting

equipment for test under Group A should provide to the test laboratory a detailed list of operating modes and corresponding  $f_{\text{sym}}$  values to use in generating the compliance masks.

The PSD shall be measured with a resolution bandwidth less than or equal to 10kHz. Large PSD variations over narrow frequency intervals (for example near the junction of the main lobe with the noise floor) might require a smaller resolution bandwidth (RBW) to be used. An appropriate way would be to choose RBW such that there is no more than 1 dB change in the signal PSD across the RBW

**TABLE K-4**  
**PSD mask for Deployment Classes 9i to 9q**  
**(Group B)**

**Note:** The equation below is for information only. Refer to ITU-T Recommendation G.991.2 Section G.4 for the Group B requirements for PSDMASK under Deployment Classes 9i to 9q.

PSDMASK<sub>SHDSL</sub>(f) =

$P_1(f) = 10 \log_{10} \left[ \frac{K_{SDSL}}{R_s} \times \frac{1}{f_{sym}} \times \frac{\left[ \sin\left(\frac{\pi f}{f_{sym}}\right) \right]^2}{\left(\frac{\pi f}{f_{sym}}\right)^2} \times \frac{1}{1 + \left(\frac{f}{f_{3dB}}\right)^{2 \times Order}} \times 10^{\frac{MaskOffsetdB(f)}{10}} \right] \text{ [dBm/Hz]}$	f < f <sub>int</sub>
<p>P<sub>2</sub>(f) = -90 dBm/Hz peak with maximum power in a [f, f + 1 MHz] window of [10 * log<sub>10</sub>(0,5683 × 10<sup>-4</sup> × f<sup>-1,5</sup>) + 90] dBm</p>	f <sub>int</sub> ≤ f ≤ 3,184 MHz
<p>P<sub>3</sub>(f) = -90 dBm/Hz peak with maximum power in a [f, f + 1 MHz] window of -50 dBm</p>	3,184 MHz < f ≤ f <sub>max</sub>
<p>P<sub>4</sub>(f) = -90 dBm/Hz peak</p>	11040 kHz < f ≤ 12040 kHz

where:

PBO = the Power Back-Off value in dB, as defined in Table K-3

K<sub>SHDSL</sub> and f<sub>sym</sub> are defined in Table K-2

f = frequency in Hz

R<sub>s</sub> = 135 Ω

$$MaskOffsetdB(f) = \begin{cases} 1 + 0,4 \times \frac{f_{3dB} - f}{f_{3dB}} & \text{[dB], } f < f_{3dB} \\ 1 & \text{[dB], } f \geq f_{3dB} \end{cases}$$

f<sub>int</sub> = lowest frequency above f<sub>3dB</sub> where the expressions for P<sub>1</sub>(f) and P<sub>2</sub>(f) intersect

f<sub>max</sub> = 11.040 MHz

Order = 6; N = 1; f<sub>3dB</sub> = f<sub>sym</sub>/2

PSDMASK<sub>SHDSL</sub>(f) is in dBm/Hz, f is in kHz.

f<sub>sym</sub> = (payload kbit rate + overhead kbit rate)/(number of bits per symbol)

The 16-TCPAM constellation has 3 bits per symbol while the 32-TCPAM constellation has 4 bits per symbol.

The PSD shall be measured with a resolution bandwidth less than or equal to 10kHz. Large PSD variations over narrow frequency intervals (for example near the junction of the main lobe with the noise floor) might require a smaller resolution bandwidth (RBW) to be used. An appropriate way would be to choose RBW such that there is no more than 1 dB change in the signal PSD across the RBW.

The power in the 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.



## APPENDIX L DEPLOYMENT CLASS 6g

Table L-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6g network systems. The termination impedance for Deployment Class 6g is 100  $\Omega$ . A typical technology is Reach Extended ADSL2.

**TABLE L-1**

**Test criteria and Reference Documents for Deployment Class 6g**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	19.9 dBm.	G.992.3 Clause.L.1.3.2
	Frequency range	138 to 552 kHz	G.992.3 Clause.L.1.3
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table L-2	G.992.3 Clause L.1.3. Maximum power in the 0 to 4kHz band is relaxed to $-10\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.3 Clause 8.6.
Longitudinal balance	Level	40dB	G.992.3 Clause A 4.3.3.1
	Frequency range	30kHz to 1104kHz	G.992.3 Clause A 4.3.3.1
Longitudinal output voltage	Level	-50dBv in any 4kHz band	-50dBv in any 4kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE L-2**  
**PSD mask and Testing Requirements for Deployment**  
**Class 6g (Group A)**

Frequency band f (kHz)	PSD (dBm/Hz) Note 2	Testing Requirements
$0 < f < 4$	-101.5	PSD and Wideband Power < -10 dBm <sub>600Ω</sub> Note 1
$4 \leq f < 80$	$-96 + 4.63 \times \log_2 ( f / 4 )$	PSD
$80 \leq f < 138$	$-76 + 36 \times \log_2 ( f / 80 )$	PSD
$138 < f \leq 276$	$-40 + 0.0214 \times ( f - 138 )$	PSD
$276 < f \leq 552$	-37	PSD
$552 < f \leq 1012$	$-37 - 36 \times \log_2( f / 552 )$	PSD
$1012 < f \leq 1800$	-68.5	PSD
$1800 < f \leq 2290$	$-68.5 - 72 \times \log_2( f / 1800 )$	PSD
$2290 < f \leq 3093$	-93.5	PSD
$3093 < f \leq 4\ 545$	$-40 - 36 \times \log_2 ( f / 1104 )$	-90 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of $(-36.5 - 36 \times \log_2(f / 1\ 104) + 60)$ dBm <sub>100</sub> Note 3
$4\ 545 < f < 11\ 040$	-113.5	-90 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of -50 dBm <sub>100</sub> Note 3
$11\ 040 < f < 12000$	-113.5	-93.5 dBm/Hz peak
<p><b>Note 1:</b> The 0 to 4 kHz band total power measurement is in 600 Ω.</p> <p><b>Note 2:</b> Above 25.875 kHz, the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p> <p><b>Note 3:</b> The power in a 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.</p>		

## APPENDIX M DEPLOYMENT CLASS 6h

Table M-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6h network systems. The termination impedance for Deployment Class 6h is 100  $\Omega$ . A typical technology is ADSL2 or ADSL2+.

**TABLE M-1**

**Test criteria and Reference Documents for Deployment Class 6h**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	19.9 dBm with power cutback in accordance with Table C-2	G.992.5 Clause A.1.3.2 and power cutback in accordance with G.992.1 Clauses 10.4.5.1 and A.3.1
	Frequency range	25.875 to 2208 kHz	G.992.5 Clause.A.1.3
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table M-2 with a flat power cutback in accordance with Table C-2	G.992.5 Clause. A.1.3 Maximum power in the 0 to 4kHz band is relaxed to $-10\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.5 Clauses 7 & 8
Longitudinal balance	Level	40dB	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1
	Frequency range	30kHz to 2208kHz	G.992.5 Clause A 4
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50 dBV in any 4 kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE M-2**  
**PSD mask and Testing Requirements for Deployment**  
**Class 6h (Group A)**

Frequency band $f$ (kHz)	PSD (dBm/Hz in Narrow Resolution Bandwidth) Note 1	Testing Requirements
$0 < f \leq 4$	- 101	PSD
$4 < f \leq 80$	$- 96 + 4.63 \times \log_2 ( f / 4 )$	PSD
$80 < f \leq 138$	$- 76 + 36 \times \log_2 ( f / 80 )$	PSD
$138 < f \leq 1104$	- 40	PSD
$1104 < f \leq 1622$	$- 40 - 18 \times \log_2( f / 1104 )$	PSD
$1622 < f \leq 2208$	$- 50 - 3 \times \log_2( f / 1622 )$	PSD
$2208 < f \leq 2500$	$- 51.3 - 65 \times \log_2( f / 2208 )$	PSD
$2500 < f \leq 3001.5$	$- 62.9 - 78 \times \log_2( f / 2500 )$	PSD
$3001.5 < f \leq 3175$	$- 83.5 - 203.5 \times \log_2( f / 3001.5 )$	PSD
$3175 < f < 3750$	-100	PSD
$3750 < f \leq 4\ 545$	$- 100 - 36 \times \log_2( f / 3750 )$	-100 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of $- 40 - 36 \times \log_2( f / 3750 )$ dBm <sub>100</sub> Note 3
$4\ 545 < f \leq 7225$	$-110 - 3 \times \log_2( f / 4545 )$	-100 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of $-110 - 3 \times \log_2( f / 4545 )$ dBm <sub>100</sub> Note 3
$7225 < f \leq 12000$	-112	-100 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of -112 dBm <sub>100</sub> Note 3
<p><b>Note 1:</b> Below 25.875 kHz the peak PSD shall be measured with a 100 Hz resolution bandwidth. Above 25.875 kHz the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p>		

## APPENDIX N DEPLOYMENT CLASS 6i

Table N-1 provides the Group A and Group B test criteria and referenced documents for Deployment Class 6i network systems. The termination impedance for Deployment Class 6i is 100  $\Omega$ . A typical technology is All digital Mode ADSL2+.

**TABLE N-1**

**Test criteria and Reference Documents for Deployment Class 6i**

Parameter	Sub-parameter	Group A (Value)	Group B
Total average power	Level	19.9 dBm with Power Cutback in accordance with Table C-2	G.992.5 Clauses I.1.3 and A.1.3.2. Power Cutback in accordance with G.992.1 Clauses 10.4.5.1 and A.3.1
	Frequency range	138 to 2208 kHz	G.992.5 Clause I.1.3
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask		Table N-2 with flat power cutback in accordance with Table C-2	G.992.5 Clauses I.1.3 and A.1.3
Line code		Not applicable	G.992.5 Clause 8.8.
Longitudinal balance	Level	40dB	G.992.5 Clause A.4 and G.992.3 Clause A 4.3.3.1
	Frequency range	30kHz to 2208kHz	G.992.5 Clause A 4
Longitudinal output voltage	Level	-50dBv in any 4kHz band	-50dBv in any 4kHz band
	Frequency range	As per longitudinal balance	As per longitudinal balance

**TABLE N-2**  
**PSD mask and Testing Requirements for**  
**Deployment Class 6i (Group A)**

Frequency band f (kHz)	PSD (dBm/Hz in Narrow Resolution Bandwidth) Note 1	Testing Requirements
$0 < f \leq 4$	- 97.5	PSD
$4 < f \leq 80$	$- 96 + 4.63 \times \log_2 ( f / 4 )$	PSD
$80 < f \leq 138$	$- 76 + 36 \times \log_2 ( f / 80 )$	PSD
$138 < f \leq 1104$	- 40	PSD
$1104 < f \leq 1622$	$- 40 - 18 \times \log_2( f / 1104 )$	PSD
$1622 < f \leq 2208$	$- 50 - 3 \times \log_2( f / 1622 )$	PSD
$2208 < f \leq 2500$	$- 51.3 - 65 \times \log_2( f / 2208 )$	PSD
$2500 < f \leq 3001.5$	$- 62.9 - 78 \times \log_2( f / 2500 )$	PSD
$3001.5 < f \leq 3175$	$- 83.5 - 246.7 \times \log_2( f / 3001.5 )$	PSD
$3175 < f < 3750$	-100	PSD
$3750 < f \leq 4\ 545$	$-100 - 36 \times \log_2( f / 3750 )$	-100 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of $-40 - 36 \times \log_2( f / 3750 )$ dBm <sub>100</sub> Note 3
$4\ 545 < f \leq 7225$	$-110 - 3 \times \log_2( f / 4545 )$	-100 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of $-50 - 3 \times \log_2( f / 4545 )$ dBm <sub>100</sub> Note 3
$7225 < f < 12000$	-112	-100 dBm/Hz peak and Max power in the [f, f + 1 MHz] window of -52 dBm <sub>100</sub> Note 3
<p><b>Note 1:</b> Below 25.875 kHz the peak PSD shall be measured with a 100 Hz resolution bandwidth. Above 25.875 kHz the peak PSD shall be measured with a 10 kHz resolution bandwidth.</p>		

## APPENDIX O DEPLOYMENT CLASS 5b

Table C1 provides the Group A and Group B test criteria for Deployment Class 5b. The test termination impedance for Deployment Class 5b is 135  $\Omega$ . A typical technology is SHDSL with modified roll-off and reduced power.

**TABLE O1**  
**Test criteria for**  
**Deployment Class 5b**

Parameter		Group A	Group B
Total average power	Level	14 dBm	14 dBm
	Frequency range	0 Hz to 1100 kHz	0 Hz to 1100 kHz
	Averaging time	$\geq 10$ s	$\geq 10$ s
PSD mask	–	Table O-2	Table O-3
Line code	–	Not applicable	Trellis Coded Pulse Amplitude Modulation
Longitudinal balance	Level	40 dB from 20 kHz to 131 kHz, with a slope of 20 dB/decade below 20 kHz and -20 dB/decade above 131 kHz	40 dB from 20 kHz to $f_{\text{sym}}/2$ kHz, with a slope of 20 dB/decade below 20 kHz and -20 dB/decade above $f_{\text{sym}}/2$ kHz
	Frequency Range	20 kHz to 2000 kHz	20 kHz to 2000 kHz
Longitudinal output voltage	Level	-50 dBV in any 4 kHz band	-50 dBV in any 4 kHz band
	Frequency Range	20 kHz to 450 kHz	20 kHz to 450 kHz

**Note:**  $f_{\text{sym}}$  is the symbol rate or baud rate on the line.

**TABLE O2**  
**PSD mask and Testing Requirements for Deployment Class 5b (Group A)**

Frequency	PSDMASK (f) in dBm/Hz	Testing Requirements
$f < f_{int}$	$10 \times \log_{10} \left[ \frac{K}{135} \times \frac{1}{f_{sym}} \times \frac{\left[ \sin \left( \frac{\pi f}{N f_{sym}} \right) \right]^2}{\left( \frac{\pi f}{N f_{sym}} \right)^2} \times \frac{1}{1 + \left( \frac{f}{f_{3dB}} \right)^{2 \times \text{Order}}} \right]$	PSD
$f_{int} \leq f \leq 1500 \text{ kHz}$	$10 \times \log_{10} \left[ 1.7971 \times 10^{-6} \times f^{-1.5} \right]$	PSD
$1500 \text{ kHz} < f \leq 11040 \text{ kHz}$	-110	-90 dBm/Hz peak; and Maximum power in the [f, f + 1 MHz] window of -50 dBm
$11040 \text{ kHz} < f \leq 12040 \text{ kHz}$	-110	-90 dBm/Hz peak

where:

PSDMASK(f) is in dBm/Hz, f is in kHz.  $f_{sym}$  (kbaud) = 66.6 to 261.4, K = 3.51, Order = 3, N = 1,  $f_{3dB}$  (kHz) =  $1.0 \times f_{sym}/2$

$f_{int}$  is the frequency where the two equations governing PSDMASK(f) intersect, in kHz.

For each data rate at which the equipment can operate, it **shall not** exceed the PSDMASK generated by choosing a value of  $f_{sym}$  which need not be related to the actual CE parameters but may be any value between 66.6 kbaud and 261.4 kbaud. Because the Group A requirement permits such wide freedom to choose any  $f_{sym}$  value in the prescribed range, a party submitting equipment for test under Group A should provide to the test laboratory a detailed list of operating modes and corresponding  $f_{sym}$  values to use in generating the compliance masks.

The PSD **shall** be measured with a 10 kHz resolution bandwidth. Large PSD variations over narrow frequency intervals (for example near the junction of the main lobe with the noise floor) might require a smaller resolution bandwidth (RBW) to be used. An appropriate way would be to choose RBW such that there is no more than 1 dB change in the signal PSD across the RBW.

The power in the 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.



**TABLE O3**  
**PSD mask for Deployment Class 5b (Group B)**

$$\text{PSDMASK}(f) = 10 \times \log_{10} \left\{ \begin{array}{ll} \frac{K}{135} \times \frac{1}{f_{\text{sym}}} \times \frac{\left[ \sin\left(\frac{\pi f}{N f_{\text{sym}}}\right) \right]^2}{\left(\frac{\pi f}{N f_{\text{sym}}}\right)^2} \times \frac{1}{1 + \left(\frac{f}{f_{3\text{dB}}}\right)^{2 \times \text{Order}}} \times 10^{\frac{\text{MaskOffsetdB}(f)}{10}}, & f < f_{\text{int}} \\ 1.797 \times 10^{-6} \times f^{-1.5} & , f_{\text{int}} \leq f \leq 1500 \text{ kHz} \end{array} \right.$$

PSDMASK (f) = -90 peak (Max power in the [f, f + 1 MHz] window of -50 dBm), 1500 kHz < f ≤ 11040 kHz  
 PSDMASK (f) = -90 peak, 11040 kHz < f ≤ 12040 kHz

where:

$$\text{MaskOffsetdB}(f) = \begin{cases} 1 + 0.4 \times \frac{f_{3\text{dB}} - f}{f_{3\text{dB}}}, & f < f_{3\text{dB}} \\ 1, & f \geq f_{3\text{dB}} \end{cases}$$

PSDMASK(f) is in dBm/Hz, f is in kHz.

$f_{\text{int}}$  is the frequency where the two equations governing PSDMASK(f) intersect, in Hz.

$f_{\text{sym}} = (\text{payload kbit rate} + \text{overhead kbit rate}) / (\text{number of bits per symbol})$

The PSD **shall** be measured with a 10 kHz resolution bandwidth. Large PSD variations over narrow frequency intervals (for example near the junction of the main lobe with the noise floor) might require a smaller resolution bandwidth (RBW) to be used. An appropriate way would be to choose RBW such that there is no more than 1 dB change in the signal PSD across the RBW..

The power in the 1 MHz sliding window is measured in a 1 MHz bandwidth, starting at the measurement frequency.

$f_{\text{sym}}$ (kbaud)	K	Order	N	$f_{3\text{dB}}$ (kHz)
66.6 to 261.4	3.51	3	1	$1.0 \times f_{\text{sym}}/2$

**Care should be taken to ensure that material used is from the current version of the Standard or Industry Code and that it is updated whenever the Standard or Code is amended or revised. The number and date of the Standard or Code should therefore be clearly identified. If in doubt please contact ACIF.**

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*Published by:*

**THE AUSTRALIAN COMMUNICATIONS INDUSTRY FORUM  
LTD**

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