Specification PTC 281: 2008

Spark Requirements for Customer-connected ADSL2+ Line Filters

Access Standards
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Australia/New Zealand Standard AS/NZS 60950.1: 2003

Australia/New Zealand Standard AS/NZS CISPR 22

Australian Standard AS/ACIF S041: 2006 Requirements for DSL CE for connection to the Public Switched Telephone Network

Australian Standard AS/ACIF S043.2: 2008 Requirements for CE for connection to a metallic local loop interface of a Telecommunications Network Part 2: Broadband

Australia/New Zealand Standard AS/NZS 3080: 2003: Generic Cabling for Commercial Premises

ETSI TS 101 952-1-5 V1.2.1 (2006-10): Specification for ADSL over POTS distributed filters

FOREWORD

This specification defines the technical requirements for the grant of Telepermits for DSL filters for use in customer premises connected to various DSL services.

When ADSL service was introduced in 2000, splitters were permanently installed at the ETP. A separate cable was run from the ETP to a jackpoint to which the ADSL modem was connected. The splitter was installed by a Telecom contractor and no customer installed option was available. This was largely due to the fact that other than the ETP, there was no suitable point in the house wiring where a splitter could be easily connected.

In 2001 PTC 280 was published. This specification covered the requirements for distributed line filters. The ADSL signal was then available at all jackpoints in a house, with line filters required on all jackpoints which had analogue telephones, faxes etc connected. This system had the advantage of flexibility in that the ADSL modem could be connected at any jackpoint, and installation required no specialist tools or personnel.

The disadvantage of using line filters is that the ADSL signal is carried by the house wiring which may be adequate for voice frequency use, but can be unsuitable for DSL frequencies. The impairments that are introduced are poor balance due to the 3 wire house wiring system that houses were wired to in New Zealand and the older cable that is susceptible to interference from the large number of noise sources found in the average home. Examples of interfering sources are light dimmers, switched mode power supplies, and electric motors.

This can cause severe degradation of the ADSL performance that is worse when ADSL2+ or VDSL is deployed. In fact it is not feasible to use line filters at all for VDSL and marginal for ADSL2+.

This specification defines the technical requirements for filters that are suitable for ADSL and ADSL2+ use.

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1. TELEPERMIT TECHNICAL REQUIREMENTS

1.1 General requirements

(1) Line filters need to meet tight performance specifications in order to restrict interference and avoid degrading voiceband telephone and data services. Such degradation must be avoided, independent of whether there is one or up to five filters installed on the same line. In view of this, all line filters shall comply with the requirements of this Specification.

(2) For all relevant tests, voice CPE characteristics are simulated by an off-hook terminating impedance of BT3, a sidetone balance impedance of BT3 and an on-hook impedance of 1.0 MΩ.

1.2 Technical requirements

(1) Technical requirements for POTS performance are generally in line with the requirements of PTC 200 for series-connected devices. However, some qualifications have been necessary in view of there being up to five filters connected on the same line, and to recognise the specific requirements of this class of product.

(2) The following electrical requirements apply under the conditions of measurement of Annex A:

1.2.1 Filter Pre-conditioning Power Test

(1) As a pre-conditioning test prior to all testing, apply 230 Volt AC from a limited current source to the line terminals of 5 samples of the filter under test, randomly selected, with the phone terminals of the filter open circuit. The filter shall withstand this voltage for not less than one minute.

1.2.2 DC Characteristics:

(1) DC loop resistance shall be ≤ 100Ω. (Input to shorted output)

(2) Insulation resistance shall be ≥ 20 MΩ at 250 Vdc (open circuit output).

1.2.3 ADSL2+ band insertion loss

A description of the test method can be found in Annex A2.3 and figure 3 of this specification.

(1) Insertion loss when measured under the conditions specified in Annex A2.3 and within the frequency range 32 to 200 kHz shall be not less than 30 dB.

(2) Insertion loss when measured under the conditions specified in Annex A2.3 and within the frequency band 200 kHz to 2200 kHz shall be not less than 55 dB.

1.2.4 Voice band insertion loss

A description of the test method can be found in Annex A2.4 and figure 4 of this specification.

(1) Insertion loss of a single filter shall be not greater than 1 dB at 1 kHz with ATU-R and 1 filter connected and with dc currents of 0 mA and 100 mA passing through it.

(2) The insertion loss shall be not greater than 1.5 dB at 1 kHz with the ATU-R and up to 5 filters connected, with dc currents of 0 mA and 100 mA passing through the first filter.

(3) Variation of insertion loss of the filters between 200 and 3400 Hz, from that at 1000 Hz shall be not greater than ±1 dB with the ATU-R and 1 filter connected, with 0 mA and 100 mA passing through the filter.

(4) Variation of insertion loss of the filters between 200 and 3400 Hz, from that at 1000 Hz shall be not greater than 1.5 dB with the ATU-R and 5 filters connected, with dc currents of 0 mA and 100 mA passing through the first filter.

1.2.5 ADSL2+ band bridging loss

A description of the test method can be found in Annex A2.5 and figure 5 of this specification.

(1) Bridging loss shall be not greater than 1 dB over the frequency range 25 kHz to 2200 kHz.

1.2.6 Network echo balance return loss

A description of the test method can be found in Annex A2.6 and figure 6 of this specification.

(1) Network echo balance return loss (EBRL) against BT3 shall be not less than 14 dB, with the ATU-R and 5 filters connected, with dc currents of 0 mA and 80 mA passing through the first filter.

1.2.7 Telephone sidetone balance return loss

A description of the test method can be found in Annex A2.7 and figure 7 of this specification.

(1) For 1 to 3 filters connected the SBRL shall be not less than 12 dB with the ATU-R and with dc currents of 0 mA and 80 mA passing through the first filter.

(2) For 4 filters connected the SBRL shall be not less than 11 dB with the ATU-R and with dc currents of 0 mA and 80 mA passing through the first filter.

(3) For 5 filters connected the SBRL shall be not less than 10 dB with the ATU-R and with dc currents of 0 mA and 80 mA passing through the first filter.

1.2.8 Longitudinal Conversion Ratio

A description of the test method can be found in Annex A2.8 and figure 8 of this specification.

(1) Longitudinal Conversion Ratio shall be not less than 40 dB for all frequencies within the range 25 kHz to 2200 kHz and for all phone terminations.

1.3 Conformance testing

(1) Conformance shall be verified by a Telecom accredited laboratory by means of testing in accordance with Annex A of this specification.

1.4 Electrical safety

1.4.1 Conformance with Electrical Safety Specification

(1) The electrical safety requirements of AS/NZ 60950.1: 2003 shall be complied with by all line filters covered by this Specification.

1.5 EMC compliance

(1) The requirements of AS/NZS CISPR 22: 2006 shall be complied with for all items covered by this Specification.

• *Most filters are expected to be passive devices and thus not, in themselves, likely to emit radio interference. However, suppliers must check that active devices when used do not exceed the regulated limits.*

• *The New Zealand requirements for general EMC compliance by items of equipment intended to be installed in customer's premises are the same as those applicable in most overseas countries, including Australia, which most suppliers seem to regard as a single market with New Zealand. As such, EMI test reports acceptable in New Zealand will generally already be available as the result of testing carried out for other markets. Declarations of Conformity are to be submitted to the Ministry of Economic Development and Ctick compliance adhered too.*

2. WIRING AND CONNECTION REQUIREMENTS

2.1 Line filter connection options

(1) For the majority of installations, a line filter will be connected into a BT socket equipped jackpoint in place of the CPE, which will simply re-connect into the output or "phone" port of the filter, using a BT plug. While the overall result is connection from a fixed-wired BT socket to a matching socket on the filter, this arrangement can be achieved in a number of ways:-

(a) A one-box assembly with a BT plug-ended cord and a single BT socket on the CPE side into which the customer's CPE may be directly connected; or

(b) A one-box version with a BT plug-ended cord and two BT sockets – one for the associated POTS CPE and one for an ADSL modem.

• *So few 3-wire telephones are now being used within the network that continuation of the practice of ringing capacitor installation in ADSL2+ Line Filters is no longer required. If customers wish to continue using these telephones on ADSL2+ equipped lines they must purchase a suitable 3-wire adaptor.*

(c) The line filter may be fitted with North American modular sockets for one or both ports and be provided with one or two separate plug-ended cords to act as adaptors.

• *See also clause 2.4 regarding filters for commercial building applications.*

• *This option may permit the use of a mass-market filter unit, but there are technical differences between the US and Telecom performance requirements, which probably require design changes in any case.*

(d) A 2-box assembly consisting of a filter with RJ connections and a separate 3-wire BT plug adapter for where older 3 wire telephones are being used.

2.2 Other options

(a) One box (containing the filter) that plugs directly into a jackpoint (as an adaptor), with one or two appliance sockets as in paragraph 2.1 (a) or (b) above. This is not a preferred option because of the risk of breakage in many service situations.

• *Such units provide little or no protection against impact from anyone passing closely by, brooms, vacuum cleaners and the like, especially if another adapter is plugged into the line filter. Such impact is likely to damage the socket in the jackpoint as well as the plug of the line filter.*

(b) A filter built into the ADSL CPE, with a second socket for a POTS CPE item to be directly connected to it.

• *Such integral filters are also subject to the requirements of this specification and will be tested in conjunction with one to four reference filters.*

(c) POTS CPE with an integral ADSL filter (full requirements in PTC 200).

• *While full requirements for products covered by options b, c are outside the scope of this specification, this specification will be referenced in the assessment of the actual filter performance of any products in these classes that are submitted for Telepermit.*

2.3 Line and Phone Connections

(1) It is essential for correct operation that filters are connected the right way around. Unless it is impossible to wrongly connect them, the filter case shall be boldly and permanently marked “LINE” and “PHONE” in the appropriate locations.

(2) Connections shall be provided to the LINE and PHONE sides of the filter.

(3) Optional provision may be made to connect a CPE ATU-R modem. All connectors shall incorporate the standard latching mechanism.

(4) Provision shall be made to connect the LINE side to contacts 2 and 5 of the standard Telecom BT wall jackpoint. No connection shall be made to contact 4.

• *The usual and recommended approach is to fit a mating BT plug connected via a short length of flexible cord on the line side, with the filter end of the cord hard-wired into the filter body. However, some commercial filters are built with North American sockets integral with the body of the filter. In such cases, an adapter cord may be supplied.*

(5) Unless suitable provisions are made to prevent physical damage to the filter or the jackpoint by sideways displacement, the BT plug shall not be rigidly attached to the filter case.

• *This requirement is intended to prevent damage to the jackpoint and filter, especially where connections are made via one or more adapters. Such breakage is likely to be caused to assemblies protruding from the wall surface by the movement of furniture, people, cleaning equipment, etc.*

(6) On the PHONE side, provision shall be made for the connection of a BT plug, using contacts 2 and 5.

(7) A 1.0 μF polyester capacitor with a breakdown voltage of 250 V_{dc} maybe connected between contacts 4 and 5 of the PHONE side BT jack. This provides ringing to older phone types, still in use.

(8) Where no ringing capacitor is provided:-

> Sales literature and packing shall clearly state that “This filter will require a separate ringing adapter to work correctly with some older telephones” and shall specify one or more suitable adapters that can be used.

• *Preferably, the filter supplier should arrange for suitable adapters to be available from all outlets supplying filters to end-users. Ringing adapters do not require a separate Telepermit.*

(9) Unless a capacitor is provided, no connection shall be made to contact 4 of the BT PHONE side jack.

2.4 Commercial building applications

(1) Commercial premises may also use “residential type wiring”, but larger premises are using generic cabling to AS/NZS 3080: 2003 with RJ 45 8-way North American modular connectors.

(2) Line filters may be designed for use at customer installations using North American style 8-way modular jackpoints (known locally as “RJ 45”), in which case they shall connect via a mating 8-way plug, using only pins 4 and 5.

(3) Filters fitted with RJ 45 plugs or sockets, designed and intended for such commercial applications, shall be clearly marked as for commercial premises only.

PTC 281: ANNEX A FILTER PERFORMANCE TESTING

A1 General testing conditions

A1.1 Number of filters

(1) Tests are generally carried out with one, two, three, four and five parallel connected filters. Off-hook CPE shall be represented by BT3 and on-hook CPE by Z_{ON} (1.0 MΩ). These can be referred to as Z_{off} and Z_{on} respectively.

(2) Where a line filter and POTS or "Phone" port is integral with another item of ADSL CPE, the filter performance of such devices shall be tested in conjunction with one, two, three, and four parallel connected "reference filters" meeting the requirements of this specification.

A1.2 DC Line current

(1) Compliance with DC line current is required for all conditions that include off-hook CPE.

(2) In all testing the DC line current shall be set up as in the specific test description.

(3) Line current is supplied by an adjustable DC power supply with min 10 H and (5 to 10) mH inductors “built out” to a total resistance of 200Ω, one of these in each leg of the circuit. The 10 H inductor is to be at the power supply end of the circuit.

(4) The DC load is the same circuit without resistors and a short-circuit replacing the DC supply.

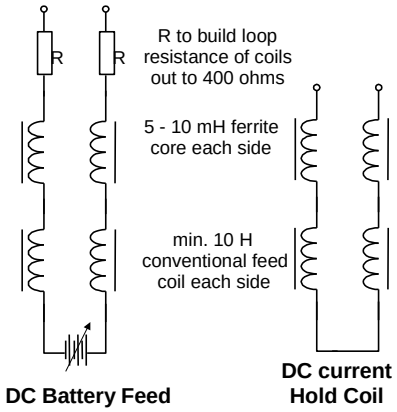


Figure 1: The Wideband DC Feed and Hold circuits.

A1.3 ATU-R simulation

(1) The "$Z_{ATU\text{-}R,\ VF}$ – Simulated impedance of ATU-R valid for Voice Frequencies (0 – 4kHz)" diagram given in Figure 2 is Telecom's equivalent circuit for simulating the ADSL2+ router impedance at VF.

(2) The "$Z_{ATU\text{-}R,\ HF}$ – Simulated impedance of ATU-R for High Frequencies (25 kHz-10MHz) diagram given in Figure 2 is Telecom's equivalent circuit for simulating the ADSL2+ router impedance at High Frequencies (HF).

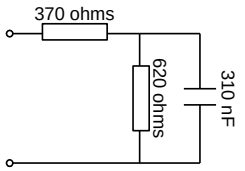
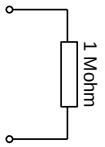
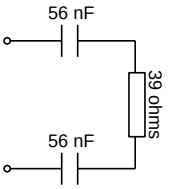
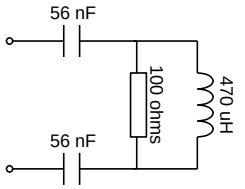
BT3 Reference Impedance	
Z_{ON} – Simulated on hook impedance of a phone.	
$Z_{ATU\text{-}R,\ VF}$ – Simulated impedance of ATU-R, valid for Voice Frequencies (0 – 4 kHz).	
$Z_{ATU\text{-}R,\ HF}$ – Simulated impedance of ATU-R for High Frequencies (25 kHz – 10MHz).	

Figure 2: Simulated and reference impedances.

A2 Specific tests

A2.1 Filter Pre-conditioning Power Test

(1) As a pre-conditioning test prior to all testing, apply 230 Volt AC from a limited current source to the line terminals of 5 samples of the filter under test, randomly selected, with the phone terminals of the filter open circuit. The filter shall withstand this voltage for not less than one minute.

(2) This test shall be completed individually on any five filters selected as the "filters under test" for where the tests require the use of 5 filters. Where only 1 filter is required for the test it may be randomly selected as any 1 of the 5 "filters under test".

A2.2 DC Characteristics

(1) DC loop resistance shall be $\leq 100\Omega$.

(2) Insulation resistance shall be $\geq 20\ M\Omega$ at 250 Vdc.

A2.3 ADSL2+ Band Insertion Loss

(1) Set the signal generator to 100 Ω source impedance and set the output signal so that it will produce nominally +10 dBm (100Ω) across an external load of 100 Ω. This signal shall be used for the test described below in A2.3; the external 100 Ω load does not form part of the A2.3 test set-up. When connected to the test set-up the signal will vary according to the load impedance of the test circuit.

(2) The above signal with a frequency range of 32 to 2200 kHz shall be applied at the network of filters. The test shall have the simulated ATU-R HF and 1 to 5 filters connected with 0, 20, 50, 80 and 100mA dc applied through the first filter. The first filter is terminated with 600 Ω and the other 4 filters are terminated with Z_{ON}. The measurements must be taken at 32 kHz, 50, 100 kHz, 200 kHz, 350, 500, 1100 and 2200 kHz.

(3) The reference measurements shall be taken with the filters bypassed and with the simulated ATU-R connected; at each of the specified dc current levels; and at each of the specified frequency points as in the diagram shown in figure 3.

(4) The insertion loss is the calculated decibel difference between the reference measurement (filters bypassed) and the measurement with the filters in circuit.

(5) The test report shall also include a graph of the worst-case test scenario with sufficient test points to show the highs and lows of the insertion loss throughout the frequency range of 32 kHz to 2200 kHz.

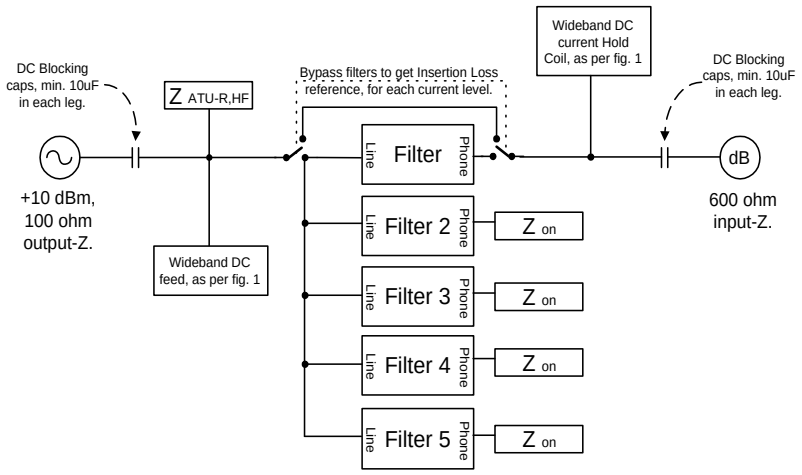


Figure 3: ADSL2+ band insertion loss test setup.

Insertion loss for 32 to 200 kHz shall be not less than 30 dB
Insertion loss for 200 kHz to 2200 kHz shall be not less than 55 dB

(6) A total of 40 readings (plus reference readings at 8 frequencies for bypassed filters) are required for this test plus the graph showing overall detail of the required frequency spectrum.

A2.4 Voice Band Insertion Loss

(1) The signal generator is set to BT3 source impedance and its output voltage controls adjusted so that a voltage of 0.8 volts RMS is produced across an external BT3 load; this signal shall be used for the test described below in A2.4

(2) The insertion loss measurements are taken over the frequency range 200 Hz to 3400 Hz with the ATU-R and 1 to 5 filters connected; with BT3 source and load impedances and with dc currents of 0 mA and 100 mA through the first filter. Filters 2 to 5 are terminated with Z_{ON} (1.0 MΩ).

(3) The reference measurements shall be taken with the filters bypassed as shown in figure 4 and with the ATU-R connected; with BT3 source and load impedances and with 0 and 100 mA dc currents through the bypass.

(4) The insertion loss is the decibel difference between the reference measurement with filters bypassed, and the measurement with the filter network in circuit.

(5) The minimum frequency points shall be 200, 500, 1000, 2000, 3000 and 3400 Hz.

Requirements:

(6) Insertion loss shall be not greater than 1 dB at 1 kHz with the ATU-R and 1 filter connected; with dc currents of 0 mA and 100 mA through the filter.

(7) The insertion loss shall be not greater than 1.5 dB at 1 kHz with the ATU-R and 1 to 5 filters connected; with dc currents of 0 mA and 100 mA through the first filter.

(8) The variation of insertion loss, within the frequency range 200 Hz to 3400 Hz, from that at 1000 Hz, shall be not greater than 1 dB with the ATU-R and 1 filter connected; with dc currents of 0 mA and 100 mA through the filter

(9) The variation of insertion loss, within the frequency range 200 Hz to 3400 Hz, from that at 1000 Hz, shall be not greater than 1.5 dB with the ATU-R and 5 filters connected; with dc currents of 0 mA and 100 mA through the first filter.

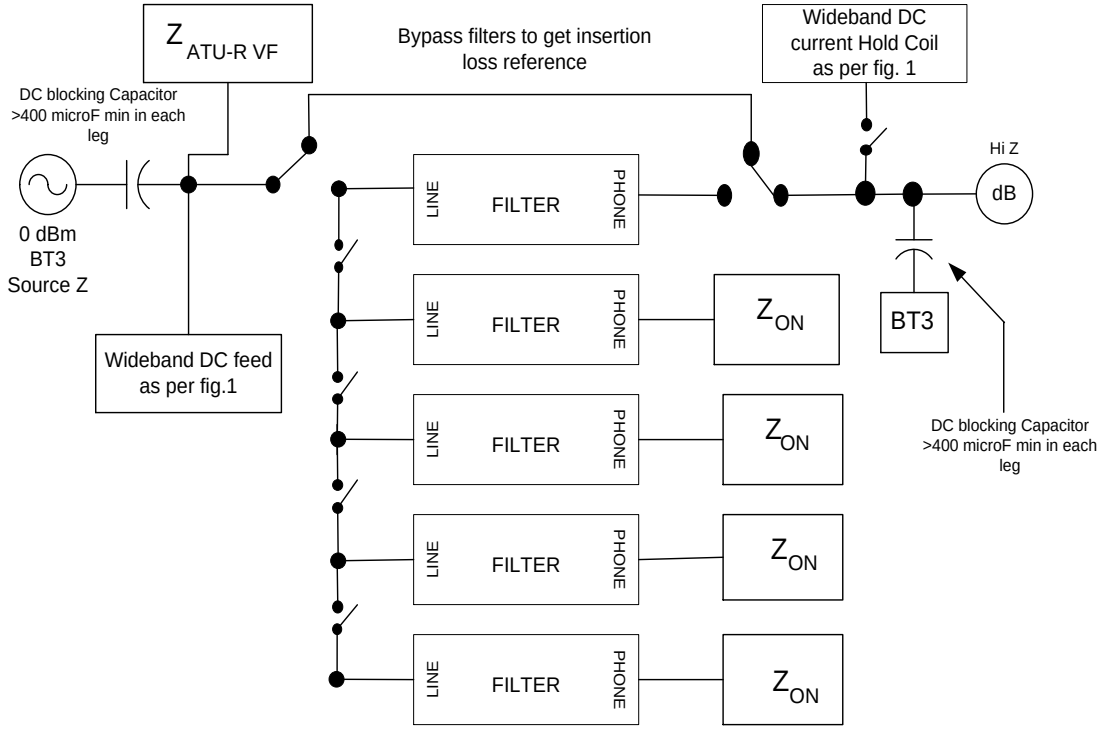


Figure 4: Voice band insertion loss test setup.

(10) There are six single point measurement readings for the bypassed filters. Plus 6 single point frequency readings as each of 5 filters are switched into circuit at 0 mA and similarly at 100 mA making a total of 66 measurements.

A2.5 ADSL2+ Band Bridging Loss

(1) Set the signal generator to 100 Ω source impedance and set its output signal such that it will produce nominally +10 dBm (100Ω) across an external load of 100 Ω. This signal shall be used for the test described below in A2.5; the external 100 Ω load does not form part of the A2.5 test set-up.

(2) Close the switch and take measurements with the ATU-R and all the 5 filters connected. Measurements are taken with the first filter terminated in Z_{ON} (1 MΩ) and then with it terminated in BT3. The measurements must be taken at 25 kHz, 50, 100 kHz, 350, 500, 1100 and 2200 kHz.

(3) The bridging loss is the decibel difference between the reference voltage measurement and the voltage measurement with the filters connected.

(4) A measurement is taken at each of the frequencies above for the ATU-R alone, then for the first filter terminated in Z_{ON}, then for the first filter terminated in BT3 making a total of 21 measurements to be recorded.

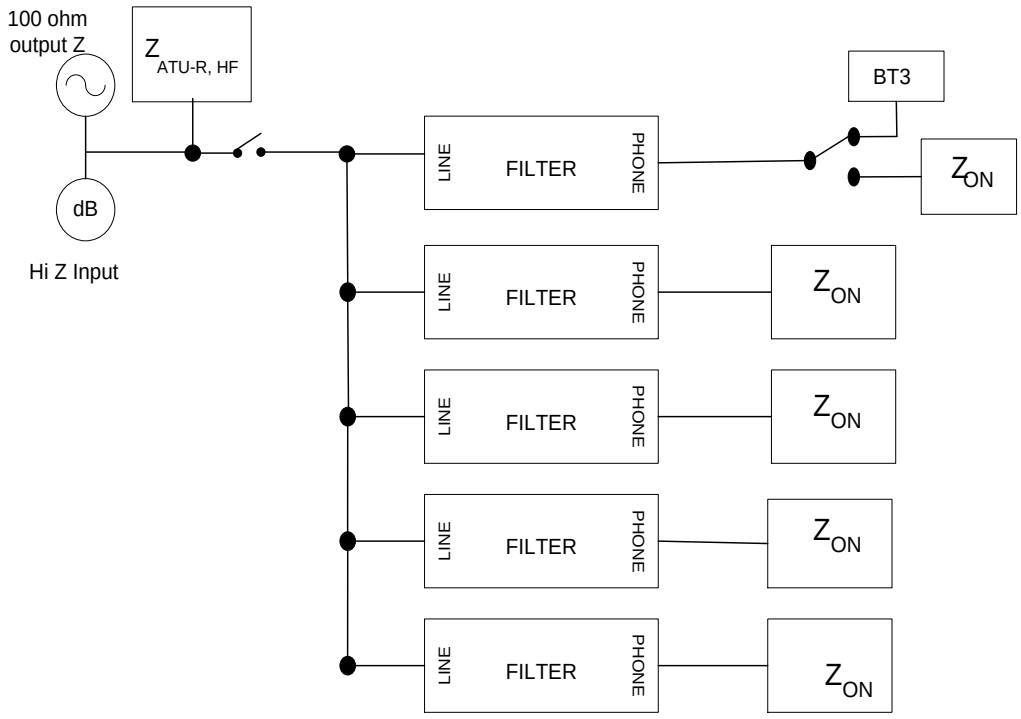


Figure 5: ADSL2+ band bridging loss test setup.

(5) Requirement:
Bridging loss shall be not greater than 1 dB over the frequency range of 25 kHz to 2200 kHz.

A2.6 Network Echo Balance Return Loss (EBRL)

(1) The EBRL is measured at the Line input to the filters against a BT3 impedance termination of the first filter with 1 to 5 filters connected and with dc currents of 20 mA and 80 mA through the first filter. The first filter is terminated with a BT3 impedance on the Phone side and the 4 parallel filters are terminated in Z_{ON} (1 MΩ); the ATU-R is always connected.

(2) The applied test signal voltage at the Line terminals is recommended to be nominally -10 dBm (600).

(3) The EBRL is calculated from the balance return loss measurements or those calculated from measurements of the complex impedance. The equation for the calculation is given on page 19.

(4) A measurement is recorded for the first filter alone and then as each of the 4 parallel filters is switched into the filter network; making a total of 5 recorded measurements.

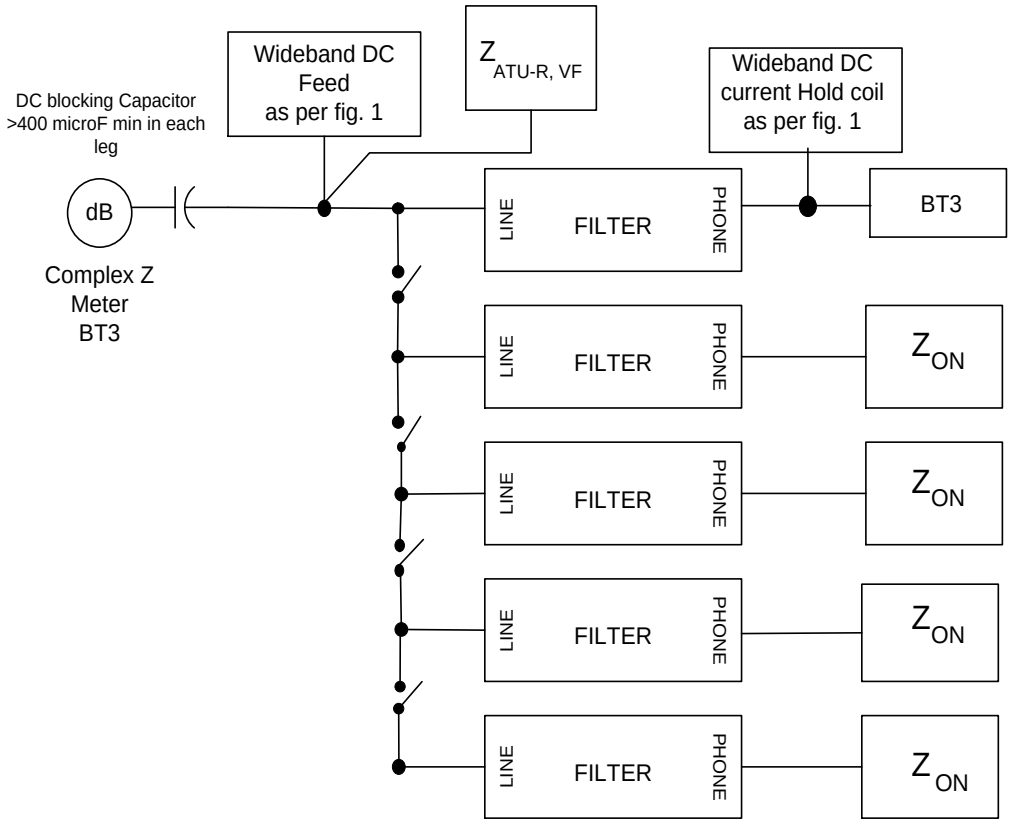


Figure 6: Network echo balance return loss test setup.

(5) Requirement:

EBRL against BT3 shall be not less than 14 dB

A2.6.1 Echo Balance Return Loss (EBRL) Calculation

EBRL was earlier known as Echo Return Loss (ERL) it is computed from measured values of balance return loss or those calculated from complex impedance measurements averaged with 1/f power weighting over the voice band using the formula in ITU-T Rec. G.122 clause 4.2 for EBRL given below.

$$EBRL = 3.85 - 10\log_{10}\left[\int_{300}^{3400} \frac{A(f)}{f}\,df\right] \quad \text{dB}$$

Where $A(f) = 10^{\frac{-L_{ab}(f)}{10}}$ with L_{ab} = balance return loss

A2.7 Telephone Sidetone Echo Balance Return Loss (SEBRL)

(1) The SEBRL is measured at the Phone side of the first filter against BT3 reference impedance; with 1 to 5 filters connected and dc currents of 20 mA and 80 mA through the first filter. The Line side terminals of the filters are terminated with BT3 impedance; the Phone side terminals of the 4 parallel filters are terminated in Z_{ON} (1 MΩ); the ATU-R is always connected.

(2) The applied test signal voltage at the Line terminals is recommended to be nominally -10 dBm (600).

(3) EBRL is computed from measured or calculated values of balance return loss. See EBRL on page 20 for the formula.

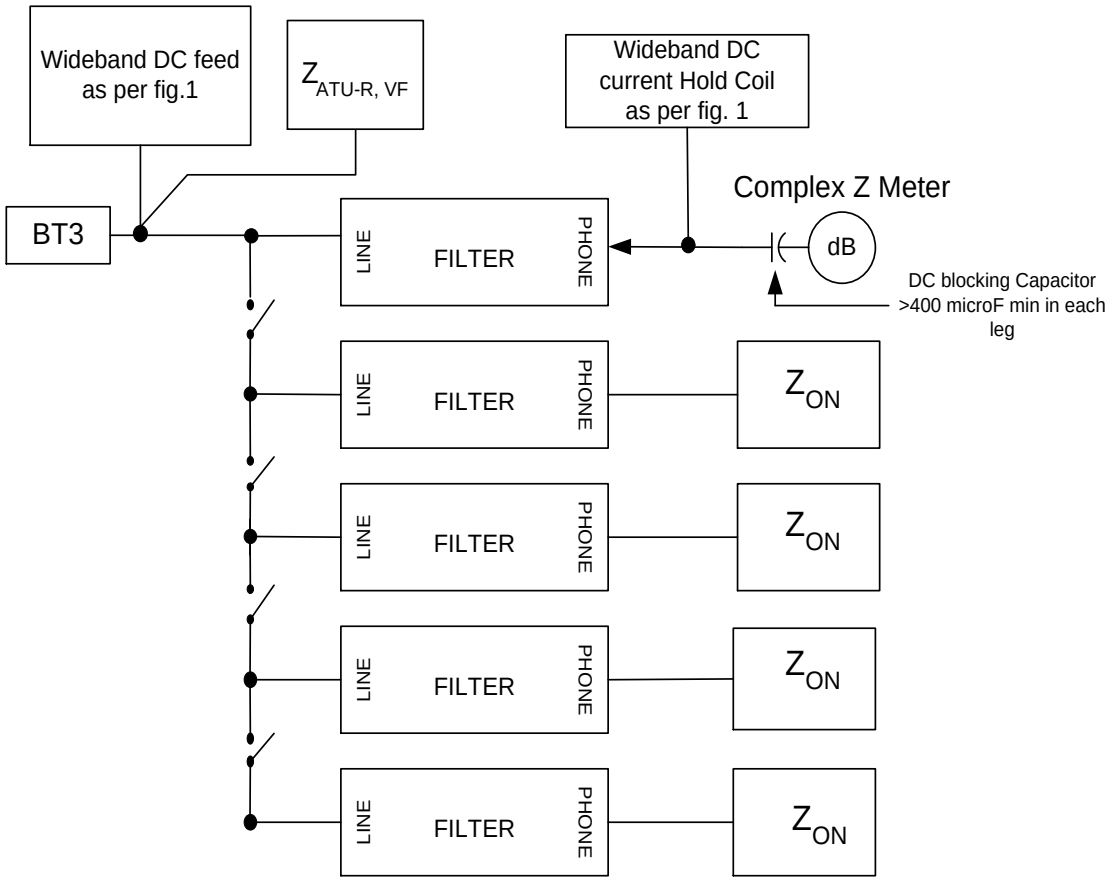


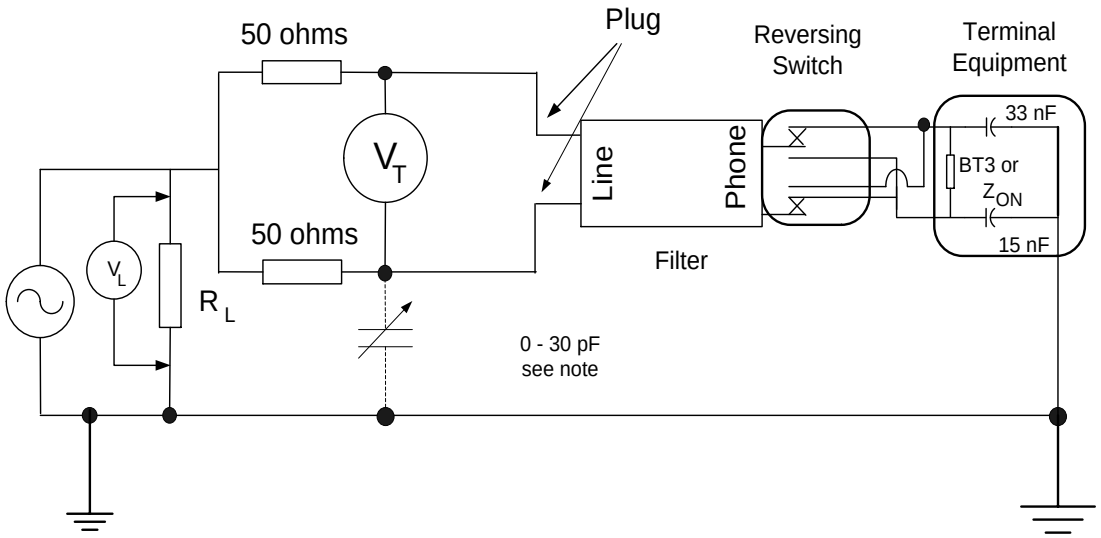
Figure 7: Telephone sidetone balance return loss test setup.

Requirement:

For 1 to 3 filters connected the SBRL shall be not less than 12 dB.
For 4 filters connected the SBRL shall be not less than 11 dB.
For 5 filters connected the SBRL shall be not less than 10 dB.

A2.8 Longitudinal Conversion Ratio

(1) The longitudinal conversion ratio LCR (ref ITU-T Rec G.117 §4.1.3) shall be measured at the line side of one filter, with the phone side terminated firstly with BT3 and secondly with Z_{ON} (1 MΩ). The Phone side terminals are earthed via the two capacitors as shown in figure 8.



Notes:

- Source impedance of generator shall be 75 or 50 ohms with matching load R_L

- 50 ohm resistors to be matched to 0.1%

- Meter for V_T is balanced and high impedance.

- Signal generator and level meter mains earth and circuit earth connections shall be interconnected.

- Balance of the measurement setup without the filter shall be measured and recorded at each frequency (given below) up to 30 pF may be used on one side of the voltmeter to improve the balance of the "network".

- As the circuit simulating the Terminal Equipment is unbalanced its effect must be measured when connected in both directions hence the need for a reversing switch.

Figure 8: Longitudinal Conversion Ratio test set-up.

(2) Measurements shall be made of the resultant transverse voltage V_T, from application of a longitudinally applied voltage V_L of magnitude equivalent to +10 dBm (100 Ω), at 25, 50, 100, 200, 500, 1100 and 2200 kHz.

(3) The Longitudinal Conversion Ratio is calculated from the formula below:

$$LCR = 20 \log (V_T / V_L) \text{ dB}$$

(4) The total number of readings is doubled because of the reversing requirement. The test report shall also include a graph of the worst-case test scenario with sufficient test points to show the highs and lows of the LCR throughout the specified frequency range.

(5) Taking high frequency measurements is difficult and care is required for the construction of the test set-up so that the resulting measurements are

accurate. Adjustment and recording of the test set-up balance with the filter unplugged shall be carried out at each frequency to compensate for the reactive impedance unbalance of the level meter and of the other set-up components and the wiring. A selective level meter is recommended to avoid measurements that include noise voltage.

(6) V_L must be measured directly with a voltmeter, do not assume the voltage from the meter on the Level Generator is accurate.

(6) Where alternative instrumentation is used, the generator voltage shall be measured with a bridging (HiZ) meter and the transverse voltage measured with a balanced bridging (HiZ) meter, for each test.

(7) Requirement:
LCR shall be at least 40 dB for all PHONE terminations.

(8) The frequency measurements required are at 25, 50, 100, 200, 500, 1100 and 2200 kHz making a total of 7 in each direction of the reversing switch 14 measurements in total.

A3 Responses to PTC 281: 2008 ADSL2+ Line Filters

A3.1 Mains Power Conformance Test

(1) Withstand mains power on input for 1 minute comply Yes/No……

A3.2 DC Characteristics

(1) DC loop resistance ≤ 100Ω comply Yes/No……

(2) DC Insulation Resistance ≥ 20 MΩ @ 250Volts comply Yes/No……

A3.3 ADSL2+ band insertion loss

Insertion loss any number of filters:

(1) 32 kHz to 200 kHz no less than 30 dB comply Yes/No……
(2) 200 kHz to 2200 kHz no less than 55 dB comply Yes/No……

Forty measurements plus 1 frequency sweep showing complete detail.

A3.4 Voice band insertion loss

(1) Insertion loss for one filter no greater than 1 dB comply Yes/No……
At 1 kHz

(2) With ATU-R & 1 to 5 filters connected comply Yes/No……
Insertion loss shall be no greater than 1.5 dB

(3) Variation of insertion loss for 1 filter comply Yes/No……
Over voiceband from 1 kHz not greater than ±1 dB

(4) Insertion loss variation up to 5 filters comply Yes/No……
Over voice band from 1 kHz not greater than ±1.5 dB

Sixty six measurements required.

A3.5 ADSL2+ band bridging loss

(1) Bridging loss shall be ≤ 1 dB comply Yes/No……
Over the ADSL2+ frequency range

Twenty one measurements required.

A3.6 Network echo balance return loss

(1) For all numbers of filters EBRL against BT3 comply Yes/No……
Shall be ≥ 14 dB

Five measurements required plus EBRL calculations.

A3.7 Telephone sidetone Echo balance return loss

(1) For 1 to 3 filters connected SEBRL comply Yes/No……
Shall be not less than 12 dB.
(2) For 4 filters connected SEBRL comply Yes/No……
Shall be not less than 11 dB.
(3) For 5 filters connected SEBRL comply Yes/No……
Shall be not less than 10 dB.

Thirty measurements required if the 3 filter requirement cannot be reached by 5 filters.

A3.8 Longitudinal Conversion Ratio

(1) Longitudinal Conversion Ratio shall be ≥ 40 dB comply Yes/No……
Fourteen measurements required.

A4. Customer Warnings

(1) Is a ringing capacitor connected in this filter? Yes/No……

Telephones using 3 wire Ringing

If the answer is NO please explain how customers have been informed to make 3 wire telephones work on their ADSL2+ capable telephone line.

SEBRL Compliance

(2) If the 5 parallel filter telephone Sidetone Balance Return Loss (SBRL) specification of this product does not meet the 1 to 3 filter requirement (12 dB) then the following notice must be displayed to customers in the product user instructions:

The Useful Number of connections within the house for this ADSL2+ Filter

Customers who wish to connect a computer plus four or five telephones to their house wiring using this ADSL2+ filter will likely experience degraded service. Telecom recommends customers in this category ring Telecom (123) and have a centralised splitter installed thereby removing the need for distributed filters.

End of Specification