



Hosting and Internet
Protocols and Signalling

Technical Reference

RCIT.0004

Splitter Specification for ADSL/POTS Spectrum Sharing

ISSUE 2.0

Implementation:

Uncontrolled Document - No Unauthorised Copying

TABLE OF CONTENTS

1. ...PURPOSE.....	3
2. ...SCOPE.....	3
3. ...PRODUCT DESCRIPTION.....	3
4. ...PERFORMANCE OBJECTIVES	5
4.1. GENERAL	5
4.2. Exchange Splitter	5
4.2.1. ETSI SPECIFICATION CHANGES AND CLARIFICATIONS FOR EXCHANGE SPLITTER.	5
4.2.2. ADDITIONS NOT COVERED IN ETSI SPECIFICATION APPLICABLE TO EXCHANGE SPLITTERS	7
4.3. Customer End Splitter.....	8
4.3.1. ETSI SPECIFICATION CHANGES AND CLARIFICATIONS FOR CUSTOMER END CENTRALIZED SPLITTER.	9
4.3.2. ETSI SPECIFICATION CHANGES AND CLARIFICATIONS FOR CUSTOMER END DISTRIBUTED SPLITTER.	10
4.3.3. ADDITIONS NOT COVERED IN ETSI SPECIFICATION APPLICABLE CUSTOMER END SPLITTERS	12
5. ...DEFINITIONS.....	13
6. ...REFERENCES	14
7. ...DOCUMENT CONTROL SHEET	16

1. PURPOSE

The purpose of this Technical Reference is to provide the technical requirements for Splitters located at both exchange and customer premises ends of a loop with spectrum sharing between ADSL and POTS.

2. SCOPE

Splitters for both exchange and customer premises ends of a loop with spectrum sharing between ADSL and POTS must be provided by the ADSL Acquirer as part of the overlaid ADSL service. The following specifications must be met by those splitters. For exchange splitters and Customer Premises (Remote) splitters this Technical Reference uses the requirements stipulated within the ETSI Technical Report and Technical Specification for low pass filters with certain alterations, limitations and additions to suit Australian conditions. This is considered necessary to allow satisfactory operation of voiceband CPE currently in use.

This Technical Reference does not contain Customer Premises splitter usage information, this is contained in Technical Reference RCIT.0006, Customer End Splitter Information for ADSL/POTS Spectrum Sharing

3. PRODUCT DESCRIPTION

The Telstra Wholesale Spectrum Sharing Service (SSS) product allows an Acquirer to use vacant frequency spectrum, at frequencies above an existing voiceband PSTN service provided by Telstra. Spectrum Sharing will be provided on an unconditioned communications pair between the boundary of a telecommunications network at an end-user's premises and a point on a telecommunications network that is a potential point of interconnection located at, or associated with, an Acquirer's customer access module (CAM) and located on the end-user side of the customer access module.

Spectrum Sharing will be provided over a single existing twisted metallic pair. Acquirers will need to provide their own DSLAMs, compliant ADSL modems and compliant filters that are suitable for connection to the Telstra network. Acquires will also be required to install a Network Termination Device (NTD) at the end-customer premises when applicable. Spectrum Sharing will be available nationally subject to the Acquirer having rolled out their equipment.

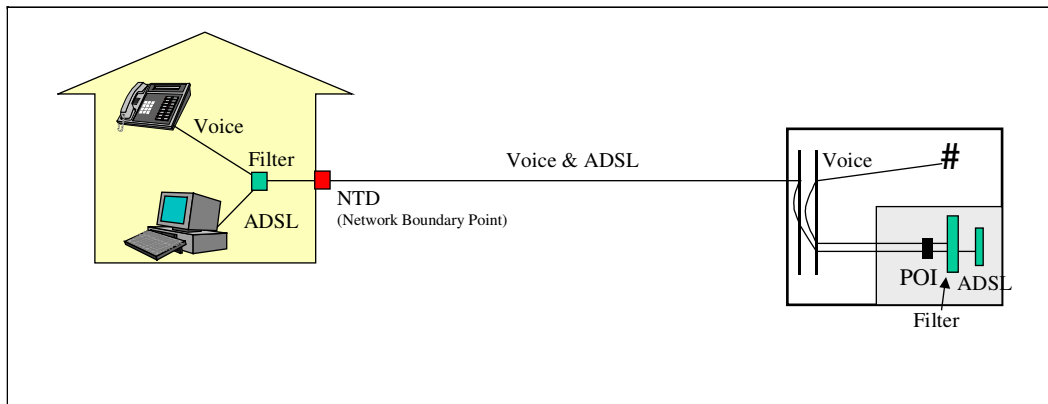
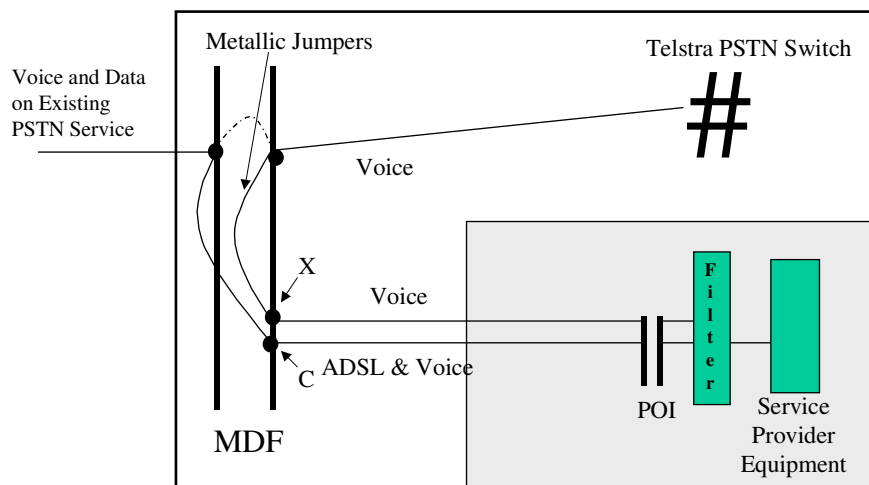


Figure 1: Telstra Wholesale Spectrum Sharing Service (end-to-end view)



**Figure2: Telstra Wholesale Spectrum Sharing Service
(Voice provided by Telstra, ADSL provided by Acquirer)**

4. PERFORMANCE OBJECTIVES

4.1. GENERAL

ETSI has published the final Technical Specification (TS) ETSI TS 101 952-1-1 V1.1.1 (2002-05) : "Specification of the low pass part of ADSL/POTS splitters". This document is part I, sub-part 1 of a series of documents covering access network xDSL transmission filters. The other document of interest is ETSI TS 101 952-1-5 V1.1.1 Sub-part 5: "Specification for ADSL/POTS distributed splitters", this was published May 2003.

4.2. EXCHANGE SPLITTER

The exchange end splitter must be provided by the Acquirer in its space, and is cabled from the telephony port back to the MDF to enable further jumpering to the telephone switch.

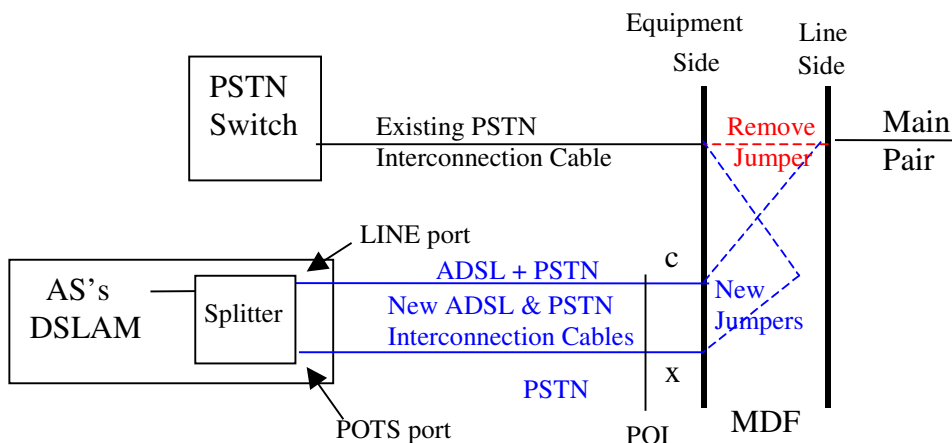


Fig. 3. Splitter in Acquirer's equipment.

The splitter provides a low pass filtering functionality in the telephony path, to effectively decouple the ADSL and telephony services.

The low pass filtering at the exchange end must meet the requirements of ETSI TS 101 952-1-1 V1.1.1 (2002-05) , with the exclusions, explanations and changes listed below. These changes have been made for the Australian telecommunications environment.

Note, all tests in ETSI TS 101 952-1-1 V1.1.1 (2002-05) must be performed at both line polarities and at both maximum and minimum line current. ie all tests in ETSI TS 101 952-1-1 V1.1.1 (2002-05) must be repeated at four line conditions.

4.2.1. ETSI SPECIFICATION CHANGES AND CLARIFICATIONS FOR EXCHANGE SPLITTER.

4.2.1.1. Testing Conditions (Section 5 of ETSI TS 101.952-1-1)

4.2.1.1.1 Feed currents

For clause 5.1.2, feed currents up to 125 mA DC may be encountered in Australia. During the transition from the Ringing to the Offhook state, large transient currents in excess of 200mA may occur. However the requirements for testing remain as in clause 5.1.2.

4.2.1.1.2 Impedances

The ETSI specifications of return loss, etc are based on the European harmonized impedance Z_R . Note that the European harmonized impedance Z_R is a close match to the Australian TN12 complex impedance. Hence either impedance can be used as a reference impedance for testing. For example if the splitter passes with Z_R , then there is no need to test with TN12 (and vice versa). If a result fails marginally with Z_R then TN12 can be used as it may pass with this slightly different impedance TN12 (and vice versa).

4.2.1.2. Splitter Requirements (Section 6 of ETSI TS 101.952-1-1)

4.2.1.2.1 Option A splitters are required

4.2.1.2.2 DC insulation resistance between terminals and earth

In Clause 6.2.1 the DC resistance between terminals and earth shall not be less than 10 Mohm when tested with 250 V DC.

4.2.1.2.3 DC insulation resistance between line terminals and between local terminals.

In Clause 6.2.2 the DC resistance between terminals and earth shall not be less than 10 Mohm when tested with 250 V DC.

4.2.1.2.4 Return loss

The return loss limit applies to the Z_R or TN12 impedance as described in 4.2.1.1.2. Z_{SL} is based on a short line terminated in 600 ohm.

The open circuit test for the Z_{ADSL} impedance does not need to be performed if either:

1. the exchange end ADSL modem has an integrated low pass splitter or
2. the procedures for removal of exchange based ADSL equipment are such that the ADSL modem and splitter are removed together.

4.2.1.2.5 Immunity to high level POTS signals

Background

An important requirement of a POTS splitter/filter is to prevent any unwanted signals at DSL frequencies being generated due to the presence of high voltage signals/transients present on the line. The effect of such frequencies on the modem can be twofold. The high voltage swing on the line generates a corresponding high voltage signal at the receiver of the modem which can, at the

very least, make the receiver go non-linear. At worst it can cause clipping. The other effect is that the frequency content of the high voltage swing will overlap the frequencies used for the upstream transmission, causing a reduction of signal to noise ratio for the carriers and hence increased error rate. High voltage swings are created under a number of circumstances. The obvious condition is when a telephone goes off-hook or goes back on-hook. Loop disconnect dialling also causes high voltage swings. Indeed older telephones literally short out the line. High voltage swings also occur at the line-card of the local exchange when line reversal is used. Thus measurement of the large signal performance is necessary for both the LE and remote splitter/filters.

Note that the test circuit Figure 17 for large signal test, is for the testing of a CPE splitter. For a LE filter the 48V feed and switch is connected to the POTS (exchange) side and the line port is terminated with 600 ohm termination.

4.2.1.2.6 Unbalance about Earth

The Unbalance about Earth requirements in Table 8 must be tightened as per the values in the following table.

Frequency range	State of S1	Value of R	Minimum Unbalance value
50 Hz to 600 Hz	closed	300	46 dB
600 Hz to 3 400 Hz	closed	300	52 dB
3 400 Hz to 4 000 Hz	closed	300	46 dB
4 kHz to 30 kHz	open	50	40 dB
30 kHz to 1 104 kHz	open	50	50 dB
1 104 kHz to 5 MHz	open	50	30 dB

4.2.1.2.7 Metering signals

The splitter does not need to accommodate 12kHz, 16 kHz or 50 Hz metering signals. Spectrum sharing is not available for loops carrying such services.

4.2.1.2.8 Signature Networks (section 7.1 of ETSI TR 101.728)

Signature Networks in clause 7.1 are unacceptable if they cause the insulation resistance tests in 5.1.2 or 5.1.3 to fail.

4.2.1.2.9 Weak high pass filter in the splitter unit

Where cable between the splitter and the Acquirer's DSLAM is greater than 50m in length then a weak high pass filter should be implemented in the splitter unit as shown in the configuration of Fig 3 in section 4.3 of ETSI TR 101.728 V1.1.1 (2002-05). The components used should be as called up in ETSI TS 101 952-1-2 V1.1.1 (2002-05) section 6.1 Option B: 1st order filter

4.2.2. ADDITIONS NOT COVERED IN ETSI SPECIFICATION APPLICABLE TO EXCHANGE SPLITTERS

Loss of power to the splitter or Acquirer's DSLAM, or other operations such as card changes in the DSLAM should not result in a reduction in performance or disconnection of the telephone service, although a short break of up to 10ms is permitted.

In order to avoid unacceptable degradation of Telstra's exchange testing, the total capacitance between A and B legs of the splitter with DSLAM connected must be less than 150 nF.

The Acquirer may apply test signals within the ADSL bands at any time provided those test signals are compliant with the ACIF Network Deployment Rules Code C559, either belonging to an existing Deployment Class or demonstrated to be compliant under the provisions for Non-deployment Class systems.

Testing of the line at DC or voice frequency may only be performed when the telephone service is inactive; in this case the method of determination of inactivity and the duration of the test is to be determined in consultation with Telstra.

Additionally, the splitter may optionally incorporate relay bypass to enable testing from the telephony port without the splitter or DSLAM connected.

The following paragraph is for information only ie not tested for this spec.

The allowable deployment classes for Telstra Wholesale Spectrum Sharing Service are Deployment Class 6a, 6b, 6d, 6e and 6f. Acquirers' DSLAM ADSL equipment must comply with the relevant ADSL transmit PSD masks and deployment rules of ITU-T G.992.1 and ACIF C559-3.

4.3. CUSTOMER END SPLITTER

The customer end splitter may be implemented as a centralized or an in line (distributed) splitter. New customer premises cabling is to be provided from the centralized splitter to the ADSL CPE. The splitter provides a low pass filtering functionality in the telephony path. The high pass component of the splitter is assumed to be in the ADSL CPE.

The low pass filtering at the customer end centralised splitter must comply with the requirements of ETSI TS 101 952-1-1 V1.1.1 (2002-05). The combined effect of up to 3 inline filters) must comply with the requirements of ETSI TS 101 952-1-5 V1.1.1 (2003-05). The filters must also comply with the exclusions, changes and clarifications listed below. These changes have been made for the Australian telecommunications environment. Note that the maximum number of inline filters to be used on a PSTN service is 3.

Note, all relevant tests in ETSI TS 101 952-1-5 V1.1.1 (2003-05) and ETSI TS 101 952-1-1 V1.1.1 (2002-05) must be performed at both line polarities and at both maximum and minimum line current. ie all relevant tests in ETSI TS 101 952-1-5 V1.1.1 (2003-05) and ETSI TS 101 952-1-1 V1.1.1 (2002-05) must be repeated at four line conditions.

4.3.1. ETSI SPECIFICATION CHANGES AND CLARIFICATIONS FOR CUSTOMER END CENTRALIZED SPLITTER.

4.3.1.1. Testing Conditions (Section 5 of ETSI TS 101.952-1-1)

4.3.1.1.1 Feed currents

For clause 5.1.2, feed currents up to 125 mA DC may be encountered in Australia.. During the transition from the Ringing to the Offhook state, large transient currents in excess of 200mA may occur. However the requirements for testing remain as in clause 5.1.2.

4.3.1.1.2 Impedances

The ETSI specifications of return loss, etc are based on the European harmonized impedance Z_R . Note that the European harmonized impedance Z_R is a close match to the Australian TN12 complex impedance. Hence either impedance can be used as a reference impedance for testing. For example if the splitter passes with Z_r , then there is no need to test with TN12 (and vice verca). If a result fails marginally with Z_r then TN12 can be used as it may pass with this slightly different impedance TN12 (and vice verca).

4.3.1.2. Splitter Requirements (Section 6 of ETSI TS 101.952-1-1)

4.3.1.2.1 Option A splitters are required

4.3.1.2.2 DC insulation resistance between terminals and earth

In Clause 6.2.1 the DC resistance between terminals and earth shall not be less than 10 Mohm when tested with 250 V DC.

4.3.1.2.3 DC insulation resistance between line terminals and between local terminals.

In Clause 6.2.2 the DC resistance between terminals and earth shall not be less than 10 Mohm when tested with 250 V DC.

4.3.1.2.4 Return loss

The return loss limit applies to the Z_R or TN12 impedance as described in 4.2.1.1.2. Z_{SL} is based on a short line terminated in 600 ohm.

4.3.1.2.5 Unbalance about Earth

The Unbalance about Earth requirements in Table 5 must be tightened as per the values in the following table.

Frequency range	State of S1	Value of R	Minimum Unbalance value
50 Hz to 600 Hz	closed	300	46 dB
600 Hz to 3 400 Hz	closed	300	52 dB
3 400 Hz to 4 000 Hz	closed	300	46 dB
4 kHz to 30 kHz	open	50	40 dB
30 kHz to 1 104 kHz	open	50	50 dB
1 104 kHz to 5 MHz	open	50	30 dB

4.3.1.2.6 Metering signals

The splitter does not need to accommodate 12kHz, 16 kHz or 50 Hz metering signals. Spectrum sharing is not available for loops carrying such services.

4.3.1.2.7 Signature Networks (section 7.1 of ETSI TR 101.728)

Signature Networks in clause 7.1 are unacceptable if they cause the insulation resistance tests in 5.1.2 or 5.1.3 to fail.

4.3.2. ETSI SPECIFICATION CHANGES AND CLARIFICATIONS FOR CUSTOMER END DISTRIBUTED SPLITTER.

4.3.2.1. *General Functional Description of Splitters (Section 4 of ETSI TS 101 952-1-5 V1.1.1)*

4.3.2.1.1 Impedances

The ETSI specifications of return loss, etc are based on the European harmonized impedance Z_R . Note that the European harmonized impedance Z_R is a close match to the Australian TN12 complex impedance. Hence either impedance can be used as a reference impedance for testing. For example if the splitter passes with Z_r , then there is no need to test with TN12 (and vice versa). If a result fails marginally with Z_r then TN12 can be used as it may pass with this slightly different impedance TN12 (and vice versa).

4.3.2.1.2 Filter Configuration

The Acquirer may implement any of the options of section 4 for the location of the filter and DC blocking components, as these are within the Acquirer's domain.

4.3.2.2. *Splitter Requirements (Section 5 and 6 of ETSI TS 101 952-1-5 V1.1.1)*

4.3.2.2.1 DC insulation resistance between terminals and earth

In Clause 6.2.1 the DC resistance between terminals and earth shall not be less than 10 Mohm when tested with 250 V DC.

4.3.2.2.2 DC insulation resistance between line terminals and between local terminals.

In Clause 6.2.2 the DC resistance between terminals and earth shall not be less than 10 Mohm when tested with 250 V DC.

4.3.2.2.3 DC insulation resistance

In Clause 6.2.2 where non linear switching is used the DC insulation resistance shall be less than 100 ohms.

4.3.2.2.4 Feed currents

For clause 5.1.2, feed currents up to 125 mA DC may be encountered in Australia.. During the transition from the Ringing to the Offhook state, large transient currents in excess of 200mA may occur. However the requirements for testing remain as in clause 5.1.2.

4.3.2.2.5 Ringing Volt Drop

The requirements of 6.3.1 and 6.3.2 apply for 25 Hz only (not 50 Hz)

4.3.2.2.6 Return loss

The return loss limit applies to the Z_R or TN12 impedance as described in 4.2.1.1.2. Z_{SL} is based on a short line terminated in 600 ohm.

4.3.2.2.7 Longitudinal conversion loss

The longitudinal conversion loss requirements in Table 8 in 6.8 must be tightened as per the values in the following table.

Frequency range	State of S1	Value of R	Minimum Unbalance value
50 Hz to 600 Hz	closed	300	46 dB
600 Hz to 3 400 Hz	closed	300	52 dB
3 400 Hz to 4 000 Hz	closed	300	46 dB
4 kHz to 30 kHz	open	50	40 dB
30 kHz to 1 104 kHz	open	50	50 dB
1 104 kHz to 5 MHz	open	50	30 dB

4.3.2.2.8 Metering signals

The splitter does not need to accommodate 12kHz, 16 kHz or 50 Hz metering signals (Clause 6.8). Spectrum sharing is not available for loops carrying such services.

4.3.2.2.9 Signature Networks (section 7.1 of ETSI TR 101.728)

Signature Networks in clause 7.1 are unacceptable if they cause the insulation resistance tests in 5.1.2 or 5.1.3 to fail.

4.3.3. ADDITIONS NOT COVERED IN ETSI SPECIFICATION APPLICABLE CUSTOMER END SPLITTERS

Telstra anticipates that ETSI will include on hook requirements similar to those in ETSI TS 101 952 sub part 1 in the yet to be published sub part 5. for distributed splitters. Therefore splitter suppliers should aim to meet the hook requirements in ETSI TS 101 952 sub part 1 . Note that the on hook requirements are desirable but not mandatory yet.

In order to avoid unacceptable attenuation of Telstra's PSTS, the total length of the tie cable from the Network Boundary Point (NBP) to the splitter shall be as specified in "Telstra Network Termination Device, Information for Cabling Providers" Guideline 012688

The Acquirer may apply test signals within the ADSL bands at any time provided those test signals are compliant with the ACIF Network Deployment Rules Code C559, either belonging to an existing Deployment Class or demonstrated to be compliant under the provisions for Non-deployment Class systems.

Testing of the line at DC or voice frequency may only be performed when the telephone service is inactive; in this case the method of determination of inactivity and the duration of the test is to be determined in consultation with Telstra.

The following paragraph is for information only ie not tested for this spec.

The allowable deployment classes for Telstra Wholesale Spectrum Sharing Service are Deployment Class 6a, 6b, 6d, 6e and 6f. Acquirers' ADSL equipment must comply with the relevant ADSL transmit PSD masks and deployment rules of ITU-T G.992.1 and ACIF S043-2.

5. DEFINITIONS

The following words, acronyms and abbreviations are referred to in this document.

Term	Definition
ACA	Australian Communications Authority
ACCC	Australian Competition and Consumer Commission
Acquirer	The service provider seeking to utilise Telstra Wholesale Spectrum Sharing Service on behalf of their retail customer.
AP	Access Provider
ADSL	Asymmetric Digital Subscriber Line
BEP	Building Entry Point
CAM	Customer Access Module
CCF	Cross Connect Facility
CPE	Customer Premises Equipment
ECP	Equipment Connection Point
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
NBP	Network Boundary Point
NTD	Network Termination Device
PSTN	Public Switched Telephone Network
PSD	Power Spectral Density
SDP	Service Delivery Point
ULLS	Unconditioned Local Loop Service

6. REFERENCES

Document Number	Title
Technical Reference RCIT.0006	Customer End Splitter Information for ADSL/POTS Spectrum Sharing
Technical Reference RCIT.0005	Wholesale Spectrum Sharing Service Issue 1.0
Guideline 012688	"Telstra Network Termination Device, Information for Cabling Providers"
ETSI TR 101.728 V1.2.1 (2002-05)	Access and Terminals (AT); Study for the Specification of the Low-Pass Section of POTS/ADSL Splitters
ETSI TS 101 952-1-1 V1.1.1 (2002-05)	Access network xDSL transmission filters; Part 1: ADSL splitters for European deployment; Sub-part 1: Specification of the low pass part of ADSL/POTS splitters
ETSI TS 101 952-1-5 V1.1.1(2003-05)	Sub-part 5: "Specification for ADSL/POTS distributed splitters"
ETSI TS 101 952-1-2 V1.1.1 (2002-05)	Access network xDSL transmission filters; Part 1: ADSL splitters for European deployment; Sub-part 2: Specification of the high pass part of ADSL/POTS splitters
ITU-T G.992	<u>Asymmetric digital subscriber line (ADSL)</u> <u>transceivers</u>
AS/ACIF S002: December 2001	Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network
AS/ACIF S043 - PART 1	Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network - Part 1: General
AS/ACIF S043 - PART 2	Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network - Part 2: Digital Subscriber Line (DSL)
AS/ACIF S043 - PART 3	Requirements for Customer Equipment for connection to a metallic local loop interface of a Telecommunications Network - Part 3: DC, low frequency AC and voiceband
DR/ACIF C559	INDUSTRY CODE UNCONDITIONED LOCAL LOOP SERVICE Network Deployment Rules
DR/ACIF C569	INDUSTRY CODE UNCONDITIONED LOCAL LOOP SERVICE Ordering, Provisioning and Customer Transfer
ACIF G572	INDUSTRY CODE UNCONDITIONED LOCAL LOOP SERVICE Fault Management

AS/NZS 60950:2000	Safety of information technology equipment (IEC 60950:1999, MOD)
AS/NZS 3548:1995	Limits and methods of measurement of radio disturbance characteristics of information technology equipment (IEC/CISPR 22:1993)

7. DOCUMENT CONTROL SHEET

Contact for Enquiries and Proposed Changes

If you have any questions regarding this document contact:

Name: Warwick O'Connor
 Designation: P3, Integration Specialist
 Phone: (03) 9634 7152
 Fax: (03) 9634 8658

If you have a suggestion for improving this document, complete and forward a copy of *Suggestions for Improvements to Documentation* (form 000 001-F01).

Issue No	Issue Date	Nature of Amendment
Draft	26/4/02	Document updated to include Merv Sewell's comments.
Draft	21/05/02	Minor corrections after internal review.
Draft	22/7/2002	Separation of exchange and customer end parts
Draft	30/8/2002	Major changes due to new ETSI TS
Draft	12/9/2002	Requirement for partial HPF and DC block at exchange end.
Draft	18/9/2002	Minor corrections after internal review.
Draft	20/02/03	Corrections after being released to industry. This RCIT will change again with new ETSI Spec for distributed splitters which should be published in the next few months.
Issue 1.0	7/4/03	Requested to change to Issue 1
Issue 2.0	10/9/04	Major changes due to new ETSI TS 101 952-1-5 V1.1.1 Sub-part 5: "Specification for ADSL/POTS distributed splitters"

Intellectual Property Rights

Equipment which is manufactured to comply with this specification may require the use of technology which is protected by patent rights in Australia. Questions about the availability of such technology, under license or otherwise, should be directed to the patent holder or Australian licensee (if known) or through enquiry at the Australian Industrial Property Organisation which incorporates the Patent, Trade Marks and Designs Office in each State.

This publication has been prepared and written by Telstra Corporation Limited (ACN 051 775 556), and is copyright. Other than for the purposes of and subject to the conditions prescribed under the Copyright Act, no part of it may in any form or by any means (electronic, mechanical, microcopying, photocopying, recording or otherwise) be reproduced, stored in a retrieval system or transmitted without prior written permission from the document controller. Product or company names are trademarks or registered trademarks of their respective holders.

Note for non-Telstra readers: The contents of this publication are subject to change without notice. All efforts have been made to ensure the accuracy of this publication. Notwithstanding, Telstra Corporation Limited does not assume responsibility for any errors nor for any consequences arising from any errors in this publication.

