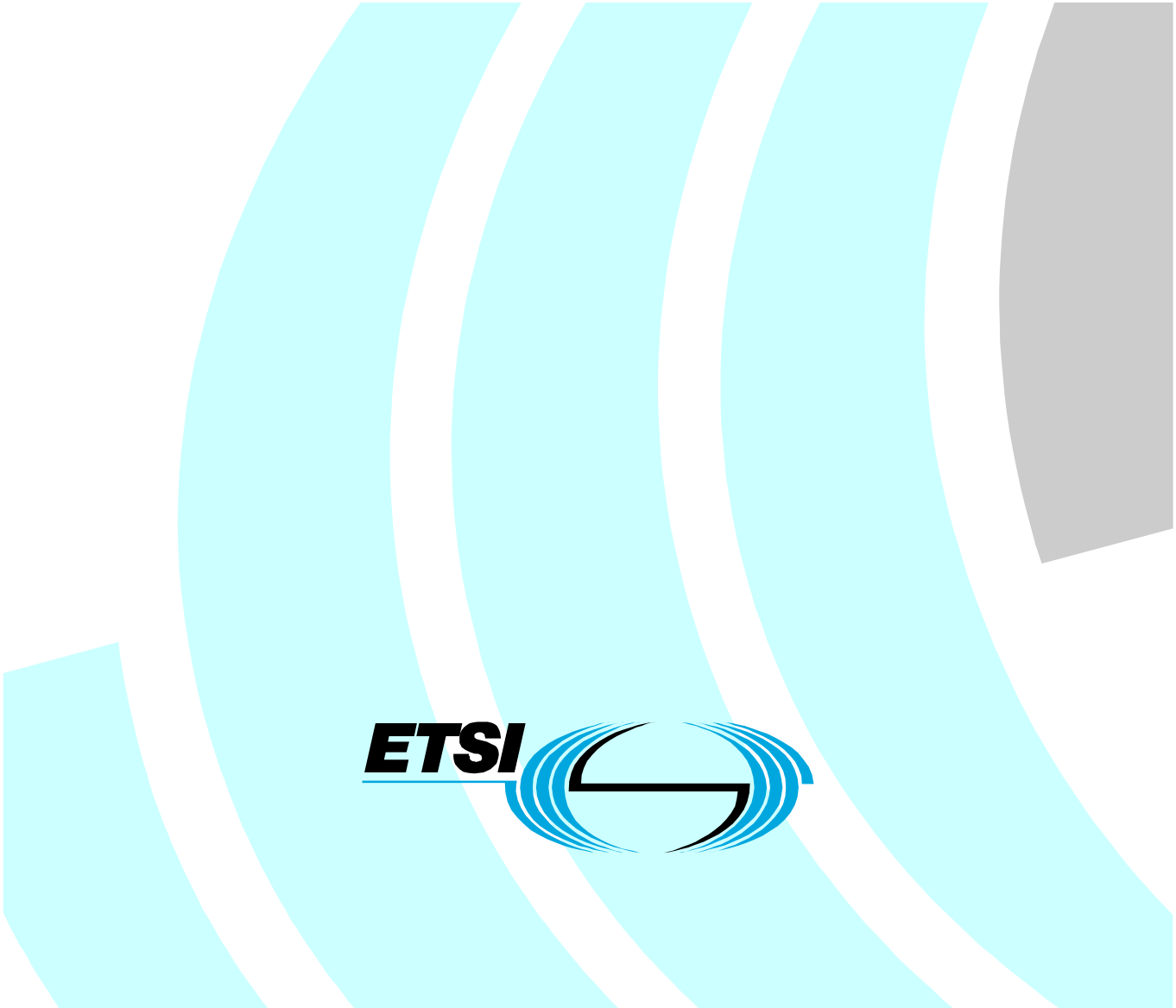
# ETSI TS 101 952-1-4 V1.1.1 (2002-11)

*Technical Specification*

**Access network xDSL transmission filters;**
**Part 1: ADSL splitters for European deployment;**
**Sub-part 4: Specification of ADSL over**
**"ISDN or POTS" universal splitters**



Reference
DTS/AT-010105-01-04

Keywords
ADSL, POTS, ISDN, splitter

***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

# Contents

# 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 and Terminals (AT).

The present document is part 1, sub-part 4 of a multi-part deliverable covering Access network xDSL transmission filters, as identified below:

**Part 1: "ADSL splitters for European deployment";**

Sub-part 1: "Specification of the low pass part of ADSL/POTS splitters";

Sub-part 2: "Specification of the high pass part of ADSL/POTS splitters";

Sub-part 3: "Specification of ADSL/ISDN splitters";

**Sub-part 4: "Specification for ADSL/"ISDN or POTS" universal splitters";**

Sub-part 5: "Specification for ADSL/POTS distributed filters".

Part 2: "VDSL splitters for European deployment".

NOTE: The choice of a multi-part format for the present document is to facilitate maintenance and future enhancements.

The present document is fully in line with initiative "eEurope 2002 - An Information Society For All", under "The contribution of European standardization to the eEurope Initiative, A rolling Action Plan" especially under the key objective of a cheaper, faster and secure Internet.

# 1 Scope

The present document specifies requirements and test methods for ADSL over"ISDN or POTS" universal splitters. This means that the splitter shall support either POTS or ISDN transmission underlying the broadband ADSL. This ADSL is as defined in annex B of ITU-T Recommendation G992.1 [6]. These splitters are intended to be installed at the Local Exchange side of the local loop and at the user side near the NTP.

The splitter filter as specified by the present document, may be implemented as an independent unit, separately from the ADSL transceiver, or may be integrated with the ADSL termination unit. The splitter may also be integrated with the baseband termination unit (e.g. POTS line card or ISDN transceiver), however this is outside of the scope of the current document.

# 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.

[1] ETSI TS 102 080: "Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines".

[2] ETSI TR 101 728: "Access and Terminals (AT); Study for the specification of low pass section of POTS/ADSL splitters".

[3] ITU-T Recommendation O.9: "Measuring arrangements to assess the degree of unbalance about earth".

[4] ITU-T Recommendation O.41: "Psophometer for use on telephone-type circuits".

[5] ITU-T Recommendation O.42: "Equipment to measure non-linear distortion using the 4-tone intermodulation method".

[6] ITU-T Recommendation G.992.1: "Asymmetric Digital Subscriber Line (ADSL) transceivers".

[7] ETSI ES 201 970: "Access and Terminals (AT); Public Switched Telephone Network (PSTN); Harmonized specification of physical and electrical characteristics at a 2-wire analogue presented Network Termination Point (NTP)".

[8] ETSI TBR 021: "Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".

[9] ETSI TR 102 139: "Compatibility of POTS terminal equipment with xDSL systems".

[10] ITU-T Recommendation G.122: "Influence of national systems on stability and talker echo in international connections".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**A-wire and B-wire:** wires in the 2-wire local loop connection provided from the exchange to the NTP

**signature network:** circuitry included at the POTS port of the splitter, the values and configuration of which may be operator dependent, which has the purpose of enabling network operator's remote line testing equipment to determine the presence of a splitter on a line

**Echo Return Loss (ERL):** return loss averaged with 1/f power weighting over the telephone band (300 Hz to 3 400 Hz), in accordance with clause 4 of ITU-T Recommendation G.122.

## 3.2 Abbreviations

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

| | |
|---|---|
| ADSL | Asymmetric Digital Subscriber Line |
| DC | Direct Current |
| ISDN (BRA) | Integrated Services Digital Network (Basic Rate Access) |
| ITU | International Telecommunication Union |
| LE | Local Exchange (Central Office) |
| NTP | Network Termination Point |
| POTS | Plain Old Telephone Service |
| TE | Terminal Equipment (e.g. telephone, fax, voice band modem etc.) |

# 4 General functional description of ADSL over "ISDN or POTS" universal splitters

The main purpose of the ADSL over"ISDN or POTS" universal splitter is to separate the transmission of either baseband POTS or ISDN signals and broadband ADSL signals, enabling the simultaneous transmission of the two services on the same twisted pair. The splitter also serves to protect POTS or ISDN from interference due to egress (and ingress) from ADSL signals. Equally it protects the ADSL transmission from ISDN intereference, and transients generated primarily during POTS signalling (dialling, ringing, ring trip, etc.). It must also prevent interference to the ADSL service due to fluctuations in impedance and linearity that occur when POTS telephones change operational state (e.g. from off-hook to on-hook).

Use of such a universal splitter is considered to be only advantageous in areas where there exists a prevailing deployment of ISDN BRA.

Insertion of a splitter filter in existing lines shall only have a low impact on the performance of existing services.

## 4.1 Functional diagram

The functional diagram for the splitter combination is given in figure 1. The "ISDN or POTS" port of the splitter is referred to as the "TELE" port.

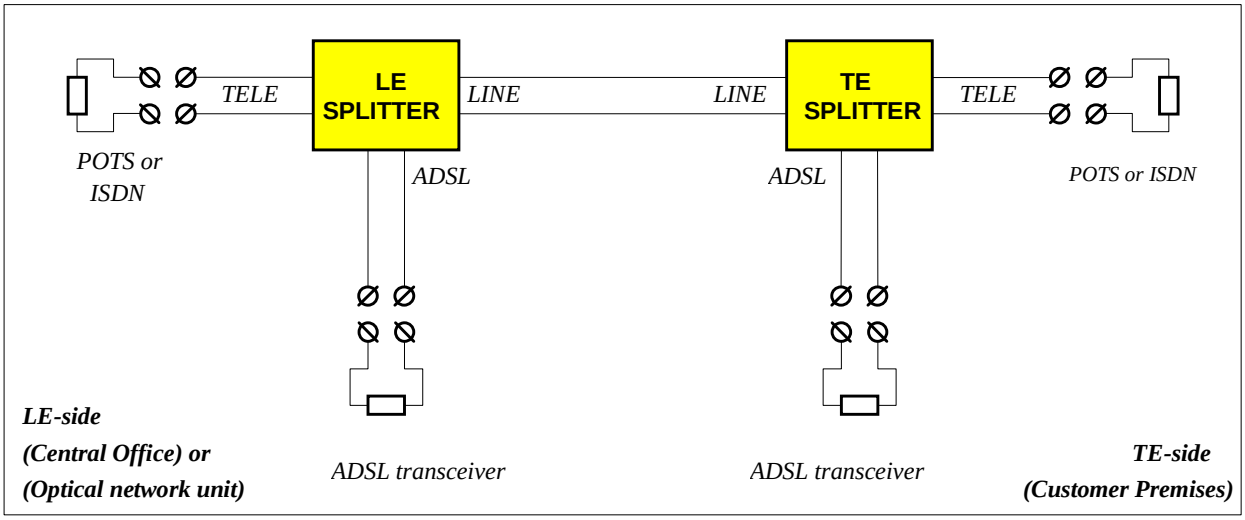



**Figure 1: Functional diagram of the ADSL/"ISDN or POTS" splitter configuration**

The transfer functions between the different ports of the splitter can be understood as follows:

- The transfer function from port "TELE" to "LINE" and vice-versa is that of a low-pass filter.
- A high level of isolation is required from port "ADSL" to "TELE" to prevent undesirable interaction between DSL and baseband services.
- The transfer function from the ADSL port to the line port and vice-versa will be that of a first order high-pass filter (i.e. blocking capacitors).

NOTE: The splitters designed according to the present document are expected to be adequate under a wide range of operational conditions. The issue of general interoperability between ISDN equipment and splitters is for further study.

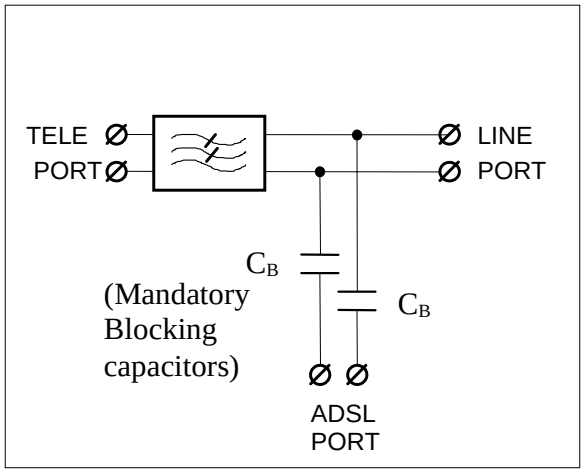



**Figure 2: Structure of the ADSL/"ISDN or POTS" filter**

# 5 Testing conditions

## 5.1 DC testing conditions

### 5.1.1 Polarity independence

The splitter shall conform to all the applicable requirements of the present document for both polarities of the DC line feeding voltage (and the DC line current) provided by the local exchange.

This may not apply in the case where a "signature network" is used as this may be polarity dependant.

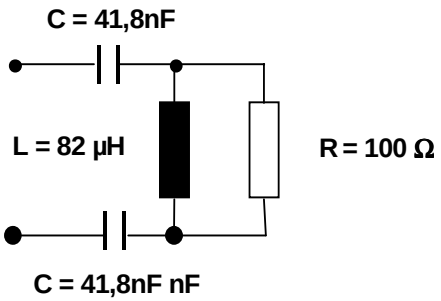
### 5.1.2 DC feeding current

Applicable requirements shall be met with a DC current of 0 mA to 80 mA.

## 5.2 Terminating Impedances

### 5.2.1 $Z_{ADSL-I}$

In many of the tests with ISDN-BA frequencies, the ADSL port of the splitter is terminated with an impedance called $Z_{ADSL-I}$. This impedance model as shown in figure 3, represents the input impedance of the ADSL transceiver as seen from the ADSL port of the splitter, and does not include the blocking capacitors. The model is intended for splitter specification in the context of the present document. The purpose of this model impedance is for splitter specification, it is not a requirement on the input impedance of the ADSL transceiver.




NOTE: $Z_{ADSL-I}$ does not include the blocking capacitors $C_B$.

**Figure 3: Schematic diagram of the impedance $Z_{ADSL-I}$ for verifying requirements of the splitter**

### 5.2.2 $Z_{ISDN}$

For requirements relating to ISDN band frequencies described in the present document, the terminating impedance $Z_{ISDN}$ is used to terminate the ISDN port. $Z_{ISDN}$ shall follow the definition of TS 102 080 [1], annex B for 4B3T (150 Ω) ISDN-BA.

NOTE: 2B1Q is for further study.

### 5.2.3 $Z_L$

$Z_L$ is used to terminate the LINE port at high frequencies and shall be equal to 100 Ω.

NOTE: This impedance value is for further study.

### 5.2.4 $Z_R$(POTS)Ω

When the splitter is to be used for POTS, the terminating impedances $Z_R$ as defined in ES 201 970 [7] and TBR 021 [8] is used. This impedance is specified in figure 4. The impedance of figure 4 can be used to terminate both the LINE port at low frequencies, and the TELE port.

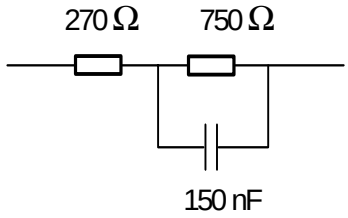



**Figure 4: Schematic diagram of the impedance $Z_R$**

NOTE: In the case of splitters to be deployed by some network operators, alternative models of reference impedances instead of $Z_R$ are currently used when matching the splitter requirements.

### 5.2.5 $Z_{RHF}$

For requirements relating to ADSL frequencies described in the present document, the terminating impedance $Z_{RHF}$ is used to terminate POTS and line ports of the low pass filter. This is the European harmonized complex impedance $Z_R$ with the modification proposed in TR 102 139 [9]. This network is shown in figure 5.

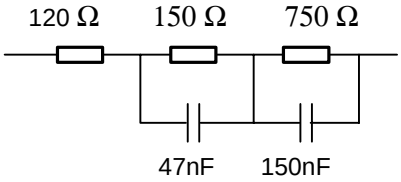



**Figure 5: Impedance $Z_{RHF}$**

## 5.3 General transmission test set-up

For many of the transmission related tests that are specified in the present document, a common general test setup is valid. This test set-up is given in figures 6 and 7, for measurements at the LINE port and TELE port respectively.

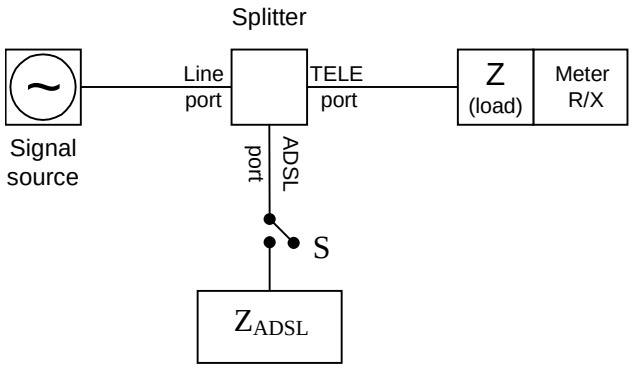



**Figure 6: Test set up for transmission testing from LINE to TELE**

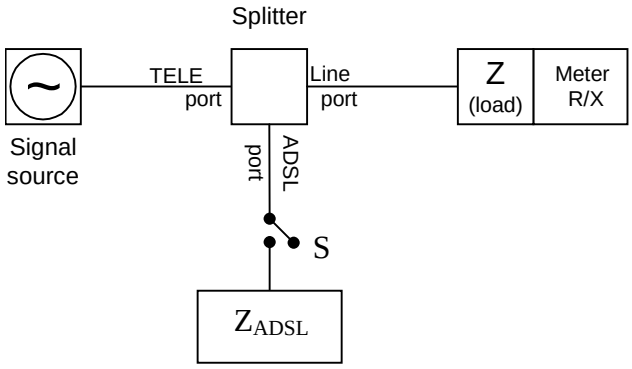



**Figure 7: Test set up for transmission testing from TELE to LINE**

# 6 Splitter requirements

## 6.1 DC requirements

### 6.1.1 DC resistance to earth

The DC resistance between each terminal (i.e. A-wire and B-wire) of the splitter and earth, when tested with 100 V DC, shall not be less than 20 MΩ.

This requirement only applies to splitters with a terminal directly connected to earth.

### 6.1.2 DC Insulation resistance between A-wire and B-wire

The DC resistance between the A-wire and B-wire terminal of the splitter, when tested with 100 V DC, shall not be less than 5 MΩ.

In the case where the splitter is fitted with a signature network, measurement of the DC isolation resistance becomes more difficult. Possible solutions include a switching system in order to open circuit the signature network for the measurement, or indeed performing the measurement before the signature network is added to the splitter card. It is left to the individual operator to determine how this measurement should be carried out. Depending on the particular test methodology used, the requirement shall be set accordingly.

### 6.1.3 DC series resistance

The DC resistance from the A-wire to the B-wire at the LINE port with the TELE port shorted, or at the TELE port with the LINE port shorted shall be less than or equal to 12,5 Ω.

This requirement shall be met for DC feeding conditions as given in clause 5.1.2.

## 6.2 High pass path of the splitter

The high pass part of the splitter, i.e. the filter between the LINE and ADSL ports, shall be a first order high pass filter made up of two blocking capacitors (one on each wire). The value of each of these capacitors shall be 27 nF. A tolerance of 5 % shall be allowed for the practical implementation of these capacitors. Each of these capacitors shall retain their nominal value for DC voltages up to 120 V.

## 6.3 Pass band loss requirements

### 6.3.1 Off-hook pass band insertion loss

The insertion loss of one splitter shall be less then 1 dB at 1 kHz.

The test set ups are given in figures 6 and 7.

Level of the test signal = -4 dBV emf.

The test shall be executed with both combinations of source and load impedances in table 1. The off-hook DC feeding current is specified in clause 5.1.2.

**Table 1: Combinations of source and load impedances for the insertion loss test**

| Source/Load combination | Impedance of signal source | Impedance of the load |
|---|---|---|
| Combination 1 | $Z_R$ | $Z_R$ |
| Combination 2 | 600 Ω | 600 Ω |

### 6.3.2 Off-hook passband insertion loss distortion

The absolute difference between the insertion loss at any frequency in the range 200 Hz to 4 000 Hz and the insertion loss at 1 kHz shall be less then 1 dB. The test shall be executed with both combinations of source and load impedances in table 1. The test set-ups are described in figures 6 and 7, the off-hook DC feeding current is specified in clause 5.1.2.

### 6.3.3 Passband insertion loss for ISDN

The passband insertion loss for ISDN shall meet the requirements of tables 2 and 3. The test setups are given in figures 6 and 7. This requirement is applicable with the switch S both open and closed. The DC feeding current is specified in clause 5.1.2.

The requirements of table 2 are valid for the case where the switch S in figures 6 and 7 is closed. The requirements of table 3 are valid for the case where the switch S in figures 6 and 7 is open.

Source impedance: $Z_{ISDN}$

Load impedance: $Z_{ISDN}$

**Table 2: ISDN band insertion loss requirements with ADSL load connected**

| Frequency band | Insertion Loss |
|---|---|
| 1 kHz to 60 kHz | < 1,2 dB |
| 60 kHz to 80 kHz | < 2 dB |

**Table 3: ISDN band insertion loss requirements without ADSL load connected**

| Frequency band | Insertion Loss |
|---|---|
| 1 kHz to 60 kHz | < 1,5 dB |
| 60 kHz to 80 kHz | < 2,5 dB |

## 6.4 Passband return loss requirements

The return loss at both the TELE and Line port of the splitter shall be measured according to figure 7. The definition of return loss is given in figure 8.

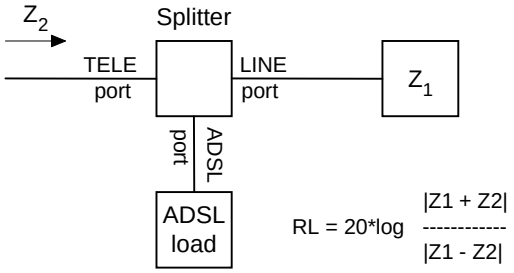



**Figure 8: Definition of return loss at the TELE port**

NOTE: For the present document, return loss requirements are only applicable at the TELE port of the splitter.

The following test set-ups and requirements are equally applicable to the LE and TE splitters. Return Loss testing is to be carried out under the off-hook DC feeding current of clause 5.1.2.

### 6.4.1 Passband return loss for POTS

The passband return loss for POTS shall be above the template of figure 10. This requirement is applicable both in the case where the switch S of figure 7 is open and closed.

Load (reference) impedance: $Z_R$

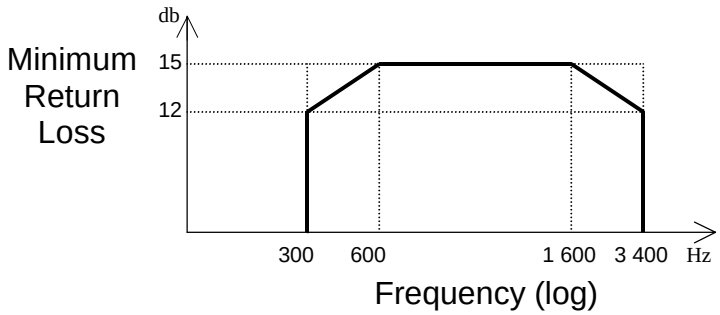



**Figure 9: Minimum return loss for POTS band**

NOTE: The return loss template of figure 9 corresponds to an echo return loss of 14 dB. In any case a minimum value of 8 dB is necessary.

### 6.4.2 Passband return loss for ISDN

The passband insertion loss for ISDN shall meet the requirements of tables 4 and 5.

The requirements of table 4 are valid for the case where the switch S in figure 7 is closed. The requirements of table 5 are valid for the case where the switch S in figure 7 is open.

Load (reference) impedance: $Z_{ISDN}$

**Table 4: ISDN band return loss requirements with ADSL load connected**

| Frequency band | Return Loss |
|---|---|
| 1 kHz to 60 kHz | > 16 dB |
| 60 kHz to 80 kHz | > 14 dB |

**Table 5: ISDN band return loss requirements without ADSL load connected**

| Frequency band | Return Loss |
|---|---|
| 1 kHz to 60 kHz | > 12 dB |
| 60 kHz to 80 kHz | > 10 dB |

## 6.5 Requirements relating to metering pulses at 12 kHz or 16 kHz

In the case where pulse metering signals are deployed on the same lines as ADSL, the insertion loss due to the splitter shall be measured at the frequency of the metering pulse. Due to the country specific nature of the rationale of this requirement, the required insertion loss shall be operator specific. A maximum insertion loss requirement of in the range 3 dB to 5 dB per splitter should be suitable for many European networks.

The test set up of figures 6 and 7 shall be used, using the condition of table 6. This requirement is applicable with the switch S both open and closed. The level of the test signal is 3,5 Vrms. This requirement is applicable with DC current as specified in clause 5.1.2.

**Table 6: Conditions for insertion loss test at 12 kHz or 16 kHz**

| Level of source voltage | Impedance of signal source | Impedance of the load (Z in figures 6 and 7) | Impedance at the ADSL port |
|---|---|---|---|
| 3,5 Vrms | 200 Ω | 200 Ω | $Z_{ADSL-I}$ |

NOTE: This is an optional requirement, and can increase the complexity of the low pass filter implementation.

## 6.6 Unbalance about Earth

The basic test set-up for measuring unbalance at the TELE port is shown in figure 10. In the case of measuring at the LINE port, the test set-up of figure 10 is used, however with the TELE and LINE terminations reversed. The test shall be carried out for the combinations described in table 7. Note that the source and measurement are always at the same port. This requirement is applicable with DC current as specified in clause 5.1.2. In the case of performing measurements at frequencies above the voiceband, for reasons of practical testing a 150 Ω impedance should be used in series with the longitudinal source (i.e. S1 in figure 10 should be open).

**Table 7: Unbalance about earth, test setups**

| #Test setup | Source and Measurement | State of S2 |
|---|---|---|
| 1 | TELE | open |
| 2 | TELE | closed |
| 3 | LINE | closed |

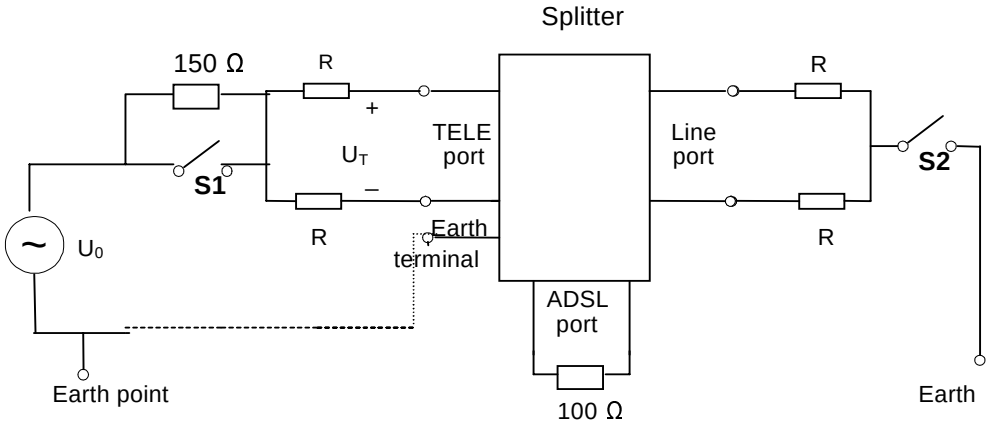
The ADSL port shall be terminated with a 100 Ω resistor for all unbalance tests described in the present document. For each of the test set-ups described above, the splitter shall meet the unbalance about earth requirements as specified in table 8.

**Table 8: Unbalance about earth, minimum values**

| Frequency range | State of S1 | Value of R | Minimum Unbalance value |
|---|---|---|---|
| 50 Hz to 600 Hz | Closed | 300 Ω | 40 dB |
| 600 Hz to 3 400 Hz | Closed | 300 Ω | 40 dB |
| 3 400 Hz to 4 000 Hz | Closed | 300 Ω | 40 dB |
| 4 kHz to 30 kHz | Open | 50 Ω | 40 dB |
| 30 kHz to 1 104 kHz | Open | 50 Ω | 50 dB |
| 1 104 kHz to 5 MHz | Open | 50 Ω | 30 dB |

The unbalance about earth is calculated by using the following equation:

$$\text{Unbalance} = 20\log_{10}\left|\frac{U_0}{U_T}\right| \quad (\text{dB})$$




NOTE 1: The dotted circuit is only used if the splitter has an earth terminal.
NOTE 2: The DC current feeding circuitry is not shown. Care should be taken that this circuitry is implemented in such a way as not to have significant influence on the accuracy of the measurement.
NOTE 3: For resistances R an equivalent circuit according to ITU-T Recommendation O.9 [3] can be used.

**Figure 10: Unbalance about earth test set-up**

If the splitter has no earth terminal, the test should be performed while the splitter is placed on an earthed metal plate of a sufficiently large size.

## 6.7 ADSL band loss requirements

### 6.7.1 Isolation requirements

The isolation of the splitter, that is the insertion loss between TELE and ADSL port and vice versa at ADSL frequencies, shall meet the requirements in table 9. In the case where the source is connected to the TELE port, the TELE port impedance in table 9 is the source impedance (and vice versa for the ADSL port).

The test setups to be used are given in figures 11 and 12 The DC feeding conditions are specified in clause 5.1.2.

**Table 9: Minimum isolation requirements and test parameters**

| Frequency range | Minimum Isolation | Impedance at TELE port | Impedance at LINE port | Impedance at ADSL port |
|---|---|---|---|---|
| 138 kHz to 2 208 kHz | > 55 dB | $Z_{RHF}$ | $Z_L$ | $Z_{ADSL-I}$ |
| 138 kHz to 150 kHz<br>150 kHz to 1 104 kHz<br>1 104 kHz to 2 208 kHz | > 55 dB<br>> 65 dB<br>> 55 dB | $Z_{ISDN}$ | $Z_L$ | $Z_{ADSL-I}$ |

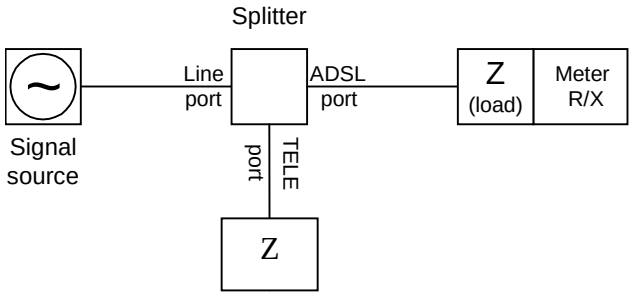



**Figure 11: Test set up for transmission testing from LINE to ADSL**

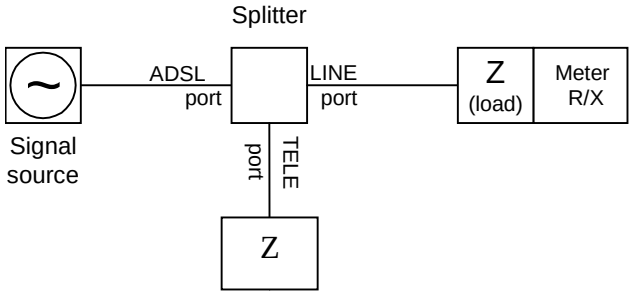



**Figure 12: Test set up for transmission testing from ADSL to LINE**

NOTE: In order to set the source/load impedance at ZADSL, a balun transformer may be used. A possible implementation is given in figure 13.

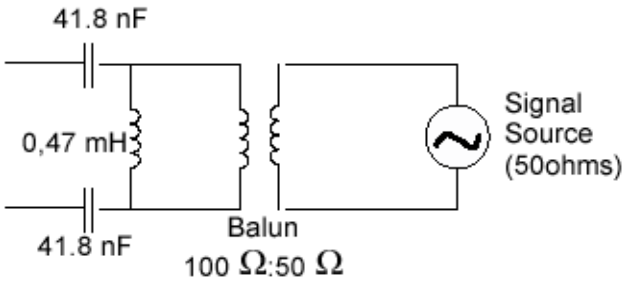



**Figure 13: Suggested implementation for setting the source impedance to $Z_{ADSL-I}$**

## 6.8 Noise

The DC feeding conditions are given in clause 5.1.2.

NOTE: Noise requirements for the ISDN band are for further study.

### 6.8.1 Audible noise level requirements

The psophometric noise power, as defined in ITU-T Recommendation O.41 [4], measured at the LINE port and the TELE port of a splitter, shall be less than -75 dBmp. The psophometer shall be referenced to $Z_R$. LINE port and TELE port should be terminated with $Z_R$. The ADSL port is terminated with the ADSL load as defined in clause 5.2.1.

### 6.8.2 ADSL band noise level requirements

In the case of a LE splitter, the noise in the frequency range 138 kHz to 1 104 kHz due to the splitter, measured at the both the ADSL port and at the LINE port, should be less than -125 dBm/Hz measured in a bandwidth of 10 kHz.

In the case of a TE splitter, the noise in the frequency range 138 kHz to 1 104 kHz due to the splitter, measured at the both the ADSL port and at the LINE port, should be less than -140 dBm/Hz measured in a bandwidth of 10 kHz.

The test set-ups of figures 14 and 15 shall be used.

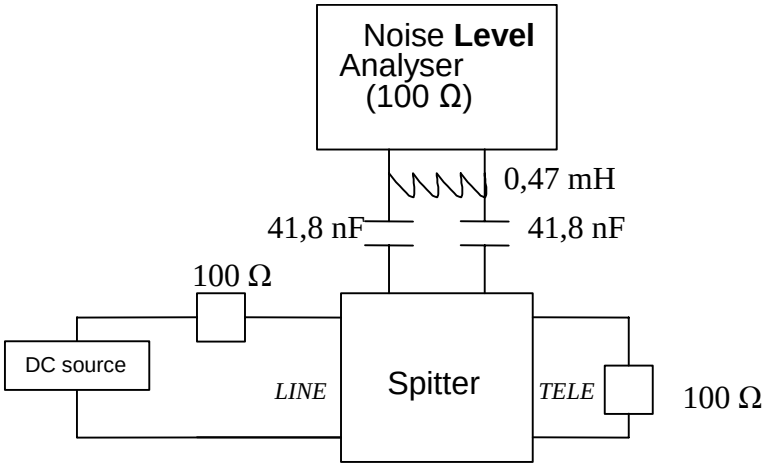



**Figure 14: Test set-up for measuring ADSL band noise at the ADSL port**

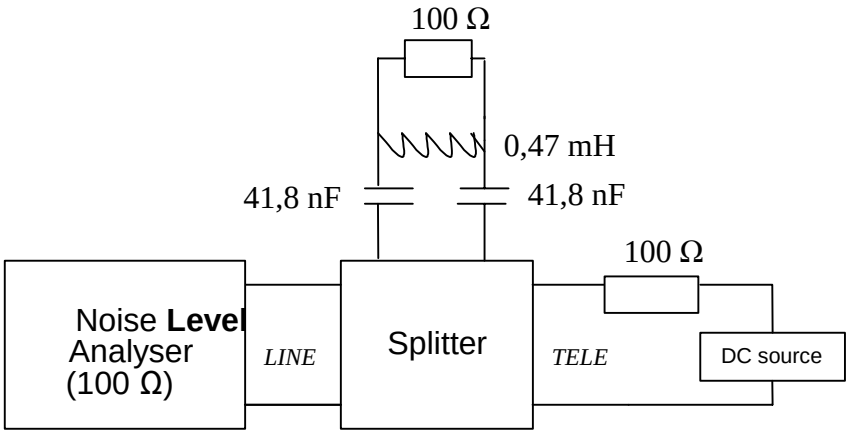



**Figure 15: Test set-up for measuring ADSL band noise at the LINE port**

## 6.9 Intermodulation distortion

### 6.9.1 POTS band intermodulation distortion requirements

The test setup to be used is given in figure 6. This requirement is applicable with the switch S both open and closed. Both the source and load impedance used shall be equivalent to $Z_R$. The DC feeding conditions are given in clause 5.1.2.

The test signal to be used is as according to ITU-T Recommendation O.42 [5].

Using the 4-tone method at a level of -9 dBm, the second and third order harmonic distortion products shall be at least 57 dB and 60 dB, respectively below the received signal level.

The second and third order harmonics of the 4-tone signal are measured at TELE port.

NOTE: A methodology for performing this test in the presence of an ADSL signal is currently under study. This would represent a more realistic scenario for splitter evaluation.

# 6.10 Delay distortion

## 6.10.1 POTS band delay distortion

The increase of the group delay distortion by inserting one splitter shall be less than the figures in table 10, relative to the lowest measured delay in the frequency range 300 Hz to 4 000 Hz. The test set up is given in figure 6. This requirement is applicable with the switch S both open and closed. The DC feeding current is specified in clause 5.1.2.

**Table 10: Group delay distortion, maximum values**

| Frequency range | Maximum value |
|---|---|
| 200 Hz to 600 Hz | 250 µs |
| 600 Hz to 3 200 Hz | 200 µs |
| 3 200 Hz to 4 000 Hz | 250 µs |

Source impedance: $Z_R$

Load impedance: $Z_R$

Level of the test signal : -10 dBV.

## 6.10.2 ISDN band delay distortion

The signal delay distortion of the low pass filter of the splitter shall be < 20 µs up to 80 kHz. The signal delay distortion is defined as the absolute difference between the minimum signal delay (as measured at a discrete frequency in the range up to 80 kHz) and the maximum signal delay as measured at a discrete frequency over the same frequency range.

The set-up for measuring group delay distortion is given in figure 6. This requirement is applicable with the switch S both open and closed. The DC feeding current is specified in clause 5.1.2.

Source impedance: $Z_{ISDN}$

Load impedance: $Z_{ISDN}$

# 6.11 ADSL related requirements

## 6.11.1 ADSL insertion loss

The insertion loss between LINE port and ADSL port shall be as specified in table 11.

The test setup of figure 16 is to be used. The source impedance shall be 100 Ω, and the load impedance shall be $Z_{ADSL\text{-}I}$.

The requirements of table 11 shall be met with the TELE port both open circuited, terminated with $Z_{ISDN}$, and terminated with $Z_{RHF}$.

**Table 11: Insertion loss between LINE and ADSL port for ADSL/ISDN splitters**

| Frequency range | Insertion loss between Line and ADSL port |
|---|---|
| 120 kHz to 170 kHz | < 3 dB |
| 170 kHz to 1 104 kHz | < 1 dB |

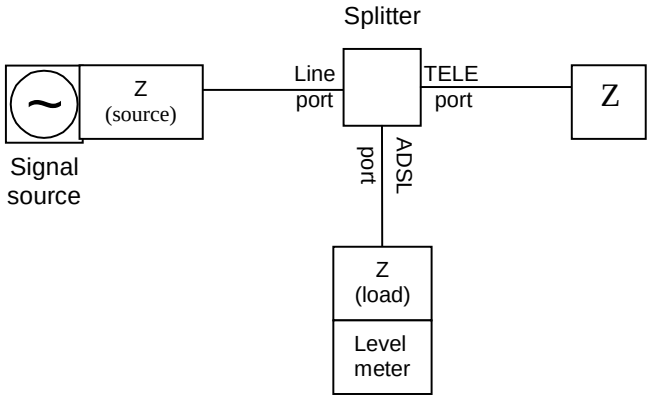



**Figure 16: Test set up for transmission testing from LINE to ADSL**

## 6.12 Requirements related to POTS transient effects

The test set-up is shown in figure 17. It consists of a switch with an on/off transition time less than 2 µs on the TELE port. The resistors $R_{SOURCE}$ are set at 1 kΩ. The DC source is set to 48 V.

The signal $V_1$ measured across the 1 000 Ω, due to each change of state of the switch $S_1$, should be less than 2 V p-p and the main lobe of the Fourier Transform of the transient has its peak at a frequency less than 15 kHz. This applies to both the on and off hook transitions of switch $S_1$.

NOTE: A possible implementation of switch $S_1$ is given in TR 101 728 [2].

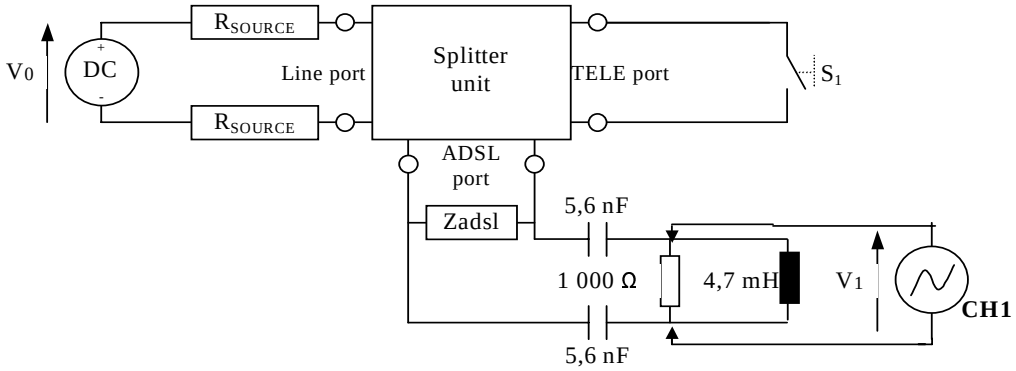



**Figure 17: Test circuit for large signal test**

NOTE: In some cases there could be disturbances from POTS TE that could show a degree of asymmetry at higher frequencies, and therefore common mode suppression methods for splitters are under study.

# Annex A (informative): Bibliography

ITU-T Recommendation G.117: "Transmission aspects of unbalance about earth".

ETSI EN 300 001: "Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".

ETSI ES 201 187: "2-wire analogue voice band interfaces; Loop Disconnect (LD) dialling specific requirements".

ETSI TS 101 952-1-2: "Access network xDSL transmission filters; Part 1: ADSL splitters for European deployment; Sub-part 2: Specification of the high pass part of ADSL/POTS splitters".

# History

| Document history | | |
|---|---|---|
| V1.1.1 | November 2002 | Publication |
| | | |
| | | |
| | | |
| | | |