

# **SAUDI TELECOM COMPANY**

## **Reference Offer for Data Access (RODA)**

### **Annex C**

#### **Technical Information**

Version number:	1.0
Version date:	August, 2007
Date of original Issue:	26 <sup>th</sup> August 2007
Authority for issue:	GM, Regulatory Affairs

**DOCUMENT HISTORY & VERSION CONTROL RECORD**

<b>Name of document</b>	Primary Document
<b>Author</b>	Director, Carrier Services, <a href="mailto:yakeel@stc.com.sa">yakeel@stc.com.sa</a>
<b>Authorised Officer</b>	GM, Regulatory Affairs
<b>Description of document</b>	Contains all the Technical Information related to the Interconnection Service provided by STC.
<b>Approved by</b>	CITC, Decision No.178/1428
<b>Date of approval</b>	August, 2007

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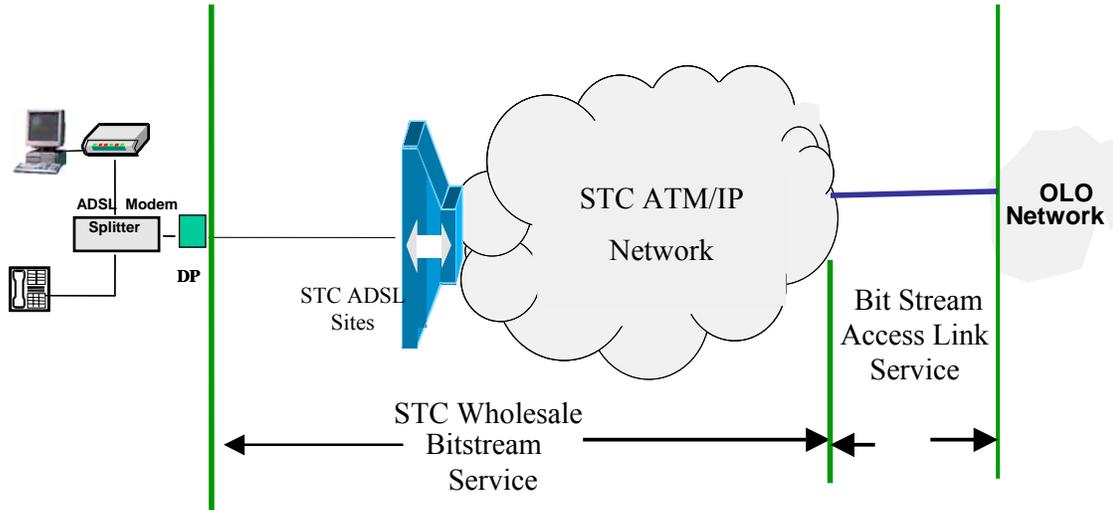
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## **A Bit Stream service- Technical Details**

### **1. Technical Interface Requirements of the Bit Stream Service**

- 1.1 The STC Bit Stream service will be made available over in-service copper pairs from the defined ADSL Serving Sites listed in Annex H (*Operations and Maintenance manual*), and where current technology allows.
- 1.2 STC is responsible for the STC ADSL exchange equipment (e.g. DSLAM) through to, and including, the copper pair connection and the DP at the Subscriber's site as shown in Figure 1 below.
- 1.3 The ADSL Modem and customer splitter shall be provided by the OLO (or their Subscriber), and shall fulfil STC's CPE Interface specifications as described in Attachment 1 of this Annex C. The ADSL Modem/splitter in the Subscriber's premises and all internal wiring provided by the OLO will be the OLO responsibility. Internal wiring provided by the Subscriber will remain the Subscriber's responsibility.
- 1.4 STC offers a Bit Stream Access Link Service that connects from nominated Edge Switches/Routers in the three major cities (Riyadh, Jeddah and Dammam as given in attachment-2 of Annex-H) to the OLO sites. The physical connection at the OLO site is single mode fibre STM-1 (G957) as described in Attachment-2 of this Annex C. The OLO shall comply with the STC specifications for the Bit Stream interface.
- 1.5 STC will only permit equipment approved by CITC to be used for the provision of the Bit Stream Service.



**Figure 1: STC Bit Stream Service**

## 2. STC's Local Loop, Physical Characteristics

2.1 The STC plant is primarily made up of a combination of 0.4 mm and 0.5 mm copper conductors. There is also a small quantity of sites served by 0.6 mm copper. Actual cable gauge per OLO site may not be recorded.

**Table-1 Buried Cables Typical Losses**

Attenuation Insertion At 300 kHz dB/km ADSL	Type of Cable Conductor Diameter
14	0.4 mm
12	0.5 mm
10	0.6 mm

2.2 The suitability of individual copper pairs will be determined by Line Test System (LTS) results. STC will carry out tests on the requested line and the test parameters may provide the following information such as :

- Electrical Continuity
- Insulation Resistance between wires and between wires and earth
- Loop resistance
- Difference in measured earth capacitance between wires
- Insertion loss at 100 kHz

2.3 As and when the test data on the lines ordered by the OLO is available through Line Test System (LTS), STC will organise this test data into a Database.

### 3. **Technical Service Constraints**

3.1 The OLO acknowledges and accepts the following technical limits relating to the Service:

3.2 The transmission performance of some Metallic Copper Pairs may mean it is technically impracticable to provide Service to those subscriber lines within a particular serving area. STC will provide information on the technical characteristics of the copper pairs of STC Outside plant Network to the OLOs according to what becomes available to STC when the service is requested.

3.3 There may be restrictions on the provision of Bit Stream Service over a particular subscriber line dependent on the existing Services on that line.

3.4 The service is not available to subscriber Sites where all or part of the Subscriber line is currently provided over fibre optic cable or radio systems.

3.5 The performance of some PSTN CPE may affect , or be affected by, the service.

3.6 Contention may reduce Downstream and Upstream burst rates.

- 3.7 Some technical limitations within the STC Network may not become apparent until after the service has been installed and working for a period of time. In such circumstances, the service for affected Subscribers may need to be withdrawn.
- 3.8 In the unavoidable event that STC needs to relocate a DSLAM, it is possible that, because of the increased distance between the DSLAM and the Subscriber, the Bit Stream Service on some subscriber line will cease to operate. In such unavoidable circumstances, the service for those Subscribers may need to be withdrawn. STC will, in case of such planned events, notify the OLO not less than seven (7) Calendar Months prior to the implementation of the DSLAM relocation. However, in case of unplanned and unpredictable events, STC is unable to give 7 months notice but will notify the impacted OLOs as early as possible.

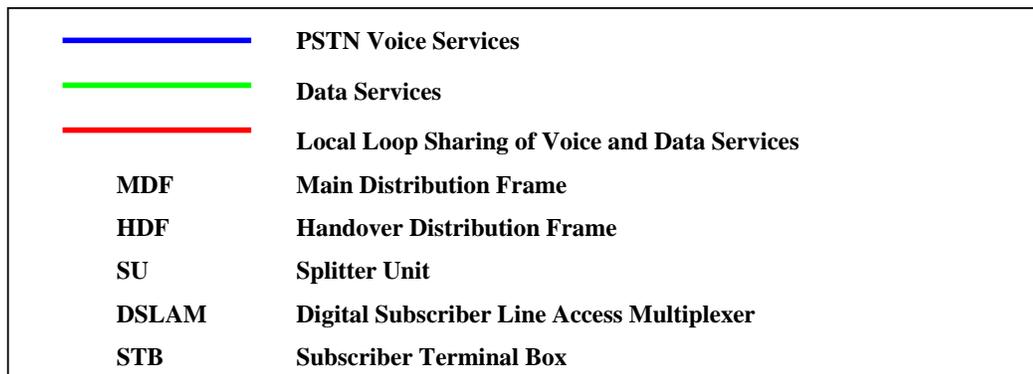
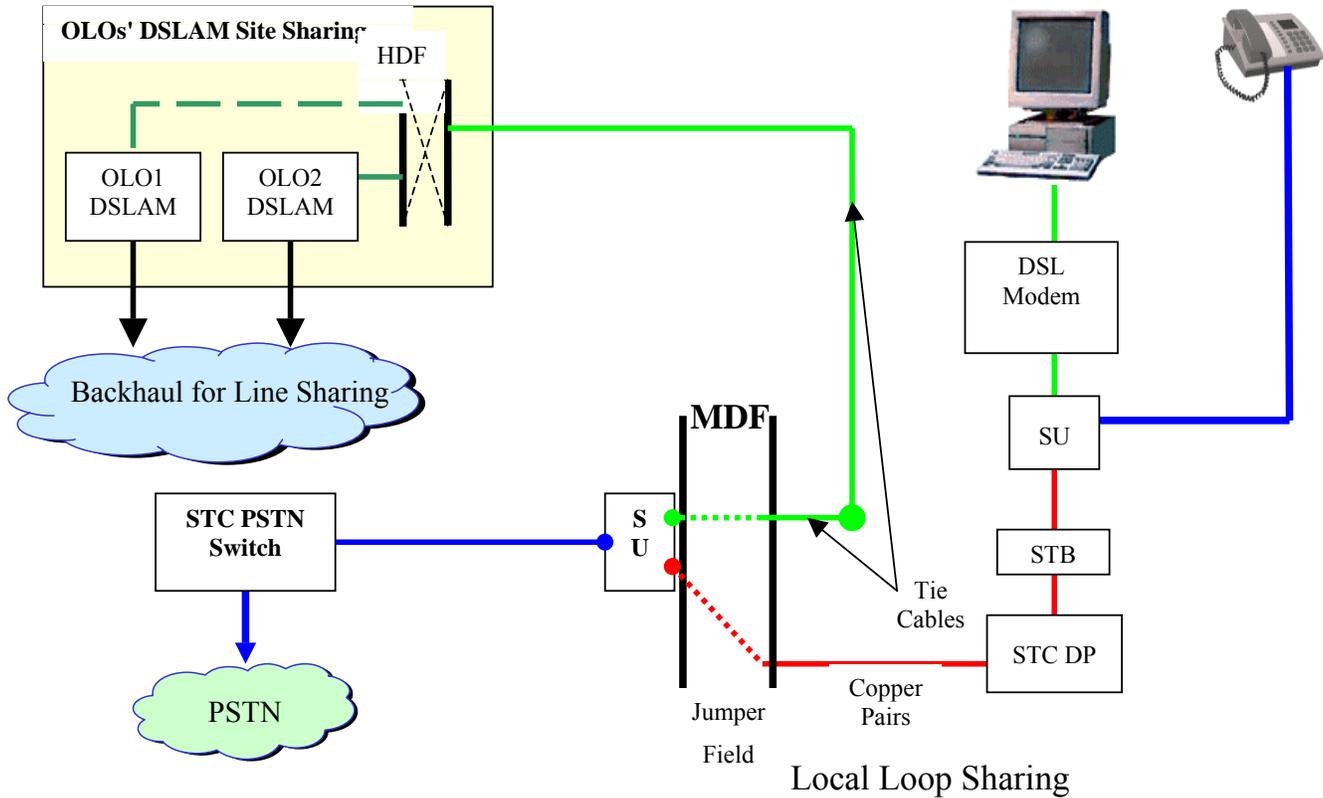
## **B Line Sharing service- Technical Details**

### **1. SCOPE**

- 1.1 This Section covers the technical requirements for the Requesting OLO's Equipment and Customer Premise Equipment (CPE) for the Line Sharing Service, and the relevant test requirements.
- 1.2 The specifications provided under Clause 3 of this Section are intended to minimize the risk of possible cross-talk interference with existing loop transmission systems and services located in other cable pairs within the same cable sheath. Such undesirable cross-talk interference could cause unacceptable degradation of performance of the existing loop transmission system and /or services in the STC network.
- 1.3 Compliance with specifications under Clause 3 of this Section does not guarantee system performance for any Requesting OLO's deployed system.
- 1.4 Spectrum Management and spectrum compatibility is an area subject to study by several telecommunications authorities, with a view to introducing new industry standards. The specifications given under Clause 3 of this Section will be the subject of periodic review by STC, at which time any new standards will be incorporated where appropriate.
- 1.5 STC will only permit DSLAM Site Sharing for equipment approved by CITC to be used for the provision of the Local Loop Sharing Service.

### **2. Line Sharing Network Configuration**

- 2.1 The following diagram shows the configuration for the Line Sharing Service in which the OLO uses the Local Loop between the STC MDF and the Subscriber. Figure 2 shows the configuration with the OLO DSLAM.



**Figure 2 Line Sharing Configuration**

2.2 The performance characteristics of all equipment provided by the OLO must conform with the relevant specifications published by STC in Annex C, Clauses 3, 4, 5, 6 and 7 of this Section.

3. **Cross-talk Information (Extract from ANSI TIE 1.4 /2000, Spectrum Management Draft Standard)**

- 3.1 The electromagnetic energy that couples into a metallic pair from services and transmission system technologies in use on other pairs in the same cable unit is unwanted energy, and is called “cross-talk noise“ (“cross-talk“).
- 3.2 Cross-talk is sensitive to frequency, signal strength and exposure. High frequency energy couples into other pairs more easily than low frequency energy because as the signal frequency increases, the cross-talk coupling loss between the pairs of a cable decreases. Hence, for two signals of equal strength, the higher the frequency, the greater the cross talk noise which is produced.
- 3.3 A strong signal will therefore transfer more power into other pairs than a weak signal. The amount of cross-talk noise is directly proportional to the power of the disturbing signal. The stronger the signal, the greater the cross-talk noise.
- 3.4 Exposure is a measure of the proximity of metallic pairs at various points along the cable and the length over which two pairs are in close proximity. The greater the exposure, the greater the total cross-talk noise.

4. **Performance Requirement For Requesting OLO’s Equipment for Line Sharing**

- 4.1 As strong signals create more cross-talk noise than weaker signals, the most effective and widely used method of controlling the cross-talk interference is through the use of the Signal Power Limitation. Signal Power Limitations specify the amplitude, frequency distribution and the total power of the electric signals at the point where the signal enters the subscriber loop cable.
- 4.2 To minimize and control the cross-talk interference introduced by Requesting OLO’s Equipment into the existing loop transmission systems and services, the performance requirements in this clause specify power limits in terms of:

- Transmitted Power Spectral Density (PSD); and

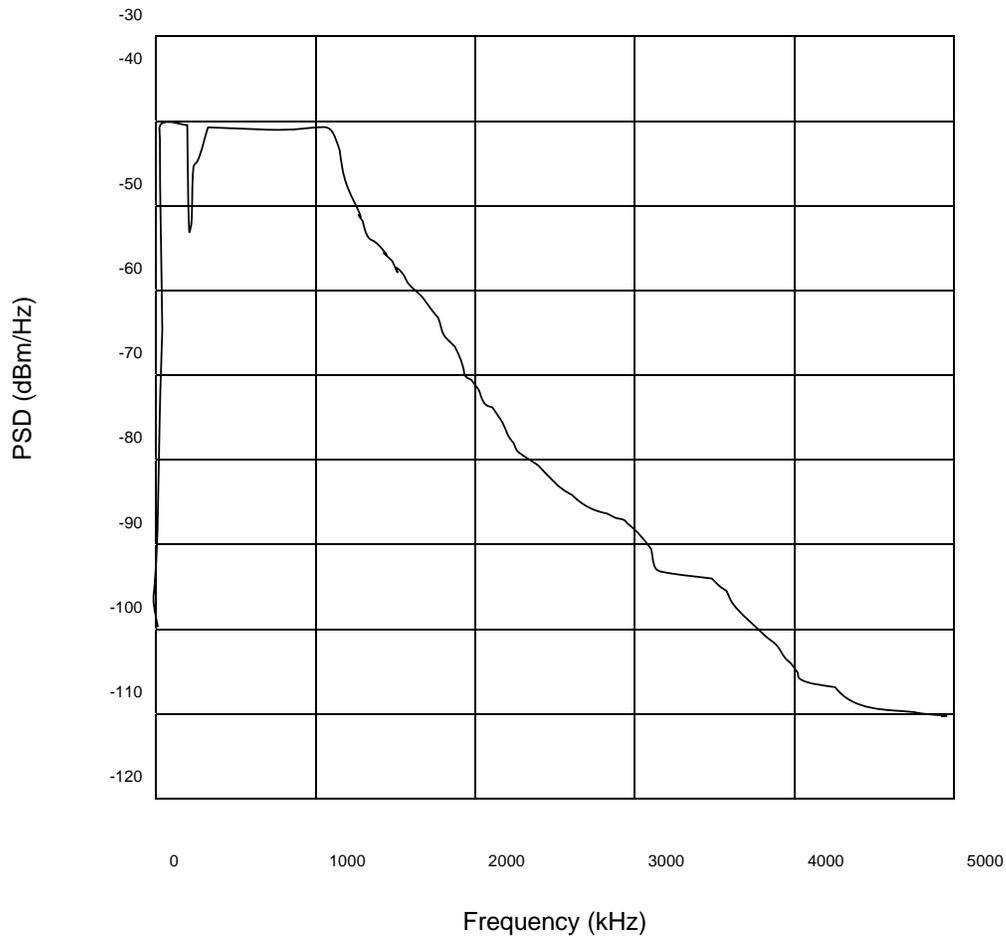
- Total Average Power Transmitted

- 4.3 The Signal Power Limitations apply to signals transmitted by ADSL transceiver units in local exchanges (ATU –C) or a remote control terminal location (ATU- R) that is normally at the subscriber premises. This Annex specifies both PSD and total Power average for both upstream (the signal travelling away from the subscribers premises) and down stream (the signal travelling towards the subscribers premises) signals.
- 4.4 The characterisation of a transmitted signal Power level and frequency content is called the power spectral density (PSD) of the signal. The primary signal power requirements in this plan are specified through the use of PSD masks and templates. The PSD mask shows the maximum power boundary or limit, in dbm per Hz, for the transmitted signal.
- 4.5 The Requesting OLO equipment must not transmit a signal above the PSD Mask or exceed the total average power for both upstream and downstream signals.
- 4.6 The PSD masks and templates are drawn from ANSI T1 E1.4 Spectrum Management Class 5 which is intended for DSL transmission systems that use ATU – C equipment and operate in the frequency spectrum for approximately 25 kHz to approximately 1104 kHz and ATU – R equipment that operates in the frequency spectrum from approximately 25 kHz to approximately 138 kHz.

## PSD template (Downstream)

### PSD template definition for downstream transmission

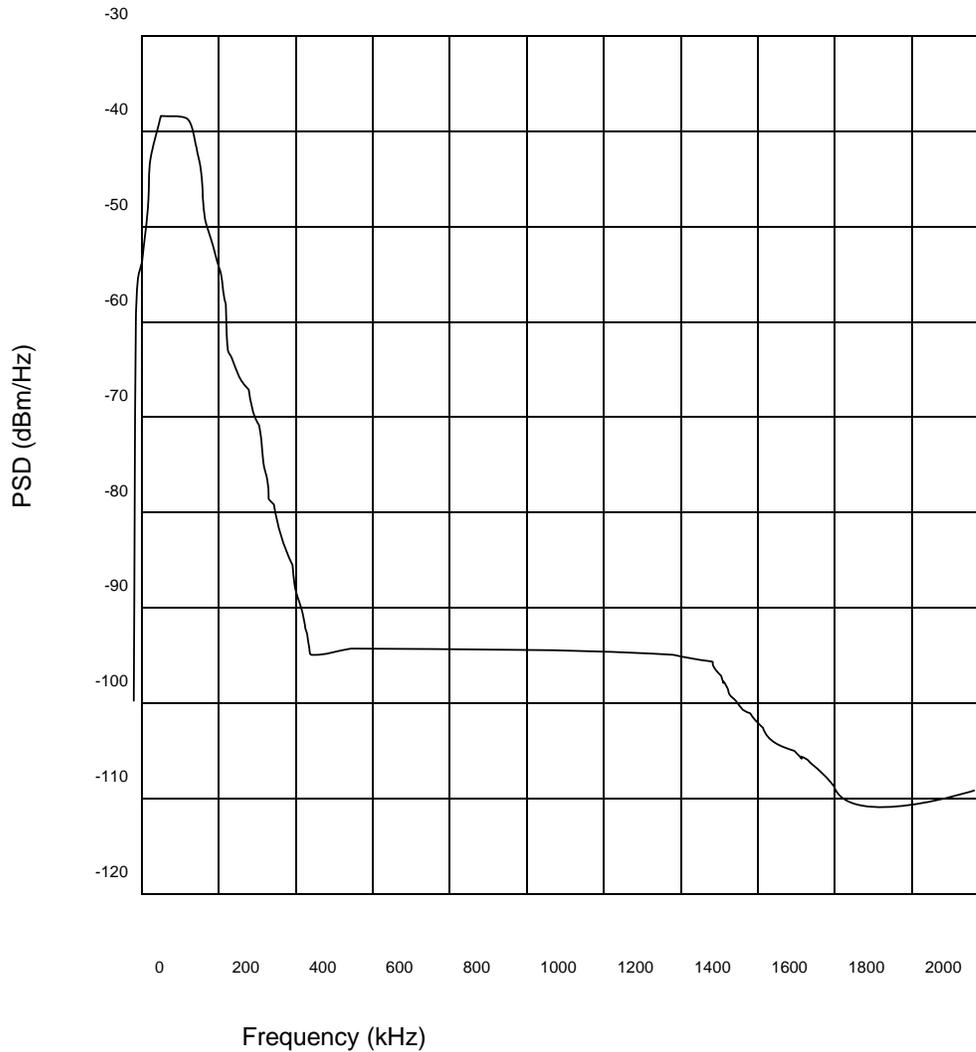
Frequency Band (kHz)	PSD (dBm/Hz)
$0 < f \leq 4$	-101, with max power in the in 0-4 kHz band of + 15 dBm
$4 < f \leq 25.875$	$-96 + 21 \times \log_2 (f/4)$
$25.875 < f \leq 81$	-40
$81 < f \leq 92.1$	$-40 - 70 \times \log_2 (f/81)$
$92.1 < f \leq 121.4$	-53
$121.4 < f \leq 138$	$-53 + 70 \times \log_2 (f/121.4)$
$138 < f \leq 1104$	-40
$1104 < f \leq 3093$	$-40 - 36 \times \log_2 (f/1104)$
$3093 < f \leq 4545$	Min $(-36.5 - 36 \times \log_2 (f/1104), -93.5)$
$4545 < f \leq 11040$	-110



### PSD template (Upstream)

#### PSD template definition for upstream transmission

Frequency Band (kHz)	PSD (dBm/Hz)
$0 < f < 4$	-101, with max power in the in 0-4 kHz band of +15 dBm
$4 < f < 25.875$	$-96 + 21.5 \times \log_2 (f/4)$
$25.875 < f < 138$	-38
$138 < f < 307$	$-38 - 48 \times \log_2 (f/138)$
$307 < f < 1221$	-93.5
$1221 < f < 1630$	Min $(-90 - 48 \times \log_2 (f/1221), -93.5)$
$1630 < f < 11040$	-110



**Total Average Power (Down Stream)**

Total average downstream power between 25 kHz and 1104 kHz transmitted by the ATU-C shall not exceed 20.9dBm .

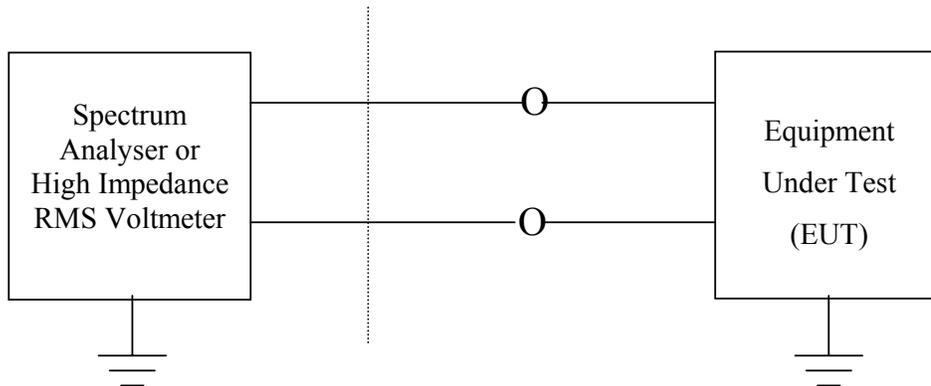
**Total average power (Upstream)**

The total average upstream power below 138 kHz transmitted by the ATU-R shall not exceed 13dBm.

- 4.7 If there is a higher potential for the cross-talk in the adopted Configuration, then in order to reduce such risk, the Requesting Licensee equipment must have Power Cutback as specified in ITU standard G992.1 and G922.2.
- 4.8 Reverse Mode ADSL Operation occurs when the ATU-C equipment (as defined in the relevant Recommendation ITU G922.2) is used to transmit in the reverse direction, that is away from the subscriber's premises.
- 4.8.1 Such Reverse Mode ADSL Operation will cause unacceptable cross-talk interference and performance degradation and is not allowed under the terms laid out in this Annex.

## 5. Test and Measurement Methods

- 5.1 Measurement setup for PSD and total average power measurement is shown in Figure 3 below.



**Figure 3: PSD and Total Average Power Measurement Set Up**

## 6. Total average power measurement

- 6.1 The total average power shall be measured and averaged over a time span of at least 10 seconds.

## 7. Power spectral density (PSD) measurement

- 7.1 The PSD is measured by averaging the observed output power of the EUT on each of a number of contiguous, regularly spaced small frequency bands, with each frequency band having a defined resolution bandwidth as shown in the Table below:

Resolution bandwidth for measuring a EUT PSD

Frequency Band (kHz)	PSD (dBm/Hz)
$f \leq 10$ kHz	100 kHz
10 kHz $< f \leq 25.875$ kHz	1 kHz
25.875 kHz $< f \leq 3.1$ MHz	10 kHz
3.1 MHz $< f \leq 30$ MHz	100kHz

- 7.2 Each frequency point of a PSD (corresponding to a measurement in a single resolution bandwidth) shall be measured by averaging the power in the resolution bandwidth of that frequency point for a time period of at least 2.0 seconds. This requirement is equivalent to setting the sweep time for a single sweep of a spectrum analyzer for a duration equal to at least 2.0 seconds per frequency point.
- 7.3 The EUT will be tested as it transmits maximum power and maximum PSD levels, at all frequencies, over which it can transmit data when deployed. The EUT shall not have any power cutback enabled during testing.
- 7.4 The EUT input shall consist of a pseudo-random uniformly distributed data sequence, and the EUT output shall be fully modulated transmitted signal with all overhead, framing, coding, scrambling, modulation, filtering and all other operations performed on the data stream that the modem would normally perform while transmitting data.

## 8. Splitter Performance Specifications

8.1 The basic functionality of a POTS Splitter is to separate the voice band and ADSL band data. POTS splitters are located on the MDF of the STC exchange and also after the demarcation point within the Customer Premises. The MDF Splitter will be provided by and be the responsibility of STC. The Customer Premise Splitter will be provided by and be the responsibility of the OLO. All Splitters connected to the STC network must comply with the following specifications to ensure interoperability.

8.1.1 The POTS splitters shall comply with functional requirements as specified in ITU G.992.1 Annex E.1 Type European, ETSI TR 101 728, ETSI TS 101 952-1-5 V1.1.1 (2003-05) and ANSI T1E1.4.

8.1.2 The POTS and the high-speed DSL traffic shall co-exist on the same copper pair and meet the following requirements:

- a) The splitter shall provide suppression of ADSL (full rate) & G.lite noise interference into the PSTN/POTS circuit as specified in ITU standard, ETSI and ANSI T1E1.4.
- b) The POTS splitter shall provide suppression of POTS interference into the digital ADSL (full rate) & G.lite stream in accordance with the procedure set down in ITU standard, ETSI and ANSI T1E1.4.

8.1.3 The failure of the POTS splitter shall not affect the POTS service.

8.1.4 The POTS splitter shall match the Terminal Balance Return Loss (TBRL) as specified in ITU-T Q.552. (Figure 11), when connected to the balance network given in Figure 2, above.

8.1.5 The inclusion of the Subscribers POTS splitters shall not introduce more than 1dB of insertion loss from 200Hz to 4kHz.

- 8.1.6 The Attenuation Frequency Distortion with the POTS splitter inserted in the copper line and terminated with the balance network and the input impedance in Figure 2 will be <1dB from 300 to 3.4kHz with respect to the insertion loss at 1kHz.
- 8.1.7 The Group Delay Distortion with the POTS splitter inserted in the copper line will be  $\leq 200\mu\text{s}$  between 200Hz to 4kHz.
- 8.1.8 The POTS splitter shall transparently allow the following line feed arrangements:
- a) -48V source fed through 2 x 250  $\Omega$  resistors.
  - b) Short circuit current limited to 55mA.
  - c) Power dissipation in on hook condition not exceeding 100mW per circuit.
  - d) 20MA constant source into loads between 120  $\Omega$  and 1200 $\Omega$ .
- 8.1.9 The POTS splitter shall transparently allow STC's ringer currents and, at the subscriber premise, support a ringing load of 4 REN.