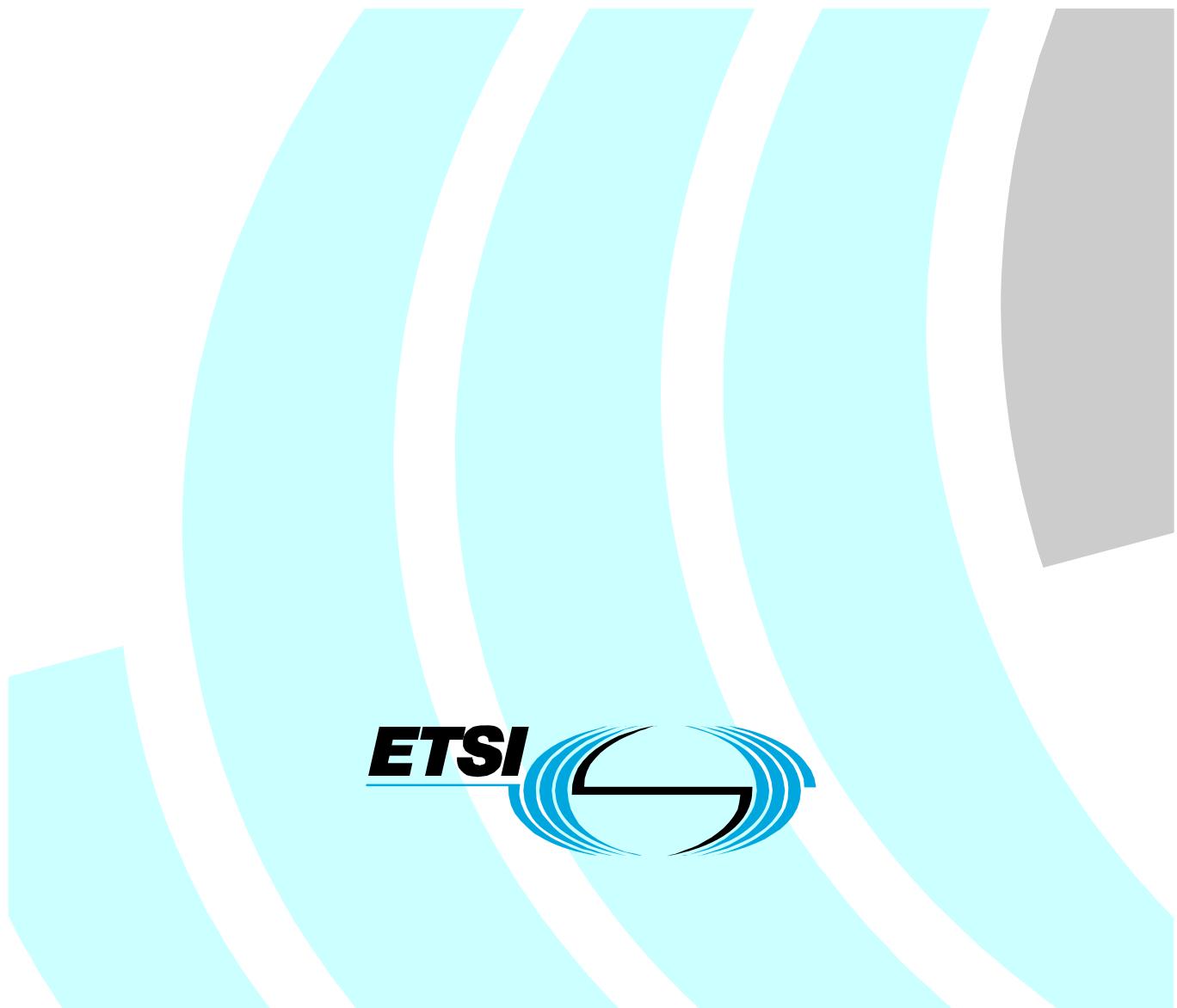


# ETSI TS 101 388 V1.4.1 (2007-08)

*Technical Specification*

**Access Terminals Transmission and Multiplexing (ATTM);  
Access transmission systems on metallic access cables;  
Asymmetric Digital Subscriber Line (ADSL) -  
European specific requirements  
[ITU-T Recommendation G.992.1 modified]**



---

Reference

RTS/ATTM-06007

---

Keywordsaccess, ADSL, basic, endorsement, interaction,  
interworking, IP, ISDN, transmission***ETSI***

---

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

***Important notice***

Individual copies of the present document can be downloaded from:  
<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

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

If you find errors in the present document, please send your comment to one of the following services:  
[http://portal.etsi.org/chaircor/ETSI\\_support.asp](http://portal.etsi.org/chaircor/ETSI_support.asp)

---

***Copyright Notification***

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2007.  
All rights reserved.

**DECT™, PLUGTESTS™ and UMTS™** are Trade Marks of ETSI registered for the benefit of its Members.  
**TIPHON™** and the **TIPHON logo** are Trade Marks currently being registered by ETSI for the benefit of its Members.  
**3GPP™** is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

---

# Contents

Intellectual Property Rights .....	6
Foreword.....	6
1    Scope .....	7
2    References .....	7
3    Definitions and abbreviations.....	8
3.1    Definitions.....	8
3.2    Abbreviations .....	9
4    Configuration of ADSL.....	9
4.1    Methods for configuring ADSL over POTS.....	9
4.1.1    EC ADSL over POTS .....	9
4.1.2    FDD ADSL over POTS .....	10
4.2    Methods for configuring ADSL over ISDN .....	10
4.2.1    EC ADSL over ISDN .....	10
4.2.1.1    Downstream transmit spectral mask .....	10
4.2.1.2    Upstream transmit spectral mask .....	11
4.2.2    FDD ADSL over ISDN.....	12
4.2.2.1    Downstream transmit spectral mask .....	12
4.2.2.2    Upstream transmit spectral mask .....	12
4.3    Aggregate transmit power .....	13
5    Transmission performance objectives and test methods .....	13
5.1    Test procedures .....	14
5.1.1    Test set-up definition .....	14
5.1.2    Noise injection network.....	15
5.1.2.1    Differential mode injection .....	15
5.1.2.2    Common mode injection .....	15
5.1.3    Signal and noise level definitions .....	16
5.1.4    Noise levels calibration.....	16
5.1.4.1    Differential mode noise calibration.....	16
5.1.4.2    Common mode noise calibration.....	17
5.1.5    Startup training procedure .....	17
5.2    Test loops .....	17
5.2.1    Background information.....	17
5.2.2    Test loop topology .....	18
5.2.3    Test loop accuracy .....	19
5.3    Impairment generators.....	19
5.3.1    Functional description.....	19
5.3.2    Cable cross-talk models .....	21
5.3.3    Individual impairment generators.....	21
5.3.3.1    Equivalent NEXT disturbance generator [G1.xx] .....	22
5.3.3.2    Equivalent FEXT disturbance generator [G2.xx].....	22
5.3.3.3    Background noise generator [G3] .....	22
5.3.3.4    White noise generator [G4].....	22
5.3.3.5    Broadcast RF noise generator [G5].....	22
5.3.3.6    Amateur RF noise generator [G6].....	23
5.3.3.7    Impulse noise generator [G7].....	23
5.3.3.8    Line sharing noise generator [G8].....	24
5.3.4    Profiles of the individual impairment generators.....	24
5.3.4.1    Frequency domain profiles of generators G1 and G2 .....	24
5.3.4.1.1    Frequency domain profiles for EC ADSL over POTS .....	25
5.3.4.1.2    Frequency domain profiles for EC ADSL over ISDN .....	26
5.3.4.1.3    Frequency domain profiles for FDD ADSL over POTS .....	26
5.3.4.1.4    Frequency domain profiles for FDD ADSL over ISDN .....	27
5.3.4.2    Time domain profiles of generator G1-G4.....	28

5.4	Transmission performance tests .....	30
5.4.1	Bit error ratio requirements.....	30
5.4.1.1	Control of transmit power in opposing direction .....	30
5.4.2	Measuring noise margin.....	30
5.4.2.1	Measuring cross-talk noise margin .....	30
5.4.2.2	Measuring impulse noise margin .....	30
5.4.3	Test sequences .....	31
5.4.4	Micro-interruptions .....	32
5.5	Performance objectives .....	32
5.5.1	Performance objectives for EC ADSL over ISDN .....	33
5.5.2	Performance objectives for EC ADSL over POTS .....	37
5.5.3	Performance objectives for FDD ADSL over ISDN.....	41
5.5.4	Performance objectives for FDD ADSL over POTS .....	45
6	ADSL splitter .....	49
6.1	Impact on existing baseband services.....	49
<b>Annex A (normative):</b>	<b>Distributed cable coefficients for the test loop cables.....</b>	<b>51</b>
<b>Annex B (informative):</b>	<b>Transmission of cable sections.....</b>	<b>57</b>
B.1	Definition of transmission function and insertion loss.....	57
B.2	Derivation of s-parameters from primary cable parameters.....	58
<b>Annex C (informative):</b>	<b>ADSL over ISDN configuration of T1.413 based modems.....</b>	<b>59</b>
C.1	Introduction .....	59
C.2	ATU-C.....	59
C.2.1	Used frequency band .....	59
C.2.2	Nominal aggregate power level.....	59
C.2.3	Pilot frequency .....	59
C.2.4	Transmit spectral mask.....	59
C.3	ATU-R.....	60
C.3.1	ATU-R transmitter reference models .....	60
C.3.2	Used frequency band .....	60
C.3.3	Nominal aggregate power level.....	60
C.3.4	Maximum number of data sub-carriers .....	61
C.3.5	Pilot frequency .....	61
C.3.6	Nyquist frequency .....	61
C.3.7	Modulation by the inverse discrete fourier transform .....	61
C.3.8	Synchronization symbol .....	61
C.3.9	Cyclic prefix .....	62
C.3.10	Transmit spectral mask.....	62
C.4	Initialization .....	62
C.4.1	C-Activate .....	62
C.4.2	C-ACT2m.....	62
C.4.3	C-ACT2e .....	62
C.4.4	R-Acknowledgment.....	63
C.4.5	R-ACT-REQ.....	63
C.4.6	R-ACK1m .....	63
C.4.7	R-ACK1e.....	63
C.4.8	R-ACK2m .....	63
C.4.9	R-ACK2e.....	63
C.4.10	C-REVEILLE .....	63
C.4.11	C-PILOT1.....	63
C.4.12	R-REVERB1 .....	64
C.4.13	R-MEDLEY .....	64
C.4.14	C-MSG2 .....	64
C.4.15	R-MSG2 .....	64
C.4.16	C-ECT and R-ECT .....	64
C.4.17	Power Cut-back .....	65

C.4.18	C-B&G .....	65
<b>Annex D:</b>	<b>Void .....</b>	<b>67</b>
<b>Annex E:</b>	<b>Void .....</b>	<b>68</b>
<b>Annex F (informative):</b>	<b>Example injection method for noise generator [G8].....</b>	<b>69</b>
History .....		70

---

## Intellectual Property Rights

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

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

---

## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Access Terminals Transmission and Multiplexing (ATTM).

The present document, in conjunction with ITU-T Recommendation G.992.1 [2] provides the European specifications for ADSL.

---

## 1 Scope

The present document specifies European requirements for ADSL.

The definition of new line codes and/or transmission systems is outside the scope of the present document.

The present document endorses ITU-T Recommendation G.992.1 [2], the contents of which apply together with the addition of the modifications being covered herein. In particular the aspects covered by the present document are related to:

- 1) Methods to allow the simultaneous delivery of ADSL and ISDN-BA services [1] on the single pair. For example the techniques and redefinition of the ADSL signals/parameters as defined in ITU-T Recommendation G.992.1 [2] to allow ISDN-BA base band signals to occupy frequencies below ADSL (from here onwards referred as out-of-band transport).
  - 2) Performance Objectives and Test methods for ADSL over POTS/ISDN-BA.
  - 3) TS 102 080 [1] backward compatibility.
  - 4) Power feeding for the transported ISDN-BA.
  - 5) Latency.
  - 6) ISDN-BA splitter characteristics.
- 

## 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

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

- [1] ETSI TS 102 080 (V1.4.1): "Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines".
- [2] ITU-T Recommendation G.992.1 (1999): "Asymmetrical digital subscriber line (ADSL) transceivers".
- [3] ETSI TS 101 388 (V1.1.1): "Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Asymmetric Digital Subscriber Line (ADSL) - Coexistence of ADSL and ISDN-BA on the same pair [ANSI T1.413 - 1998, modified]".
- [4] ITU-T Recommendation G.996.1 (2001): "Test procedures for digital subscriber line (DSL) transceivers".
- [5] ANSI T1.413: "Network to Customer Installation Interfaces - Asymmetric Digital Subscriber Line (ADSL) Metallic Interface".
- [6] ETSI TS 101 952-1-1: "Access network xDSL transmission filters; Part 1: ADSL splitters for European deployment; Sub-part 1: Generic specification of the low pass part of DSL over POTS splitters including dedicated annexes for specific xDSL variants".