



Specification PTC 280: 2001

Interim Telecom Requirements

for Customer-connected

ADSL Line Filters

Access Standards
Telecom Corporation of New Zealand Limited
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Related Telecom Specifications

PTC 100: Telecom Permit to Connect: General Conditions

TNA 102: Telephone Network General Interface Requirements

PTC 103: Code of Practice for Residential –Type Customer Premises Wiring

PTC 1xx Code of Practice for Customer Premises Wiring for ADSL
(for future publication)

PTC 200: Requirements for the Connection of Equipment to Analogue Lines

PTC 270: Interim Arrangements for ADSL CPE Provisional Telepermits

Other Relevant Documents/Standards

Australia/New Zealand Standard AS/NZS 3260:1993

Australia/New Zealand Standard AS/NZS 60950: 2000

Australia/New Zealand Standard AS/NZS 3548:1993 (EN 55022, CISPR 22)

New Zealand Electricity Regulations: 1997

New Zealand Electrical Codes of Practice

Radio Communications Act 1989

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FOREWORD

This Specification defines provisional technical requirements for the grant of Telepermits for line filters to be associated with customer premises equipment (CPE) and premises wiring connected to Telecom's "JetStream" and other related services using Asymmetrical Digital Subscribers Line (ADSL) transmission.

There are now over 6 000 different items of CPE that may be connected to the Telecom network. The impact of ADSL signals on these products is not known, as their technical characteristics were not defined at the frequencies used for ADSL. To avoid interaction problems, which could impact on both voice frequency and ADSL CPE, there are two basic options; install a single splitter at or immediately adjacent to the network entry point, or use one or more line filters on the line side of any "plain old telephone service" (POTS) CPE connected to a line carrying ADSL signals.

A single permanently installed splitter with a separate cable run to the ADSL jackpoint is the preferred option, as it is not only the most assured means of preventing interaction problems, but also a way of avoiding radio interference. Unfortunately, splitters can involve a high installation cost. However, service trials have shown that it will usually be possible to avoid degradation of POTS CPE performance, as long as the customer connects suitable line filters at each jackpoint. By so doing, a customer will be able to avoid the costs of having a contractor visit the premises to install a splitter.

Each filter will have two functions; to ensure that the POTS CPE connected "behind" it does not interfere with the ADSL service, and to attenuate the ADSL signals so that they will not interfere with the normal operation of that equipment. For example, the POTS CPE could de-modulate the ADSL signals to generate voiceband noise.

Telecom's full-rate ADSL uses frequencies overlapping the AM broadcast radio band and there is potential for spurious radiation from poorly balanced customer wiring and CPE. This could result in unacceptable levels of radio frequency interference (RFI). Unlike splitters located at the entry point, line filters do not isolate all the existing premises wiring from the high frequency signals. While it is expected that the use of line filters will not conflict with the RFI suppression requirements in many installations, additional measures for limiting radio frequency interference may be required in areas having low radio signal levels or in any cases where customers often listen to distant AM broadcast radio stations.

Although the use of line filters can usually avoid the need for a site visit by a Telecom installer, it may not be a practicable or economic approach in some

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customers' premises, either due to their cabling configurations or where there are a large number of jackpoints and CPE items installed.

Line filters, by their very nature, introduce both series and bridging loss for the CPE connected to them and can degrade the normal POTS performance of that CPE or the line as a whole. The performance requirements of this specification limit the amount of degradation to what will generally be acceptable levels even when up to five units are installed on the same line, but the installation of a splitter may be the only practicable option in larger installations if more than five filters are required.

In accepting the use of line filters as an alternative to the installation of a splitter, this Specification relaxes the more cautious approach towards RFI and CPE interaction issues taken in the draft CPE specification, PTC 270. The first draft of PTC 270 mandated the use of Telecom-installed line splitters connected at the network entry point. This will be amended in due course.

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TELECOM DISCLAIMER

While every care has been taken, Telecom nevertheless makes no representation or warranty, express or implied, with respect to the sufficiency, accuracy, or utility of any information or opinion contained in this draft Specification. Telecom expressly advises that the use of or reliance on such information is at the risk of the person concerned.

Telecom shall not be liable for any loss (including consequential loss) damage or injury incurred by any person or organisation arising out of the sufficiency, accuracy, or utility of any such information or opinion.

In particular, the question of radio interference is very dependent on the nature of the wiring in the customer's premises. As a result, it cannot be guaranteed that RFI will be avoided in all cases, even where line filters are fully compliant with this Specification and are fitted at every jackpoint.

Telecom is undertaking trials to determine the extent to which filters can be used, but it is already clear that they will not always be fully effective. In view of these factors, Telecom reserves the right to amend this draft specification and its associated wiring arrangements.

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1. SCOPE**1.1 General**

(1) Telecom offers a number of high speed data services using Asymmetrical Digital Subscribers Line (ADSL) transmission. The first of these are known as “JetStream” and “JetStart. These services are primarily designed for accessing the internet over a customer’s telephone line, such that both forms of communication can take place simultaneously. There are also variants of this service, for setting up such facilities as “Virtual Private Networks” (VPN’s) or supporting specialised applications, and these will be introduced progressively. Telecom’s “JetStream” and related services are based on ITU-T Rec. G.992.1. However, the network equipment used by Telecom (the DSL Access Multiplexer or “DSLAM”) will also facilitate interoperability with customer premises equipment (CPE) to the T1.413 Issue 2 specifications and, possibly later, to the G.992.2 standard.

(2) This specification outlines the minimum performance requirements for plug-in line filters used at jackpoints. Hard-wired filters used as alternatives to line splitters and connected to the fixed wiring at the network entry point, are not covered in this Specification.

(3) The requirements of this specification cover basic interoperability, network protection and radio interference limitation matters. It must be recognised that these requirements do not purport to be sufficiently complete to ensure that satisfactory operation can be guaranteed, especially over the full range of line, CPE, and customer premises wiring conditions. Also, it must be stressed that there may be changes in network equipment, or in the types and number of CPE items used by a customer, such that, even where operation is initially satisfactory, it cannot be guaranteed in the long term.

1.2 Specification format

(1) General background information and requirements forming part of this Specification are printed in plain text in numbered clauses. Comments and notes intended for explanatory purposes and not part of the formal text. These are printed in italics in a smaller print size, in unnumbered clauses, but preceded with a “•” symbol.

(2) The word “shall” indicates a mandatory requirement, all of which must be met in order to qualify for a Telepermit. Mandatory requirements are shaded for ease of reference. The word “should” indicates a non-mandatory recommendation of Telecom. The word “may” indicates an option having no consequence to Telecom.

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1.3 Marketing features

(1) This Specification does not define or restrict the design methods of line filters submitted for Telepermit, nor the physical dimensions of such products. It simply defines the technical parameters that have to be met, the basic electrical interfaces and the information that needs to be provided to purchasers and installers.

- *Additional functions and features provided by the equipment are regarded as marketing features to be determined by the product designers.*

1.4 Warnings

(1) Telecom is mindful of the wide range of wiring arrangements used in customers' premises, in terms of age, the number of jackpoints fitted, the lengths of cabling runs and the types of cable used. Also, there is a wide range of different CPE types and the number of CPE items connected in any premises.

(2) The grant of a Telepermit requires independent confirmation that the design meets the requirements of this specification and that the resultant products will significantly reduce interference to or degradation of other Telecom network services. Because so many variables arise in practice in regard to the use of filters, neither Telecom nor the supplier is in a position to guarantee that the use of line filters will be adequate in all cases.

(3) As a result, despite compliance with this Specification, suppliers shall warn their customers that no assurance can be given to the effect that the use of line filters will avoid all potential problems.

- *Suggested text of warnings to customers and standard advisory information are provided in the Appendices to this Specification.*
- *Because of this doubt over their "universal effectiveness", this specification should be regarded as "interim" and changes to this specification can be expected as the result of technical developments and experience gained from further operation of ADSL services with line filters.*
- *It must be recognised that there is far more assurance of satisfactory operation if a splitter is used and correctly installed in conjunction with a separate cable and jackpoint for the ADSL CPE. However, line filters provide another option, which may be cheaper to install and just as effective as a splitter for many customers.*

(4) Because of the number of factors outside its direct control and most customers' inability to determine exactly what types of wiring have been installed, Telecom shall not be liable for any form of compensation to suppliers or purchasers of Telepermitted line filters that prove inadequate in preventing radio interference or degraded performance of other CPE in the customer's premises.

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(5) Any changes to this specification will be incorporated into a later edition or, possibly, a superseding specification. Telepermits issued against this interim specification may expire should significant problems be revealed in service. Suppliers will then be required to arrange further testing against any changed provisions, in order to qualify for a full Telepermit.

1.5 General Telepermit requirements

(1) This Specification shall be read in conjunction with PTC 100, which covers the general conditions applicable to the Telepermit system.

- *PTC 100 is available on-line free of charge via the Access Standards website, which is <http://www.telepermit.co.nz>.*

(2) Where there is any conflict between the requirements of this Specification and PTC 100, the requirements of this Specification shall take precedence.

- *This is particularly important in the case of ADSL services, as there is still some doubt about the definition of network interface details.*

(3) In view of the potential for changes in the future, the technical requirements of the particular issue of this specification, which is current at the time of application, shall be met by all line filters submitted for Telepermit.

(4) In the event of a major change in technical requirements, a filter meeting this interim specification may no longer comply with a later version. Should such non-compliance be the cause of service problems, it may be necessary to cancel or set additional conditions in relation to the use of products Telepermitted to this interim specification.

1.6 Changes in PTC Specifications

(1) Telecom will develop this specification to cover new or changed requirements with the aim of publishing such information as is necessary for suppliers to design product which will better meet customer requirements

(2) Telecom will publish this draft document and later issues, free of charge, on the Access Standards website. Actual specification changes will be supplemented by further information in the Access Standards Newsletter, as and when required.

- *The URL of the Access Standards website is <http://www.telepermit.co.nz>.*

(3) Where justified by the results of service experience, Telecom reserves the right to review any Telepermit grant and to amend the requirements of this Specification.

- *This may arise in the event of network changes or problem reports affecting a significant proportion of installations or the CPE associated with them.*

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2. DEFINITIONS

The terminology and acronyms used in this specification are mostly described in full at their first appearance, or are those used by ITU-T, particularly that defined in Rec. G.100, Rec. G.992.1 and Rec. G.992.2. The following covers the more frequently used terms:-

2-wire: is Telecom's standard residential-type premises wiring practice, using British Telecom-style sockets, with balanced wiring.

- *2-wire jackpoints have superseded the earlier "3-wire" jackpoints and wiring system based on British Telecom practices, but retain the same socket assembly and plug type.*

3-wire: is Telecom's earlier wiring practice, which uses British Telecom-style sockets, but with un-balanced wiring due to the use of a third wire as a common ringing supply for all 3-wire connected CPE on the line concerned.

ADSL: Asymmetrical Digital Subscriber Line

- *The form of line transmission used by Telecom for "JetStream" and related services.*

AM Broadcast band: the band of radio frequencies extending from 550 kHz to 1600 kHz used for amplitude modulated public broadcast services.

ATU-C: ADSL Transceiver Unit – used at the exchange or "central office" end of an ADSL line.

- *Generally referred to in this document as a "DSLAM"*

ATU-R: ADSL Transceiver Unit – Remote End

- *Generally referred to in this document as the CPE or modem*

Compatibility: Those functions of the CPE that bear upon the capability of Telecom's network to perform correctly.

- *In this specification, this relates to measures to contain harmful crosstalk and radiation, together with issues that would otherwise impair the performance or maintenance of the POTS line.*

DSLAM: Digital Subscribers Line Access Multiplexer

Echo Balance Return Loss (EBRL) was earlier known as Echo Return Loss (ERL), which is still used by ANSI. EBRL is a single value voice frequency loss of a signal that passes directly from the receive to the send port of the 4-wire side of a hybrid circuit, as a consequence of the degree of impedance match

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between the hybrid balance impedance and that impedance presented to the 2-wire port of the hybrid. Thus it pertains to the degree of talker echo perceived at the far-end telephone and to the degree of sidetone perceived at the near-end telephone, of an end to end telephone connection.

EBRL is determined from measured values of balance return loss, or from values calculated from complex impedance measurements in accordance with Rec. G.100 §4.1 and Rec. G.122 §B.2. Measurements shall cover the frequency range 300 Hz to 3400 Hz at no less than 200 Hz intervals. The balance return loss values are then averaged with 1/f power weighting over the voice band using the “tabulated data” method for echo loss in Rec. G.122 §B.4, as specified by Rec. G.100 §4.5, to determine the required echo balance return loss.

An example is given in TABLE B.1/G.122. Note that the loss values in column (4) are the balance return loss values and actual values are used at all frequencies, including 300 Hz and 3400 Hz, where TABLE B.1 (misleadingly) shows 8 (infinity).

G.Lite: the designation given to the draft standard for splitterless ADSL, originally using a restricted downstream frequency band and designed to avoid the need for a splitter, by making use of separate line filters connected at all jackpoints connecting voiceband CPE.

Line filter: a low pass filter, used with “splitterless” ADSL systems, and fitted at every jackpoint in the customers premises which connects POTS CPE.

POTS: “Plain Old Telephone Service”

PSD: Power Spectral Density

- *A parameter used to measure the power levels within a specified bandwidth used for ADSL. Limiting PSD is a key factor in controlling potential interference between services carried on the same cable.*

Splitter: a type of low pass filter, located at or directly adjacent to the network termination point, which splits the premises wiring into separate high and low frequency paths in order to separate and isolate POTS wiring and CPE from the ADSL pair within the customer’s premises.

T1.413: The US standard for ADSL, currently at Issue 2.

- *The US standard is very similar to ITU G.992.1 in many respects, although there are differences. Telecom’s DSLAM is able to negotiate connections with modems supporting the T1.413, Issue 2 standard.*

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3. GENERAL

3.1 Frequency ranges and interference issues

(1) An ADSL customer's physical line currently terminates at the local exchange on a Nokia V5 DSLAM, which is in accordance with the "Alcatel Reference Model". It supports ITU-T Rec. G.992.1, ANSI T1.413 issue 2 ATU-R CPE and, later, CPE to ITU-T Rec. G.992.2. The frequencies transmitted to line from the DSLAM are in the range 26 – 1104 KHz, with some harmonics likely at much lower levels out to 11 MHz. These operating frequencies overlap with those used for medium wave broadcast services (550 kHz – 1600kHz) and thus have the potential to cause interference with those radio services unless the installation conforms with Telecom recommended practices.

- *Rapid developments in DSL technology will result in later generation DSLAM's being installed by Telecom. These may have some impact on the technical requirements of this specification.*

(2) The customers' equipment contains an "ATU-R" complying with Telecom Specification PTC 270, providing "full" ADSL as "ADSL over POTS". POTS is transported as baseband on the physical access pair. The customer's ADSL modem transmits to line in the range 26 – 138 KHz, again with some spillover outside this range.

(3) To prevent interaction or mis-operation of other CPE in the customer's premises and to avoid radio frequency interference, Telecom can arrange installation of a splitter at or directly adjacent to the entry point to each customer's premises. However, this involves a site visit and resultant cost to the customer. Many customers wish to minimise their costs and may be able to do so by purchasing and installing their own line filters as simple "plug-in" devices.

3.2 Use of line filters

(1) Many customer installations should be able to make good use of plug-in line filters installed at jackpoints on the line side of each item of POTS CPE used on the line carrying ADSL signals.

- *Telecom has encouraged the installation of 2-wiring in customers' premises since 1996 and has carried out a large number of conversions. In addition, a better class of premises cabling has been recommended since that time and most new installations have since been undertaken with this cable.*

Telecom's trials to assess this risk have been promising in the main centres and this Specification is being published in order to permit third party supply of filter units. Based on the results of more widespread use of line filters, it is expected that Telecom will publish guidelines covering the conditions under which line filters can be used with a high probability of success.

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(2) Notwithstanding the likely suitability of line filters for many customers, especially those with modern telephone wiring and located in the main centres, where local AM broadcast stations have high signal levels, there is a risk that line filters will not be suitable in other situations.

- *Telecom's earlier "3-wiring" is still in wide use. While the fitting of separate "line filters" at each jackpoint in such customer's premises is generally expected to prevent interference to or from the associated POTS CPE, radio interference at levels exceeding those defined under New Zealand regulations is possible.*

(3) In the event that ADSL CPE and/or wiring arrangements not complying with Telecom's recommendations cause interference to other products and services within the end customer's premises, any remedial action necessary is the direct responsibility of the customer.

- *With over 6 000 different types of CPE so far granted Telepermits, and almost all of these first placed in service before the introduction of ADSL services, Telecom is not in a position to advise filter suppliers of those products, already owned by customers, which may be subject to interference by ADSL services on the same line. This will be a matter of trial and error, at least during the initial stages of line filter usage.*

- *Telecom's Residential Customer Wiring Maintenance service relates to the maintenance of satisfactory operation of the wiring for POTS services. It does not extend to modifying or replacing wiring found to be unsuitable for high frequency data services.*

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4. TELEPERMIT TECHNICAL REQUIREMENTS**4.1 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) The electrical requirements herein are a simplified selection from draft ANSI spec T1E1.4/2000-110R4, adapted for the Telecom network and its CPE characteristics. The main difference is that network echo balance return loss is measured at a DSLAM line circuit POTS port, which normally connects directly to the customer's PSTN line circuit. This allows network echo balance return loss to be measured directly against the standard hybrid balance impedances, in order that Telecom's critical network echo performance is maintained.

- *Such echo penalises the distant end of a call, rather than the end causing the echo.*

(3) The draft ANSI requirements for DC feed and longitudinal balance (which ANSI terms "transverse balance") have been changed to produce valid results for the Telecom network and the CPE connected to it.

(4) 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 M Ω .

- *The above changes are such that published return loss characteristics for commercial filters produced for overseas markets are meaningless and filters complying with the ANSI specification may not necessarily comply with this specification.*

4.2 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:

4.2.1 DC Characteristics:

(1) DC loop resistance shall be $\leq 100 \Omega$. (input to shorted output)

(2) Insulation resistance shall be $\geq 5 \text{ M}\Omega$ at 250 Vdc (open circuit output).

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4.2.2 ADSL band insertion loss

- (1) Insertion loss for 25 to 50 kHz shall be ≥ 20 dB
- (2) Insertion loss for 50 to 1100 kHz shall be ≥ 25 dB

4.2.3 Voice band insertion loss

- (1) For all cable lengths, ATU-R connection and number of filters connected, insertion loss of the filters at 1000 Hz shall be ≤ 2 dB.
- (2) For all above conditions, variation of insertion loss of the filters between 200 and 3400 Hz from that at 1000 Hz shall be $\leq \pm 1.5$ dB.

4.2.4 ADSL band bridging loss

- (1) Bridging loss shall be ≤ 2 dB over the frequency range.

4.2.5 Network echo balance return loss

- (1) For 3600 m of cable and with from one to five filters connected, EBRL against N shall be ≥ 7 dB.
- (2) For all other combinations of cable and numbers of filters, EBRL against BT3 and N shall be ≥ 9 dB;

4.2.6 Telephone sidetone balance return loss

- (1) For all cases EBRL shall be ≥ 10 dB (30 results).

4.2.7 Longitudinal balance

- (1) Longitudinal balance, measured as Longitudinal Conversion Ratio, shall be at least 40 dB for all PHONE terminations.

4.3 Conformance testing

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

4.4 Electrical safety

- (1) The electrical safety requirements of AS/NZ 60950 (IEC 60950, previously AS/NZ 3260 or IEC 950) shall be complied with by all line filters covered by this Specification.
- (2) Test reports to AS/NZ 3260 or its equivalent shall be supplied by a testing laboratory which is either recognised by Office of the Chief Electrical Engineer of the Ministry of Consumer Affairs (a division of the Ministry of Economic Development), or which is accredited by IANZ or one of its affiliated overseas laboratory registration authorities for electrical safety testing.
- (3) Any separate external power supply used with active filters shall also comply with the requirements of AS/NZ 3260 or its equivalent.

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4.5 EMC compliance

(1) The requirements of AS/NZ 3548 (CISPR 22 or its direct overseas equivalent) shall be complied with by 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, it would be advisable to check whether any active devices 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, test reports acceptable in New Zealand will generally already be available as the result of testing carried out for other markets. Where applicable, Declarations of Conformity are to be submitted to the Ministry of Economic Development.*

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5. WIRING AND CONNECTION REQUIREMENTS

5.1 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, preferably incorporating a 1 μ F ringing capacitor, 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, preferably incorporating a 1 μ F ringing capacitor, with a BT plug-ended cord and two BT sockets – one for the associated POTS CP and one for an ADSL modem;

- *Either option, with the ringing capacitor incorporated, is recommended. Lack of a ringing capacitor may cause confusion to customers with earlier 3-wire connected telephones.*

(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 5.4 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;

- *This is technically satisfactory, but not particularly attractive to customers, especially where it is exposed to view. The extra cords and connectors could prove a fault liability in time. Use of this format is discouraged, as such filters are likely to be more expensive and less attractive to customers. As a result, they may not be fitted in all jackpoints in the premises.*

5.2 Other options

(a) One box that plugs directly into a jackpoint (as an adapter), with one or two sockets as in "a" and "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.*

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(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) A jackpoint with an integral line filter for POTS CPE in premises using ADSL (full requirements in PTC 223);

(d) POTS CPE with an integral ADSL filter (full requirements in PTC 200);

- *While full requirements for products covered by options b, c and d 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.*

5.3 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.

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(7) It is strongly recommended that a 1.0 μ F, 250 Vdc polyester capacitor is connected between contacts 4 and 5 of the PHONE side BT jack. This provides ringing to older phone types, still in common use.

(8) Where no ringing capacitor is provided:-

(a) 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; and

• 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.

(b) the filter shall be clearly marked "2-wire only".

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

5.4 Commercial building applications

(1) Commercial premises may also use "residential type wiring", but more of the larger premises are now using generic cabling to AS/NZS 3080 (IEC/ISO 11801), with 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 such.

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6. TELEPERMITTING PROCESS**6.1 Performance specifications**

(1) Suppliers shall provide full technical specifications of their product(s), together with test reports in accordance with Annex A of this Specification showing that all requirements of this Specification have been complied with. This documentation shall be submitted to Access Standards, along with the Telepermit application.

(2) Where there are any non-compliances with this Specification, or products have been submitted which provide what the supplier recommends as performance superior to the requirements of this specification, such matters shall be clearly stated in the application documentation.

(3) The application shall include details of the make and model of each product covered by the application.

- *A suitable form for making these applications is published on the Access Standards website <http://www.telepermit.co.nz>.*

6.2 Applications for Telepermit testing

(1) Testing shall be undertaken by a Telecom-accredited laboratory in accordance with Annex A. At least 5 samples of the product concerned are to be sent to the accredited laboratory for testing.

- *A list of accredited laboratories for each class of product can be found on the Access Standards website.*

(2) Should any problems come to notice as the result of formal testing, or in the light of actual service experience, Telecom reserves the right to amend the Annex A or Annex B test criteria .

- *Arrangements are in place to accredit one or more independent Testing Authorities to certify testing against this or subsequent specifications. One of the aims of this provisional Specification is to verify the adequacy of testing procedures and determine whether there is any need to expand the range of tests.*

(3) The accredited test laboratory will levy charges for the testing carried out in accordance with this Specification, as is done for other PTC compliance testing work.

- *The rates charged for testing work will be set by the laboratory concerned.*

(5) In the event of any problems or compliance issues being noted by the accredited test laboratory, Telecom's Engineering Support Laboratory reserves

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the right to conduct such additional tests as they consider necessary to confirm compliance with network requirements.

(6) In such cases, a formal test report will be returned to the applicant.

(7) With the agreement of the applicant, five sample units submitted for testing will be retained by the test laboratory during the provisional Telepermit period. They will then be available for checking on-going network support in the event of customer complaints.

6.3 Applications for Telepermit

(1) The applicant shall provide the following documentation in support of a provisional Telepermit application:-

- (a) a sample of the proposed instructions and warnings to customers relevant to the product concerned; and
- (b) a copy of the product brochure outlining the technical parameters of the product; and
- (c) either a sample for retention by Access Standards, as a reference, or colour photographs of the product, showing internal and external views of the product in sufficient detail for clear identification of the circuit board layouts and components; and

Where applicable:

- (e) either a copy of the EMC test report, or a copy of the Declaration of Conformity submitted to the Ministry of Economic Development, or a copy of the Ministry's acknowledgement of that Declaration.
- (f) a copy of the electrical safety test report for the product and for any external power supplies that are intended to be used with the product;

(2) Applications for Telepermits shall be submitted to Access Standards on the specified Telepermit application form, together with all supporting items listed above. These should all be sent direct to Access Standards

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7. TELEPERMIT HOLDER RESPONSIBILITIES

7.1 Information to customers and retailers

(1) Due to the doubt over the “universal” suitability of filters to this specification, suppliers gaining Telepermits will have to use a high degree of discretion in offering their product to the market. This includes any commitments made to retailers and to prospective customers.

- *Because of the wide variations in service conditions and the number or types of POTS CPE already connected to a line, it is not possible to guarantee customer satisfaction in every conceivable situation. Similarly, it is not possible or practicable for Telepermit testing to cover every situation.*

(2) In view of the possibility that the customer will have to return products should they not prove suitable for use with particular types of CPE or in some wiring environments, etc, the supplier shall clearly indicate any conditions that will apply to the return of product and refund of the price paid.

(3) Suppliers shall ensure that their retailers are instructed to always check with a prospective customer as to the availability of service to that customer before offering to sell line filters for use with ADSL CPE.

- *Checks can be made via the “JetStream” website, using the customer’s telephone number for the line to which the service is to be provided.*

7.2 Supplier undertakings

(1) As with all Telepermit applications, the prospective Telepermit Holder shall undertake to comply with the general conditions published in Specification PTC 100, with the conditions of this Specification, and with any special conditions associated with a particular Telepermit grant.

(2) Suppliers are held responsible for ensuring that their products perform in accordance with any claims made on behalf of those products.

- *This is, in any case, a basic requirement of New Zealand consumer protection legislation.*

7.3 Advice to customers

(1) Line filters shall be provided with illustrated instructions suitable for use by customers with no detailed technical knowledge of ADSL operation. Sample instructions are published in Annex B of this specification. These shall be adapted for each product. Explanatory drawings depicting the specific filter being supplied and its modes of connection should replace the text where appropriate..

(2) Products shall include a conspicuous warning that their use will not be successful in a number of circumstances.

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(3) Suppliers shall ensure that customers are made aware of the need to arrange for the installation of a splitter and associated wiring work if this proves most appropriate to their needs. Also; that charges will be incurred for such installation work.

- *Telecom is able to arrange for such installation work on request by the customer, ISP's (Internet Information Service Providers), computer suppliers, etc. The relevant charges are defined in Telecom's product information on "JetStream" and related services.*

7.4 Product support

(1) Suppliers shall provide full support for all product sold to customers, including prompt response to any claims that the product has proved unsuitable for the customer's installation.

(2) Where an in-service problem develops and Telecom suspects that the product does not comply with this Specification, or where an unacceptable proportion of a product previously certified as compliant with this specification gives rise to problems, then the Telepermit conditions may have to be amended.

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PTC 280: 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 $1.0\text{ M}\Omega$. These are 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. However, to simplify tests and contain testing costs, this is tested only for ADSL Band Insertion Loss, which is most sensitive to DC.

(2) Testing other requirements with DC is required only when ADSL Band Insertion Loss changes with DC current.

(3) Line current is supplied by an adjustable DC power supply with min 10 H + (5 to 10) mH inductors built out to a total resistance of $200\ \Omega$, in each leg. The 10 H inductor is at the power supply end of the assembly.

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

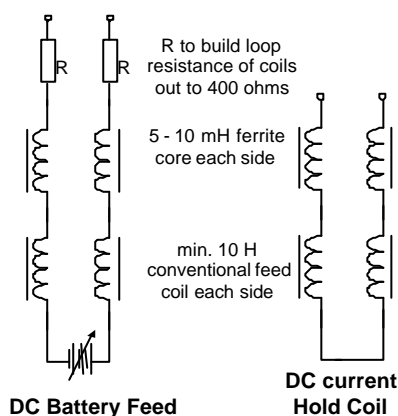


Figure 1: Wideband DC feed and hold circuits.

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A1.3 ATU-R simulation

Where applicable, the ATU-R shall be simulated by $28 \text{ nF} + 39 \Omega$ and measurements repeated with an open circuit in place of ATU-R, for voice frequencies. At ADSL frequencies, ATU-R is simulated by $28 \text{ nF} + (470 \mu\text{H} // 100 \Omega)$. The series resistance of the inductor is not critical, but its design must be consistent with valid operation up to 1100 kHz.

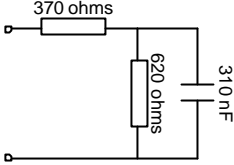
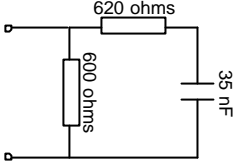
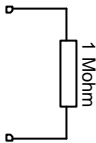
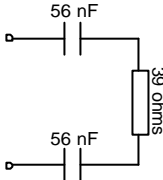
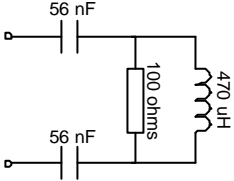
BT3 Reference Impedance	
N Reference Impedance	
Z_{ON} – Simulated on hook impedance of a phone.	
Z_{ATU-R, VF} – Simulated impedance of ATU-R, valid for Voice Frequencies (0 – 4 kHz).	
Z_{ATU-R, HF} – Simulated impedance of ATU-R for High Frequencies (25kHz – 10MHz).	

Figure 2: Simulated and reference impedances.

A1.4 Test Line

- (1) The access line used for tests is 0.2, 1.5 and 3.6 km of 0.4 mm PEFUT cable.
- (2) Consideration will be given to approval of equivalent artificial cable having constants of $274 \Omega/\text{km}$ and $49.2 \text{ nF}/\text{km}$ for VF tests. Line sections shall not

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exceed 0.5 km and all termination and interconnection points shall be at half sections. Where such artificial cable is approved, measurements at 3.5 km will be acceptable where 3.6 km is specified.

A1.5 Use of DSLAM

- (1) DSLAM line circuit components, specifically Splitter C and ATU-C, shall be the actual equipment as deployed by Telecom.
- (2) Direct on-site access to the LINE and POTS ports is required.
- (3) Power need not be connected to the line card and the core network connection to ATU-C may be ignored.

A2 Specific tests**A2.1 DC Characteristics**

- (1) DC loop resistance shall be $\leq 100 \Omega$.
- (2) Insulation resistance shall be $\geq 5 M\Omega$ at 250 Vdc.

A2.2 ADSL Band Insertion Loss

- (1) With a +10 dBm signal of frequency 25 to 1100 kHz applied at the line interface from a 100Ω source, with and without simulated ATU-R hf and five filters connected, the signal across a 600Ω termination of one filter is measured with 20, 40, 60 and 80 mA DC applied (8 freq range measurements). The other four filters are terminated with $1 M\Omega$.
- (2) The receive level shall also be measured across 600Ω with no DC on the line side of the filter, with and without simulated ATU-R, after removal and bypassing the filters. (2 freq range measurements)
- (3) The insertion loss is the measured receive levels with and without simulated ATU-R hf, less the measured receive levels with and without simulated ATU-R hf and the filters removed and bypassed. (8 freq range results)

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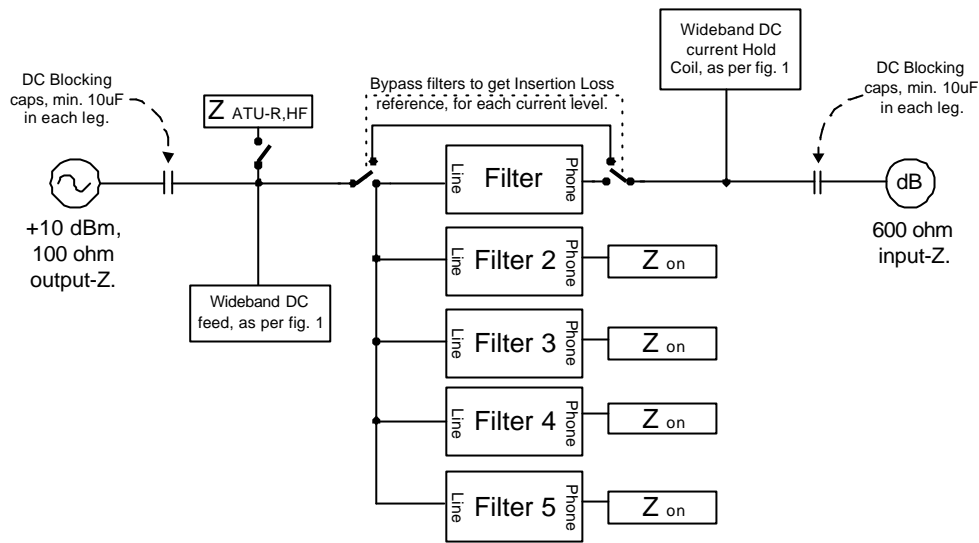


Figure 4: ADSL band insertion loss test setup.

Insertion loss for 25 to 50 kHz shall be ≥ 20 dB
 Insertion loss for 50 to 1100 kHz shall be ≥ 25 dB

NOTE:

Should the insertion loss change with increased DC, then other tests that include off-hook CPE shall be repeated with 80 mA or the current resulting from application of 60 VDC to the feed circuit of Figure 1. However, where the change of insertion loss with increased DC is significant, it is more likely that the candidate filter will fail some other requirements.

A2.3 Voice Band Insertion Loss

(1) Measured over the range 200 to 3400 Hz, between one filter with simulated ATU-R in parallel, and the DSLAM POTS port via 0.2, 1.5 and 3.6 km of cable. Both ends are terminated with BT3. Measurements are repeated for the three cable lengths with addition of one, two, three and four parallel connected filters, each terminated with 1.0 M Ω .

(2) Insertion loss is the measured receive levels for each of the combinations of cable, ATU-R and connected filters (30 measurements), less the received level for the same length of cable and ATU-R connection, but with the filters bypassed and isolated (6 measurements).

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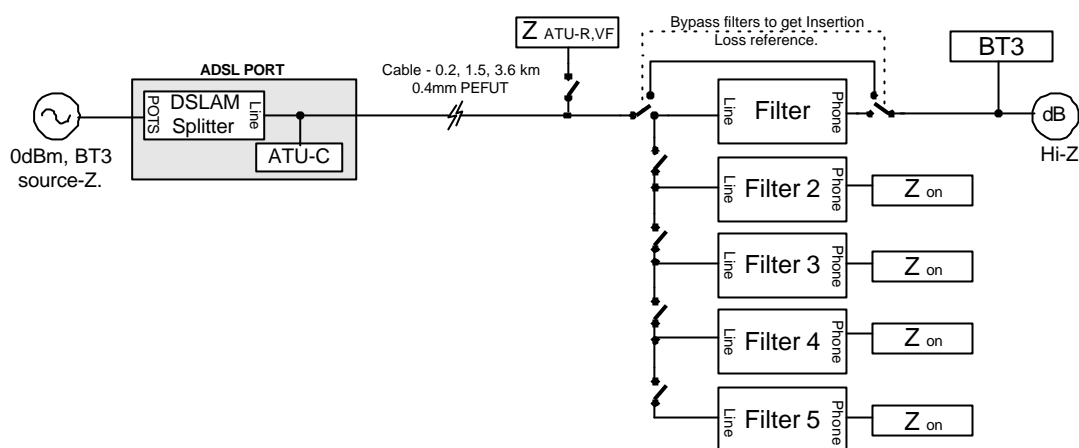


Figure 3: Voice band insertion loss test setup.

For all cable lengths, ATU-R connection and number of filters connected, insertion loss of the filters at 1000 Hz shall be ≤ 2 dB.

For all above conditions, variation of insertion loss of the filters between 200 and 3400 Hz from that at 1000 Hz shall be $\leq \pm 1.5$ dB.

A2.4 ADSL Band Bridging Loss

(1) The line interface is supplied with 25 to 1100 kHz from a 100 Ω generator and the bridging level measured across the ADSL frequencies simulated ATU-R. Five filters are connected – firstly all are terminated with 1 M Ω on the phone side and secondly, with one of the terminations changed to BT3. Bridging loss is the difference between the level across ATU-R alone and that for each of the two filter terminations. (2 frequency range results)

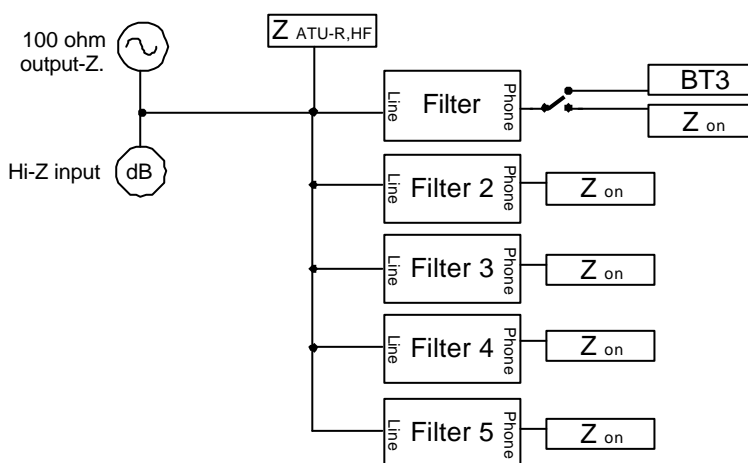


Figure 5: ADSL band bridging loss test setup.

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Bridging loss shall be ≤ 2 dB over the frequency range.

A2.5 Network Echo Balance Return Loss

(1) Balance return loss is measured at the POTS port of the DSLAM line card, against both BT3 and N reference impedances. From this point, the circuit includes 200m, 1500m and 3600m of 0.4mm PEFUT cable to simulated ATU-R with one filter connected in parallel. The first filter is terminated on the phone side with BT3.

(2) Measurements are repeated for the three cable lengths with the addition of one, two, three and four parallel connected filters, each terminated with 1.0 M Ω .

(3) EBRL is computed from the balance return loss measurements, or those calculated from measurements of complex impedance, for each condition. See definitions under EBRL, for formula.

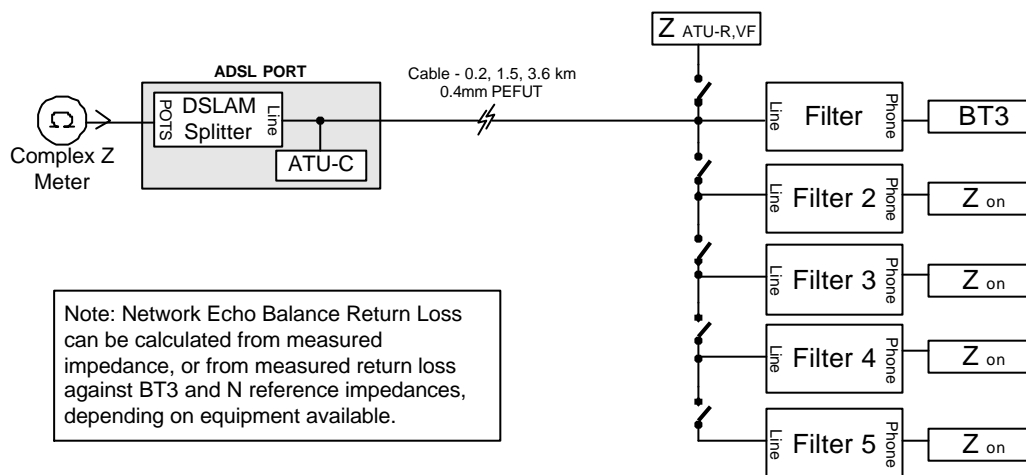


Figure 6: Network echo - balance return loss test setup.

For all combinations of cable and numbers of filters: EBRL against BT3 and N shall be ≥ 9 dB; except that for 3600 m of cable, EBRL against N may be ≥ 7 dB. (60 results)

A2.6 Telephone Sidetone Echo Balance Return Loss

(1) Test arrangements are the same as for Network Echo Balance Return Loss above, except that the POTS port is terminated with BT3 and balance return loss measurements are made at one filter against only a BT3 reference. As above, measurements are made using the three lengths of cable and with the addition of one, two, three and four parallel connected filters, each terminated with 1.0 M Ω .

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(2) EBRL is computed from measured or calculated values of balance return loss, for each condition. See definitions under EBRL, for formula.

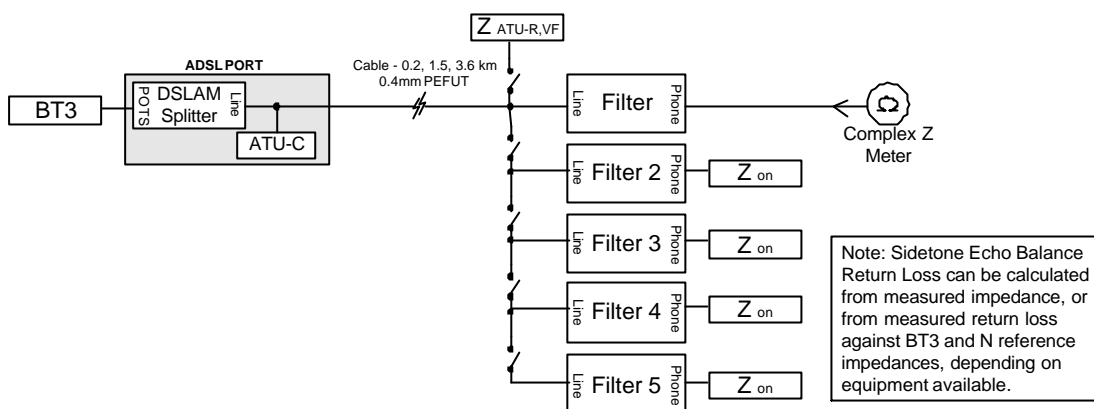
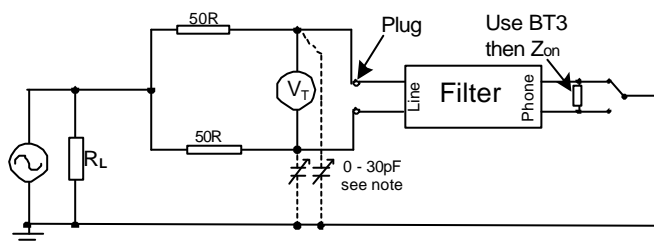


Figure 7: Telephone sidetone balance return loss test setup.

For all cases EBRL shall be ≥ 10 dB (30 results).

A2.7 Longitudinal Balance

(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 with BT3 and separately with $1\text{ M}\Omega$. In each case, the set-up earth is also connected to each phone side leg in turn.



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 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. If 60 dB from 25 kHz to 11 MHz cannot be achieved then up to 30 pF may be used on one side of the voltmeter, to improve the balance. If this cannot be achieved with 30 pF on one or other side of the voltmeter, then either the test rig will have to be redesigned or the voltmeter replaced with a more suitable type with common mode rejection ratio (CMRR) of not less than 60 dB up to at least 11 MHz, for input levels up to at least that injected - i.e. +10 dBm to +15 dBm into 75 or 50 ohms.

Figure 8: Longitudinal balance test set-up.

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(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 to +20 dBm, at 25, 50, 100, 200, 500 and 1100 kHz. $LCR = 20 \log (V_T / V_L)$ dB. (Total of 30 results, incl set-up balances).

(3) Care appropriate to high frequency measurements is needed for construction of the test set-up. Adjustment (and recording) of the test set-up balance with the filter unplugged is required at each frequency to compensate for reactive impedance unbalance of the level meter, other set-up components and wiring. A selective level meter is recommended to avoid measurements that include noise voltage.

(4) Where available, a level output generator is recommended with a level meter set to the same bridging impedance as the generator (50 Ω or 75 Ω). This simplifies measurements, when $LCR =$ generator setting in dBm – level meter reading in dBm.

(5) 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.

LCR shall be at least 40 dB for all PHONE terminations.

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PTC 280: ANNEX B CUSTOMER INFORMATION**SAMPLE INSTRUCTIONS TO CUSTOMERS TO BE PROVIDED WITH LINE FILTERS****NOTE:**

1. These instructions are to be amended, as necessary, to align with the characteristics of the product concerned. Non-applicable options are to be deleted. The product concerned shall be clearly illustrated to minimise the risk of the customer connecting equipment incorrectly.
2. Retailers shall advise customers that while filters are an easy and inexpensive option, in some instances they will not work satisfactorily with the customers wiring. The customer will, in this instance, have to an authorised person install a splitter to enable them to run the ADSL service.
3. Retailers should also warn customers that there is a possibility that the correct operation of some types of existing telephone and data terminal equipment may be disrupted by the ADSL service. While the probability of this is low, it may sometimes cause difficulties for customers.
4. The retailer shall state their policy on the return of filters and modems (if supplied by the retailer) in the event of a failed filter installation and the customer not wanting to proceed with a half installation.

INSTRUCTIONS FOR THE OUTSIDE OF PRODUCT PACKAGING:

Because customers may not open the packaging until they install their equipment or until their ADSL line is provisioned, some of these instructions should appear clearly on the outside of the packaging and/or in sales literature provided to the customer prior to purchase.

- Filters connect to your telephone jackpoint.
- The use of line filters is not recommended for customers wishing to listen to distant medium wave (550 to 1600 kHz) AM broadcast stations, although they will be satisfactory for reception of local and national stations in the four main centres – Auckland, Wellington, Christchurch and Dunedin. The risk of interference increases outside these centres.
- You will need a filter for every item of non-ADSL equipment you have connected to a telephone jackpoint; such as phones, fax, caller display unit, dial up modem (including such devices as a Sky digital decoder with integral modem).

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- Up to 5 filters can be used on a single telephone line. If you need to connect more than 5 non-ADSL equipment, then filters are not suitable for your requirements. You will need to arrange for a splitter to be installed at your premises.
- You must NOT use a filter for your ADSL modem.
- If you want to plug your phone (or other non-ADSL equipment) and modem into the same jackpoint, then you will need to purchase a double adapter.

NOTE: If the filter has a modem and phone socket, these last two instructions are not required.

Please connect your filters BEFORE your ADSL service has been supplied to you.

If you wait until after your ADSL service has been supplied, you may experience some noise disruption. See inside for more details.

INSTRUCTIONS FOR INSIDE THE PACKAGING:

Using filters with your ADSL service

- Your ADSL modem does not require a filter. It will connect directly to any telephone jackpoint.
- Any non-ADSL equipment, such as a phone, fax, caller display unit, dial-up modem (including such devices as a Sky digital decoder with integral modem), MUST be connected to a telephone jackpoint via a filter.

CAUTION: Failure to connect ALL telephone type equipment via a filter will result in loss of the data link whenever a call is made or answered. In many cases the link will also be lost when a call is received, even if it is not answered.

- It is important that filters be connected the right way around. Where it is possible to connect it either way, the side marked **LINE** is plugged into the jackpoint and that marked **PHONE** connects to the telephone equipment.
- If the same jackpoint is needed for the connection of telephone equipment as well as the ADSL modem, you will need a double adapter. This is to be plugged into the jackpoint first. The ADSL modem is then plugged into one

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outlet of the double adapter and the filter into the other. The telephone equipment is then plugged into the **PHONE** side of the filter.

- Some filters include a modem socket as well as a phone socket so that both types of equipment can be connected at one jackpoint without a double adapter. Ensure that the correct outlet is used for each type.
- Should a second item of telephone equipment need to be connected at the same jackpoint as the ADSL modem, a double adapter is plugged into the **PHONE** side of the filter. Both items of telephone type equipment then plug into the adapter.

The following advice is required **ONLY** for those filters **NOT** incorporating a ringing capacitor:

- Some types of telephones connected via this filter may not ring when called. If you have this problem, a ringing adapter is needed between the **PHONE** side of that filter and the phone plug. Ringing adapters are available from where you purchased your filter.

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SAMPLE WARNINGS TO CUSTOMERS TO BE PROVIDED WITH LINE FILTER PRODUCT INFORMATION

- In the event that the ADSL service is connected to your line before you have connected your filters, you may experience occasional noise bursts when using your telephone. These noise bursts are normal, but they will disrupt data transmission for fax and dial-up modems. To overcome this problem, install your filters immediately, even if you are not ready to install your modem.
- In some cases it is possible that the performance of dial-up modems (including those within fax machines and Sky digital decoders) may be degraded following installation of filters. Check that these are operating satisfactorily after installing filters.
- Filters are not the best installation option if you have a security alarm and/or medical callers installed that automatically call a selected number when activated. In this case, you should have a splitter installed by an authorised specialist. Discuss installing a splitter with your modem supplier or filter retailer.
- In some circumstances, the ADSL service installed with filters may cause interference to reception of AM radio stations, in particular to distant medium wave (550 to 1600kHz) AM broadcast stations. The interference is heard as a constant hissing sound.
- Should unacceptable radio interference occur, do not report this to the Ministry of Economic Development until you have had your wiring inspected and, where necessary, modified to reduce the problem. This involves having a specialist install a splitter in your home and rearranging your wiring to overcome the problems. This work will be charged for. Your present modem can still be used after these wiring changes, but it can be connected to only one jackpoint. You must decide the location of this jackpoint prior to arranging the installation work.
- In such cases, you should be entitled to a refund for the filters you have purchased, as they have proved unsuitable for your intended purpose. Of course the filters should be returned in good condition, including the original packing, and fit for resale. Your receipt for the purchase may be requested by the retailer concerned.