

NEW ZEALAND

COPPER LOCAL LOOP

INTERFERENCE MANAGEMENT PLAN

PART 3

REQUIREMENTS FOR DEPLOYMENT CLASS SYSTEMS

DECEMBER 2007

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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 the MPF. 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 obligation described in section 8.2 of Part 1 of this IMP. 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 IMP is through satisfying the Deployment Classes and Deployment Rules as in Clause 8.3 of Part 1 of this IMP, and do not apply when the alternative method of compliance in Clause 8.4 of Part 1 of this IMP is used.
- 1.3 The Deployment Classes and Deployment Rules:
- (a) list the technologies that have been taken into account in determining deployment class characteristics that systems must meet under the IMP;
 - (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) 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 international standards.
- 1.4 Not all available technologies are represented in the Deployment Classes.
- NOTE: A 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 of this IMP.*
- 1.5 The use of a Deployment Class for other technology types is not restricted, provided the operation of the system complies with the aggregate transmit power and PSD 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 Service Provider 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 MPF.

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 PEFUT 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 Clause 8.2 of Part 1 of this IMP.

NOTE: Clause 8.2 prohibits a 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 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 'Nominal' and 'Compliance' 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, which in turn may reference the respective international standard.

2.2 Nominal and Compliance 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) Nominal requirements, which specifies the requirements for operation of the Deployment Class system;

(b) Compliance requirements, 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 Nominal requirements or Compliance 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 Compliance requirements are taken from the ITU-T standard 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 Compliance requirements in this Industry Code. Nominal requirements, which correspond to tighter (i.e. lower) PSD masks than the Compliance requirements, are available as an alternative path for compliance of systems which cannot comply with the line code aspect of the Compliance requirements.

2.3 Total Aggregate Transmit Power

- 2.3.1 The total aggregate transmit power at the MPF-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 aggregate transmit power is as specified in Appendix B in Part 1 of this IMP.

2.4 Power Spectral Density (PSD)

- 2.4.1 The PSD at the MPF-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.
- 2.4.2 The methodology for the measurement of the PSD is as specified in Appendix B in Part 1 of this IMP.

2.5 Line Code

- 2.5.1 The system line code shall comply with the Compliance requirements of the applicable Deployment Class. Systems utilising different line codes from that defined in the class standard meets the requirements provided the system fully complies with both PSD spectral mask and the maximum aggregate power as specified for that class.

2.6 Longitudinal Balance

- 2.6.1 The longitudinal balance of the system towards the Service Provider 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

$$\text{Longitudinal Balance (dB)} = 20\log |V_i/V_m|$$

where: V_m is the metallic or differential voltage

V_i 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 of this IMP.

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 Ω in series with 0.15 μ 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 of this IMP.

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 an MPF shall be calculated using the formulae of Appendix A to Part 1 of this IMP.
- 2.8.4 A system belonging to a Spectrally Asymmetric Deployment Class shall not be fed from an MPF-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 Service Provider proposing to operate a system from an MPF-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 an MPF shall only apply with respect to the NRP at which the MPF originates.
- 2.8.6 Where Pair Separation is required under a Deployment Rule, the cable pair used for the MPF 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 ITU G992 series Recommendations 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 IMP.

2.10 Use of Two System Types on a single MPF

- 2.10.1 This IMP 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 Service Provider.
- 2.10.2 Where two types of system use the same MPF, the operation of the systems is taken to comply with the obligation in Clause 8.2 in Part 1 of this IMP 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 IMP (i.e. with the other turned off).

APPENDIX A: SUMMARY OF NETWORK DEPLOYMENT CLASSES

Deployment 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)				
1b	Appendix B		Appendix B	Sym-metric Highest	E1 HDB3	1024
4a	Appendix C	Appendix C	Symmetric Lower	ISDN BR 2B1Q	Unlimited	40
6a	Appendix D1	Appendix D2 PTC 270	Asymmetric Lower	ADSL FD with Reduced NEXT	Unlimited. Pair Separation at the Highest NRP from Deployment Class 1b is required.	160
6e	Appendix E	Appendix D2 PTC 273	Asymmetric Lower	ADSL FD Low Power	Unlimited	160
6g	Appendix F1	Appendix F2 PTC 273	Asymmetric Lower	Reach Extended ADSL2 non overlapped spectrum	MIMINUM deployment limit 28.5 dB (equivalent to 3.0 km 0.4 mm PEFUT) – not to be deployed on shorter loops. Pair Separation at the Highest NRP from Deployment Class 1b is required.	160
6h	Appendix G1	Appendix G2 PTC 273	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum	Unlimited Pair Separation at the Highest NRP from Deployment Class 1b is required.	160
6i	Appendix H1	Appendix H2 PTC 273	Asymmetric Lower	All Digital Mode ADSL2+ non overlapped spectrum	Unlimited Pair Separation at the Highest NRP from Deployment Class 1b is required.	160

Deployment 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)				
6j	Appendix G1	Appendix G3 PTC 273	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum with extended upstream bandwidth (Annex M) Mask EU-44	Unlimited Pair Separation from the Highest NRP of Deployment Class 1b is required.	160
6k	Appendix G1	Appendix G3 PTC 273	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum with extended upstream bandwidth (Annex M) Mask EU-52	Deployment Limit 36.1 dB (equivalent to 3.8 km 0.4 mm PEFUT). Pair Separation from the Highest NRP of Deployment Class 1b is required.	160
6l	Appendix G1	Appendix G3 PTC 273	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum with extended upstream bandwidth (Annex M) Mask EU-56	Deployment Limit 33.3 dB (equivalent to 3.5 km 0.4 mm PEFUT). Pair Separation from the Highest NRP of Deployment Class 1b is required.	160
6m	Appendix G1	Appendix G3 PTC 273	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum with extended upstream bandwidth (Annex M) Mask EU-60	Deployment Limit 29.5 dB (equivalent to 3.1 km 0.4 mm PEFUT). Pair Separation from the Highest NRP of Deployment Class 1b is required.	160
6n	Appendix G1	Appendix G3 PTC 273	Asymmetric Lower	ADSL2 or ADSL2+ non overlapped spectrum with extended upstream bandwidth (Annex M) Mask EU-64	Deployment Limit 24.7 dB (equivalent to 2.6 km 0.4 mm PEFUT). Pair Separation from the Highest NRP of Deployment Class 1b is required.	160
8b	Appendix I	Appendix I	Symmetric Highest	HDSL 2B1Q 1168 kbit/s	Deployment Limit 21.9 dB (equivalent to 2.3 km 0.4 mm PEFUT).	160
9d	Appendix J	Appendix J	Symmetric Highest	SHDSL (192 to 1160 kbit/s)	Deployment Limit 39.9 dB (equivalent to 4.2 km 0.4 mm PEFUT).	160
9e	Appendix J	Appendix J	Symmetric Highest	SHDSL (192 to 1544 kbit/s)	Deployment Limit 30.4 dB (equivalent to 3.2 km 0.4 mm PEFUT).	160

Deployment 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)				
9h	Appendix J	Appendix J	Symmetric Highest	SHDSL (192 to 1800 kbit/s)	Deployment Limit 26.6 dB (equivalent to 2.8 km 0.4 mm PEFUT).	160
9f	Appendix J	Appendix J	Symmetric Highest	SHDSL (192 to 2056 kbit/s)	Deployment Limit 22.8 dB (equivalent to 2.4 km 0.4 mm PEFUT).	160
9g	Appendix J	Appendix J	Symmetric Highest	SHDSL (192 to 2312 kbit/s)	Deployment Limit 20.9 dB (equivalent to 2.2 km 0.4 mm PEFUT).	160
9i	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 2624(C-16) kbit/s) or (768(C-32) to 3496(C-32) kbit/s)	Deployment Limit 19.0 dB (equivalent to 2.0 km 0.4 mm PEFUT).	160
9j	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 2880(C-16) kbit/s) or (768(C-32) to 3840(C-32) kbit/s)	Deployment Limit 18.1 dB (equivalent to 1.9 km 0.4 mm PEFUT).	160
9k	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 3072(C-16) kbit/s) or (768(C-32) to 4096(C-32) kbit/s)	Deployment Limit 17.1 dB (equivalent to 1.8 km 0.4 mm PEFUT).	160
9l	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 3264(C-16) kbit/s) or (768(C-32) to 4352(C-32) kbit/s)	Deployment Limit 16.2 dB (equivalent to 1.7 km 0.4 mm PEFUT).	160
9m	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 3456(C-16) kbit/s) or (768(C-32) to 4608(C-32) kbit/s)	Deployment Limit 15.2 dB (equivalent to 1.6 km 0.4 mm PEFUT).	160
9n	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 3648(C-16) kbit/s) or (768(C-32) to 4864(C-32) kbit/s)	Deployment Limit 14.3 dB (equivalent to 1.5 km 0.4 mm PIUT).	160

Deployment 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)				
9o	Appendix K	Appendix K	Symmetric Highest	ESHDSL (192(C-16) to 3840(C-16) kbit/s) or (768(C-32) to 5120(C-32) kbit/s)	Deployment Limit 14.3 dB (equivalent to 1.5 km 0.4 mm PEFUT).	160
9p	Appendix K	Appendix K	Symmetric Highest	ESHDSL (768(C-32) to 5376(C-32) kbit/s)	Deployment Limit 14.3 dB (equivalent to 1.5 km 0.4 mm PEFUT).	160
9q	Appendix K	Appendix K	Symmetric Highest	ESHDSL (768(C-32) to 5696(C-32) kbit/s)	Deployment Limit 13.3 dB (equivalent to 1.4 km 0.4 mm PEFUT).	160

TABLE A-1

Table of Network Deployment Classes

NOTE 1: Unless otherwise indicated, the appendices referred to under 'Network Equipment' and 'Customer Equipment' are contained in Part 3 of this IMP.

NOTE 2: Deleted

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. .

NOTE 7: Deleted

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.

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 160Khz unless otherwise stated

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 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	Nominal Requirements	Compliance Requirements
Total aggregate 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-3	Table B-2
Line code		Not Available	G.703 Clause 9.1, 9.2, Annex A

NOTE 1: Because Deployment Class 1b systems are not directly deployable in this IMP, the Nominal PSD Mask is only used for spectral compatibility assessment of the E1 Basis System.

TABLE B-2

PSD mask for Deployment Class 1b

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

TABLE B-3

Nominal PSD mask for Deployment Class 1b

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

APPENDIX C: DEPLOYMENT CLASS 4a

Table A-11 provides the Nominal and Compliance test criteria and Referenced Documents for Deployment Class 4a. The test termination impedance for Deployment Class 4a is 135 Ω . A typical technology is ISDN BR 2B1Q.

Table C-1

Test criteria and Referenced Documents for Deployment class 4a

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total aggregate power	Level	14 dBm	ITU-T G.961 Appendix II Clause II.12
	Frequency Range	0 Hz to 160 kHz	ITU-T G.961 Appendix II Clause II.12
	Averaging Time	≥ 10 s	≥ 10 s
PSD Mask		Table C-2	ITU-T G.961 Appendix II Clause II.12.4
Line Code		Not Applicable	ITU-T G.961 Appendix II Clause II.1
Longitudinal balance	Level	55 dB from 281.2 Hz to 40 kHz, with a slope of 20 dB/decade below 281.2 Hz and -20 dB/decade above 40 kHz	ITU-T G.961 Appendix II Clause II.13.3.1
	Frequency range	5 Hz to 1 MHz	ITU-T G.961 Appendix II Clause II.13.3.1
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 C-2

PSD mask for Deployment class 4a (Nominal PSD)

Frequency Range, f (kHz)	PSD (dBm/Hz)
$0 < f \leq 25$	-32.5
$25 < f \leq 76$	$-32.5 - 10.35 \times \log_{10}\left(\frac{f}{25}\right)$
$76 < f \leq 79$	$-37.5 - 0.5 \times \left(\frac{f - 76}{3}\right)$
$79 < f \leq 85$	$-38 - 19.6 \times \log_{10}\left(\frac{f - 69}{10}\right)$
$85 < f \leq 100$	$-42 - 4 \times \frac{f - 85}{15}$
$100 < f \leq 115$	$-46 - 7 \times \frac{f - 100}{15}$
$115 < f \leq 120$	-53
$120 < f \leq 225$	$-53 - 55 \times \log_{10}\left(\frac{f}{120}\right)$
$225 < f \leq 635$	$-68 - 70 \times \log_{10}\left(\frac{f}{225}\right)$
$635 < f \leq 30000$	$-143 - 10 \times \log_{10}\left(\frac{(10^3 \times f)^{1.5}}{1.134 \times 10^{13}}\right)$

APPENDIX D1: DEPLOYMENT CLASS 6a Network Equipment

Table D-1 provides the Nominal and Compliance test criteria and referenced documents for Deployment class 6a Network Equipment. The test termination impedance for Deployment class 6a is 100 Ω . A typical technology is ADSL FD with reduced NEXT.

TABLE D-1

Test criteria for Deployment Class 6a Network Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total aggregate power	Level	G992.1 Clause A1.2.3.3 with power cutback applied in accordance with G992.1 A 3.1	G.992.1 Clause.A.1.2.3.3
	Frequency Range	25.875 to 1104 kHz	G.992.1 Clause.A.1.2.3.3
	Averaging Time	≥ 10 s	≥ 10 s
PSD Mask		The nominal PSD defined in G992.1 Clause A1.2.3.3 with no pass band ripple and power cutback applied in accordance with G992.1 A 3.1	G.992.1 Clause A.1.3. Maximum power in the 0 to 4kHz band is relaxed to $-10\text{dBm}_{600\text{ohms}}$
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

APPENDIX D2: Deployment Class 6a and 6e Customer Equipment

Table D-4 provides the Nominal and Compliance test criteria and Referenced Documents for Deployment classes 6a and 6e Customer Equipment. The test termination impedance for Deployment Classes 6a and 6e is 100 Ω . Typical technologies are ADSL FD and ADSL FD with reduced power.

Table D-4

Test criteria for Deployment Class 6a and 6e Customer Equipment

Parameter		Group A	Group B
Total Average Power	Level	G992.1 Clause 2.4.3.1	G.992.1 Clause A.2.4.3.3 [7]
	Frequency range	25.875 kHz to 138 kHz	G.992.1 Clause A.2.4.3.3 [7]
	Averaging time	≥ 10 s	≥ 10 s
PSD Mask	–	The average PSD defined in G992.1 Clause 2.4.3.1 with no pass band ripple.	G.992.1 Clause A.2.4 [5] The maximum power in the 0 to 4 kHz band is to be -65 dBm in place of the -75 dBm (+15 dBm) in G.992.1 [7] (See Note)
Line Code	–	Not applicable	G.992.1 Clauses 8.7, 8.10, 8.11 and either Clause 8.8 or 8.9 [7]
Longitudinal Balance	Level	40 dB	G.992.1 Clause A 4.3.1 [7]
	Frequency Range	30 kHz to 1104 kHz	G.992.1 Clause A 4.3.1 [7]
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

Note: The limit for the maximum power in the 0 to 4 kHz band assumes that the high pass filter is included in CE. If an external splitter or filter is required to meet this requirement, the specification and installation of such a filter is to be detailed in the CE manual.

APPENDIX E: DEPLOYMENT CLASS 6e Network Equipment

Table E-1 provides the Nominal and Compliance test criteria and Referenced Documents for Deployment class 6e Network Equipment. The test termination impedance for Deployment class 6e is 100 Ω . A typical technology is ADSL FD with reduced power.

TABLE E-1

Test criteria for Deployment Class 6e Network Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
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	≥ 10 s	≥ 10 s
PSD mask		The nominal PSD defined in G992.1 Clause A1.2.3.3 with no pass band ripple and the pass band PSD reduced by 10db to -50dBm/Hz	G.992.1 Clause . A.1.3 reduced by 10 dB Maximum power in the 0 to 4kHz band is relaxed to -10dBm _{600ohms}
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 1104 kHz	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

APPENDIX F1: DEPLOYMENT CLASS 6g Network Equipment

Table F-1 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 6g network systems. The termination impedance for Deployment Class 6g is 100 Ω . A typical technology is Reach Extended ADSL2.

TABLE F-1

Test criteria for Deployment Class 6g Network Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G992.3 Clause L.1.3.2 value defined for spectrum management purposes.	G.992.3 Clause.L.1.3.2 and Power Cutback in accordance with G.992.1 Clause 10.4.5.1 and A.3.1
	Frequency range	G.992.3 Clause.L.1.3	G.992.3 Clause.L.1.3
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G 992.3 Clause L 1.3.1Table L.4	G.992.3 Clause L.1.3. Maximum power in the 0 to 4kHz band is relaxed to -10dBm _{600ohms}
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

APPENDIX F2: DEPLOYMENT CLASS 6g Customer Equipment

Table F-3 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 6g customer equipment. The termination impedance for Deployment Class 6g is 100 Ω . A typical technology is Reach Extended ADSL2.

TABLE F-3

Test criteria and Reference Documents for Deployment class 6g Customer Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G.992.3 Clause L.2.3.2 value defined for spectrum management purposes	G.992.3 Clause.L.2.3.2
	Frequency range	G.992.3 L.2.3	G.992.3 Clause.L.2.3
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G.992.3 Section L.2.3.1 Table L.9	G.992.3 mask 2 Clause L.2.3 Figure L.4.
Line code		Not applicable	G.992.3 Clause 8.8
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

APPENDIX G1: DEPLOYMENT CLASSES 6h, 6j to 6n Network Equipment

Table G-1 provides the Nominal and Compliance test criteria and referenced documents for Deployment Classes 6h, 6j, 6k, 6l, 6m and 6n network systems. The termination impedance for Deployment Classes 6h, 6j, 6k, 6l, 6m and 6n is 100 Ω . A typical technology for Deployment Class 6h is ADSL2 or ADSL2+ non overlapped spectrum. A typical technology for Deployment Classes 6j to 6n is ADSL2 or ADSL2+ non overlapped spectrum with extended upstream bandwidth (also known as Annex M to ADSL2/2+).

TABLE G-1

Test criteria and Reference Documents for Deployment Classes 6h, 6j to 6n Network Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G.992.5 Clause A.1.3.2 value defined for spectrum management purposes	G.992.5 Clause A.1.3.2
	Frequency range	G.992.5 Clause.A.1.3	G.992.5 Clause.A.1.3
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G992.5 Clause A.1.3 Table A.3	G.992.5 Clause. A.1.3 Maximum power in the 0 to 4kHz band is relaxed to -10dBm/600 Ω
Line code		Not applicable	G.992.5 Clauses 7 & 8
Longitudinal balance	Level	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1
	Frequency range	G.992.5 Clause A 4	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

APPENDIX G2: DEPLOYMENT CLASS 6h Customer Equipment

Table G-31 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 6h customer equipment. The termination impedance for Deployment class 6h is 100 Ω .

Typical technologies are ADSL2 non-overlapped spectrum or ADSL2+ non-overlapped spectrum.

Table G-3

Test criteria and Reference Documents for Deployment Class 6h Customer Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G.992.5 Clause A.2.2.2 value defined for spectrum management purposes	G.992.5 Clause A.2.2.2
	Frequency range	G.992.5 Clause A.2.2	G.992.5 Clause A.2.2
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G.992.5 Table A.5	G.992.5 Clause. A.2.2 [Maximum power in the 0 to 4kHz band is relaxed to $-65\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.5 Clauses 7 & 8
Longitudinal balance	Level	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1
	Frequency range	G.992.5 Clause A 4	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

APPENDIX G3: Deployment Class 6j to 6n Customer Equipment

Table G-5 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 6j, 6k, 6l, 6m and 6n customer equipment. The termination impedance for Deployment Classes 6j to 6n is 100 Ω .

Typical technologies are the transmission masks EU-44, EU-52, EU-56, EU-60 and EU-64, providing extended ADSL upstream bandwidth in Annex M for ADSL2 or ADSL2+.

Table G-5

Test criteria and Reference Documents for Deployment Classes 6j to 6n customer equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G.992.5 Clause M.2.2.2 value specified for spectral management purposes	G.992.5 Clause M.2.2.2
	Frequency range	G.992.5 Clause M.2.2 and table M.3	G.992.5 Clause M.2.2 and table M.3
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G.992.5 Table M.4 and Table M.5	G.992.5 Clause. M.2.2.1 Maximum power in the 0 to 4kHz band is relaxed to $-65\text{dBm}_{600\Omega}$
Line code		Not applicable	G.992.5 Clauses 7 & 8
Longitudinal balance	Level	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1	G.992.5 Clause A 4 and G.992.3 Clause A 4.3.3.1
	Frequency range	G.992.5 Clause A 4	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

APPENDIX H1: DEPLOYMENT CLASS 6i Network Equipment

Table H-1 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 6i network systems. The termination impedance for Deployment Class 6i is 100 Ω. A typical technology is All digital Mode ADSL2+.

TABLE H-1

Test criteria and Reference Documents for Deployment Class 6i

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G.992.5 Clauses I.1.3 and A.1.3.2 value specified for spectrum management purposes.	G.992.5 Clauses I.1.3 and A.1.3.2.
	Frequency range	G.992.5 Clause.I.1.3	G.992.5 Clause.I.1.3
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G.992.5 Clauses I.1.3 and A.1.3.1 and table A.3	G.992.5 Clauses I.1.3 and A.1.3
Line code		Not applicable	G.992.5 Clause 8.8.
Longitudinal balance	Level	G.992.5 Clause A.4 and G.992.3 Clause A 4.3.3.1	G.992.5 Clause A.4 and G.992.3 Clause A 4.3.3.1
	Frequency range	G.992.5 Clause A 4	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

APPENDIX H2: Deployment Class 6i Customer Equipment

Table H-3 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 6i. The termination impedance for Deployment class 6i is 100 Ω . A typical technology is All Digital Mode ADSL2+ non overlapped spectrum.

Table H-3

Test criteria and Reference Documents for Deployment Class 6i Customer Equipment

Parameter	Sub-parameter	Nominal Requirements	Compliance Requirements
Total average power	Level	G.992.5 Clause I.2.2.2 value specified for spectrum management purposes	G.992.5 Clause I.2.2.2
	Frequency range	G.992.5 Clause I.2.2	G.992.5 Clause I.2.2
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		T G.992.5 Clauses I.2.2 table I.4	G.992.5 Clauses I.2.2
Line code		Not applicable	G.992.5 Clause 8.8 and 8.9
Longitudinal balance	Level	G.992.3 Clause A 4.3.3.1	G.992.3 Clause A 4.3.3.1
	Frequency range	G.992.5 Clause A I.4	G.992.5 Clause A I.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

APPENDIX I: Deployment Class 8b

Table I-1 provides the Nominal and Compliance test criteria and referenced documents for Deployment Class 8b. The test termination impedance for Deployment class 8b is 135 Ω . A typical technology is HDSL 2B1Q (1168 kbit/s).

Table I-1

Test criteria and Referenced Documents for Deployment class 8b

Parameter		Nominal Requirements	Compliance Requirements
Total Average Power	Level	14 dBm	ETSI TR 101 830-1 V1.4.1 Clause 10.2.1
	Frequency range	0 Hz to 584 kHz	ETSI TR 101 830-1 V1.4.1 Clause 10.2.1
	Averaging time	≥ 10 s	≥ 10 s
PSD Mask	–	Table I-2	ETSI TR 101 830-1 V1.4.1 Clause 10.2.3
Line Code	–	Not applicable	ETSI TS 101 135
Longitudinal Balance	Level	ETSI TR 101 830-1 V1.4.1 Clause 10.2.4	ETSI TR 101 830-1 V1.4.1 Clause 10.2.4
	Frequency Range	ETSI TR 101 830-1 V1.4.1 Clause 10.2.4	ETSI TR 101 830-1 V1.4.1 Clause 10.2.4
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 I-2**Nominal PSD mask for Deployment Class 8b**

Frequency f (kHz)	PSD (dBm/Hz)
0	-38.7
74	-38.7
186	-39.7
313	-42.7
462	-58.7
551	-74.7
819	-76.7
998	-86.7
1117	-98.7
1460	-99.7
1585	-105.5
$1585 < f \leq 30000$	$-143 - 10 \times \log_{10} \left(\frac{(10^3 \times f)^{1.5}}{1.134 \times 10^{13}} \right)$

Note: The values between the specified points are derived by linear interpolation of frequency and PSD limit in dBm/Hz.

APPENDIX J: Deployment Classes 9c to 9h

Table J-1 provides the Nominal and Compliance test criteria and reference documents for Deployment Classes 9c, 9d, 9e, 9f, 9g and 9h. The test termination impedance for Deployment Class 9 is 135 Ω .

Typical technologies are SHDSL for the 16-TCPAM rates up to 2312 kbps and eSHDSL for the 32-TCPAM rates up to 3080 kbps.

Table J-1

Test criteria and Reference Documents for Deployment classes 9c to 9h

Parameter	Sub-parameter	Nominal Requirement	Compliance Requirement
Total average power	Level	G.991.2 Clause B4.1 Table B.12 G.991.2 Clause F4 Table F.3 for 32 TCPAM	G.991.2 Clause B4.1 Table B.12
	Frequency range	0 Hz to 1.5 MHz	0 Hz to 1.5 MHz
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G.991.2 Clause B4.1 nominal PSD G.991.2 Clause F.4 nominal PSD for 32-TCPAM.	G.991.2 Clause B4.1 G.991.2 Clause F.4 for TCPAM
Line code		Not applicable	Trellis Coded Pulse Amplitude Modulation
Longitudinal balance	Level	G991.2 Clause B.5.4.	G991.2 Clause B.5.4
	Frequency Range	G991.2 Clause 11.1	G991.2 Clause 11.1
Longitudinal output voltage	Level	G991.2 Clause B.5.5	G991.2 Clause B.5.5
	Frequency Range	G991.2 Clause B.5.5	G991.2 Clause B.5.5

APPENDIX K: Deployment Classes 9i to 9q

Table K-1 provides the Nominal and Compliance test criteria and reference documents for Deployment Classes 9i, 9j, 9k, 9l, 9m, 9n, 9o, 9p and 9q. The test termination impedance for Deployment class 9 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	Nominal Requirements	Compliance Requirements
Total average power	Level	G991.2 Clause F.4 Table F.3	G991.2 Clause F.4 Table F.3
	Frequency range	G991.2 Clause F.4	G991.2 Clause F.4
	Averaging time	≥ 10 s	≥ 10 s
PSD mask		G991.2 Clause F.4 nominal mask	G991.2 Clause F.4
Line code		Not applicable	Trellis Coded Pulse Amplitude Modulation
Longitudinal balance	Level	G991.2 Clause B.5.4	G991.2 Clause B.5.4
	Frequency Range	G991.2 Clause 11.1	G991.2 Clause 11.1
Longitudinal output voltage	Level	G991.2 Clause B.5.5	G991.2 Clause B.5.5
	Frequency Range	G991.2 Clause B.5.5	G991.2 Clause B.5.5