File No	RDPS-POTS434	
Revision	R0	
System Application	ISDN Filter for ADSL	
Product Type	ISDN / POTS	
Product Name	CPF104IG	
Date	Oct. 16, 2002	
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1. Introduction:

The CPF104IG is a splitter module that has been specifically designed to implement the functionality of low pass filter in ISDN over ADSL application. The CPF104IG integrate low pass filter that block the high frequency energy from reaching the ISDN device and provide isolation from impedance effects of the ISDN device on ADSL. Because the ISDN splitter connects directly to the subscriber loop media , it must also provide some protection for externally induced line hits or faults which could damage any attached equipment or endanger humans interacting with the installed equipment. The circuit protection will be provided mostly by standard central office line protection means and additional protection measures built into splitter to protect against line overstress which could damage the splitter itself. This splitter mainly consist of one low pass filter which provide ISDN and POTS solution respectively

2. Reference:

Ref. 1 :	ETSI TS 101 388	Asymmetric Digital Subscriber Line European specific requirements
Ref. 2 :	ANSI T1.413	Network and customer installation interface.
Ref. 3 :	ITU G.992.1 Annex B	
Ref. 4 :	ITU-T K.21	Resistibility of telecommunication switching equipment to Overvoltages and overcurrents .

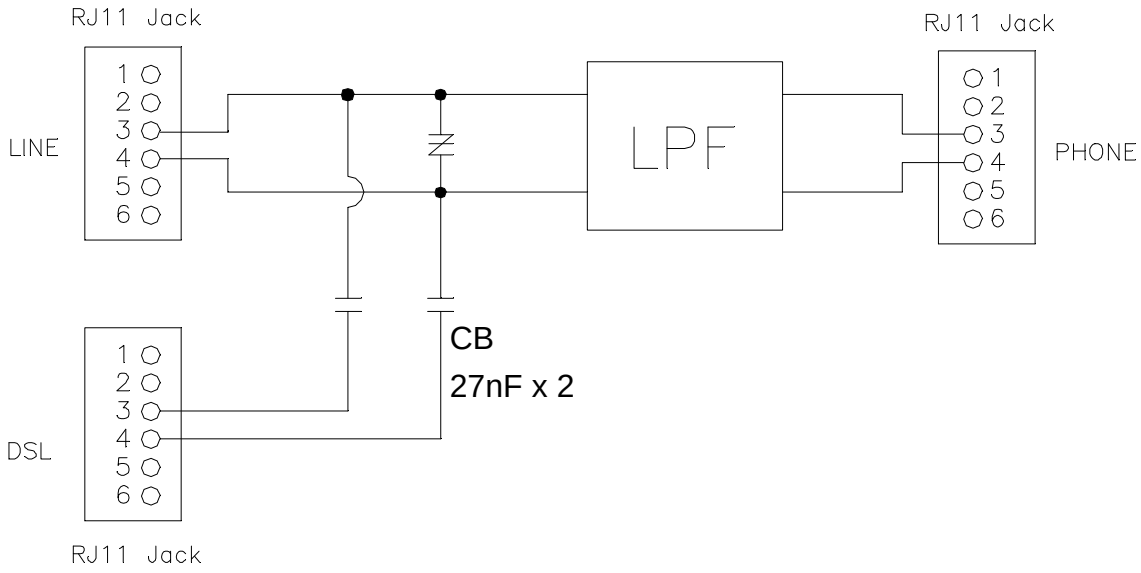
3. Abbreviations:

ADSL	Asymmetric Digital Subscriber Line
ISDN	Integrated Service Digital Network
CO	Central Office
CPE	Customer Premise Equipment.
POTS	Plain Old Telephone Service
RT	Remote Terminal
Z_{ADSL}	Network termination of ADSL

4. Technical requirements:

4.1. Schematic :

A block diagram of this product is graphically illustrated as below.



4.2. Electrical Specification :

4.2.1. General requirement :

Splitter parameter	Electrical requirements	
	Range	values
ISDN band(3dB bandwidth)		DC to 80KHz
Nominal impedance	for ISDN	135 ohm
Nominal impedance	for POTS	600 ohm
Current voice band		
Loop current		100mA
DC resistance		
DC resistance		<=12.5 ohm
DC resistance tip to ground		>5 M ohm
Low Pass Filter Passband requirements between ISDN port and Line port		
Insertion loss	1KHz to 40KHz	<0.8 dB
	40KHz to 80KHz	<2 dB
Low Pass Filter stopband requirements between ISDN port and Line port		
Attenuation	150KHz to 1104KHz	>65 dB
Return Loss requirements for Low Pass Filter on the ISDN port		
Return loss	4KHz to 40KHz	>16 dB
	40KHz to 80KHz	>14 dB
Low Pass Filter Passband requirements between POTS port and Line port		
Insertion loss	200Hz to 3600Hz	< 1dB
Return Loss requirements for Low Pass Filter on the POTS port		
Return loss	300Hz to 2KHz	>14 dB
	2.1KHz to 3.4KHz	>11 dB
High Pass Filter Passband Loss requirement between ADSL port and Line port		
Insertion loss	120KHz to 170KHz	<3 dB (100ohm)
	170KHz to 1104KHz	<1 dB (100ohm)

Splitter parameter	Electrical requirements	
	Range	values
Delay Distortion for Low Pass Filter between POTS / ISDN port and line port		
Delay Distortion	200Hz to 600Hz	< 250usec (600ohm)
	600Hz to 3200Hz	< 200usec (600ohm)
	3200Hz to 4000Hz	< 250usec (600ohm)
	Up to 80KHz	< 20usec (135ohm)
Unbalance about earth for Low Pass Filter on POTS/ISDN port and Line port		
Longitudinal conversion loss(LCL)	50Hz to 600Hz	> 40dB (600ohm)
	600Hz to 3400Hz	> 46dB (600ohm)
	3400Hz to 4000Hz	> 40dB (600ohm)
	Up to 30KHz	> 40dB (135ohm)
	30KHz to 1104KHz	> 46dB (135ohm)
	1104KHz to 5MHz	> 40dB (135ohm)

4.2.2. DC characteristic :

All requirement of this specification can be met in the presence of all ISDN loop currents from 0mA to 100mA. This ISDN splitter can pass ISDN tip-to-ring dc voltages of 0V to 72V and ringing signals of 40V to 80Vrms at any frequency from 22Hz to 28Hz with a DC component in the range from 0V to 72V. The dc resistance from tip-to-ring at the line port interface with the phone interface shorted, shall be less than or equal to 12.5 ohms. The DC resistance from tip-to-ground and from ring-to-ground at the ISDN interface with the U-R interface open shall be greater than or equal to 5 Megohms. The ground point shall be local building or green wire ground. As an objective , the dc resistance should exceed 10MΩ.

4.3. Test methodology

4.3.1. Filter insertion loss and attenuation and return loss test for ISDN port :

4.3.1.1. Test equipment :

a : HP4395A Network / Spectrum / Impedance Analyzer

b : HP87512A Transmission / Reflection test set

c : Balun North Hills : 0303LB(50Ω : 135Ω)

4.3.1.2. Test Setup: is shown in Fig.1 .

4.3.1.3. Test procedure :

a : Set HP4395A in B/R mode for insertion loss and attenuation test while in A/R mode for Return loss test.

b : Connecting the Analyzer to the ISDN and LINE sides of splitters through the North Hills Balun 0303LB

c : Set frequency of interest given in specification.

d : Calibrating the HP4395A network Analyzer via the thru for attenuation test while open, short, load calibration being performed for Return loss.

e : Measurement insertion loss and attenuation and Return loss.

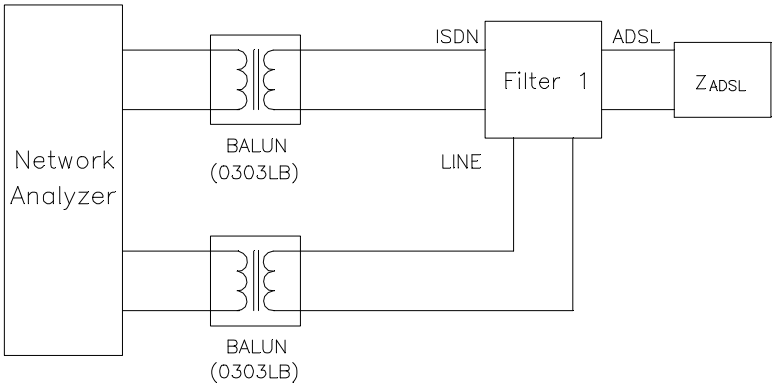


Fig.1. Test Setup

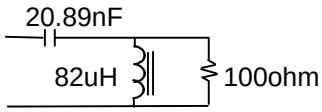


Fig.1-a Z_{ADSL} Load

4.3.2. Filter insertion loss test for POTS port :

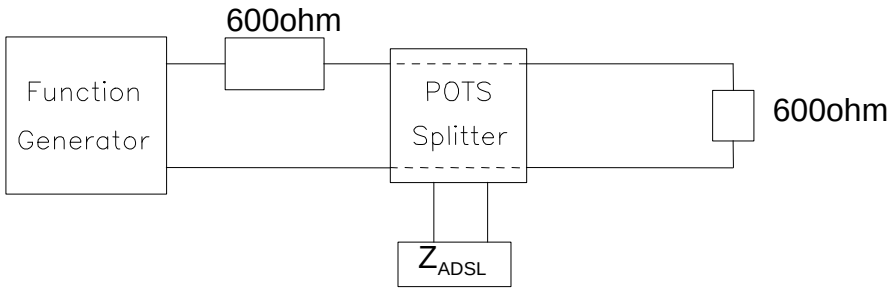
The insertion loss of a device connected into a given transmission system is defined as the ratio, expressed in dB, of the load power available(before and after insertion) delivered to the output network beyond the point of insertion at a given frequency. In general , the insertion loss of a device inserted in a given transmission system mainly caused by internal component resistive loss while all of the impedance between source , load and device interface having been matched. To perform the insertion loss measurement ,thru calibration must be done prior the testing . General Insertion loss equation can be expressed as following.

Insertion loss = 20 log $|V2 / V1|$ dB where

V1 = the measured voltage value of load without LPF in circuit.

V2 = the measured voltage value of load with LPF in circuit.

The test setup is shown in drawing below. :



4.3.3. Filter Return Loss test for POTS port :

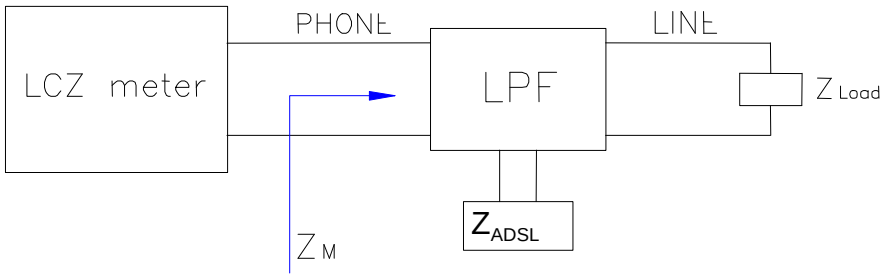
Return loss measure the amount of energy that is lost due to reflection which resulted from impedance mismatching at the interface. Return loss is essentially defined as the ratio of the power incident upon a given transmission system to the power reflected caused by impedance mismatch with respect to reference impedance at the interface between source and device. Return loss figure are a function of the impedance of the circuit involved and are therefore frequency dependent. These impedance must be closely maintained in order to reduce the possibility of undesirable reflection and echoes which in long distance circuit the telephone user or destroy the data being sent. To perform the return loss test ,open ,short, load calibration must be done prior measurement while the LCZ impedance Analyzer being selected in impedance mode. Return loss is general expressed in decibels.

General Return loss equation as below:

Return loss = 20 log $|Z_{Load} + Z_M / Z_{Load} - Z_M|$ dB

Where Z_{Load} = the reference impedance Z_M = the measured impedance

The test setup is shown in drawing below :



5. Environmental condition:

5.1. Resistibility to overvoltages and overcurrents:

The splitter has to comply with requirements as per ITU-T K.21.

5.2. Climatic conditions:

5.2.1. Operating temperature:

Application indoor

Long time operation guarantee temperature (5 to 40 ^{0}C)

Short time operation guarantee temperature (0 to 50 ^{0}C)

(According to ETS 300 019, class 3.2)

5.2.2. Storage and transport:

Low ambient temperature - 20 ^{0}C

High ambient temperature +85 ^{0}C

(According to MIL-STD-202 method 107)

5.2.3. Operation humidity:

Long time operation guarantee humidity (5 to 85 %)

Short time operation guarantee humidity (5 to 90 %)

Short time : within 72 continuous hours and 15 days in a year

6. Reliability conditions:

6.1. Thermal shock :

Temperature from -20 °C to +85 °C for 5 cycles

(According to MIL-STD-202 , method 107)

6.2. Temperature humidity exposure :

+50 °C /95RH , 96hrs

(According to MIL-STD-202 , method 103)

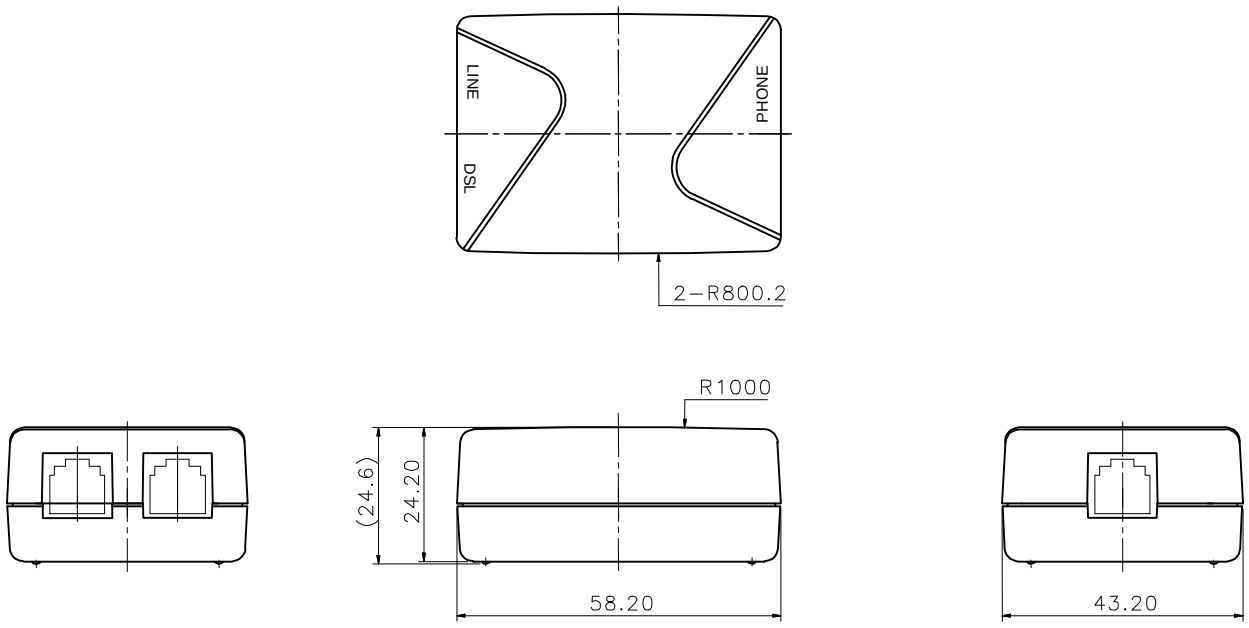
6.3. Vibration test :

Random vibration , frequency 5-500Hz , sweep time :1 hr / axis /

Force : 2.4grams (According to MIL-STD-202 , method 204)

7. Mechanical condition:

7.1 : Dimension :



Note :

1: Unit mm.