File No	RDPS-POTS321	
Revision	R1	
System Application	Asymmetric Digital Subscriber Line	
Product Type	ISDN / POTS Splitter	
Product Name	CPF101NW	
Date	Mar. 15th, 2002	
Issued By	Bert Lin - Design Engineer, R&D_1 Bert@ycl.com.tw	
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Issued Date		

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1. Introduction:

The CPF101NW is a splitter module that has been specifically designed to implement the functionality of low pass filter in ISDN over ADSL application.The CPF101NW 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 TR 101 728 V1.1.1(2000-12)
Ref. 2 : Splitter requirement specification for HM130
Ref. 3 : ITU-T G.992.1 Asymmetrical Digital Subscriber Line (ADSL) Transceiver
Ref. 4 : ITU-T K.21 Resistibility of subscribers terminal to over-voltages and over-currents.
Ref. 5 : ITU-T K.44 Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents—Basic Recommendation

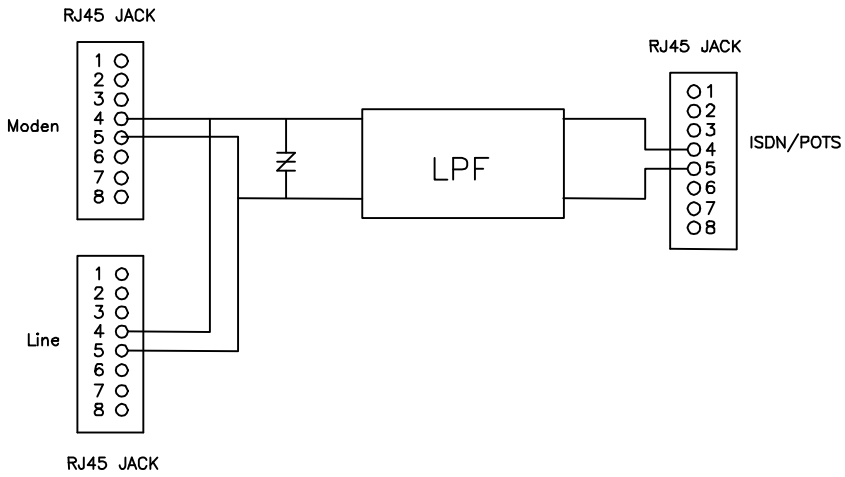
3. Abbreviations:

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. Block diagram :

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



4.2. Electrical specification:

4.2.1. ISDN requirement :

Splitter parameter	Electrical requirements	
	Range	values
ISDN band(3dB bandwidth)		DC to 94KHz
ADSL band		160KHz-1104KHz
Nominal impedance		
Line impedance ZL		135 ohm
CO impedance ZTc		135 ohm
RT impedance ZTr		135 ohm
Modem impedance		100 ohm
Current voice band		
Loop current		200mA
DC resistance		
DC resistance		<=12.5 ohm
Isolation resistance tip/ring		>5 M ohm
ISDN band characteristic		
Splitter parameter	Rang	Value
Insertion Loss	1KHz<f<40KHz	<0.8dB
	40KHz<f<80KHz	<2.0 dB
Return Loss	1KHz<f<40KHz	≥16 dB
	40KHz<f<80KHz	≥14 dB
Stop Band Attenuation	150KHz<f<1104KHz	>65 dB

4.2.2. POTS requirement :

Splitter parameter	Electrical requirements	
	Range	values
Frequency range		
Splitter bandwidth		DC to 16KHz
Nominal voice band		0.3KHz to 3.4KHz
Billing tone		16KHz±80Hz
Ringing frequency		22Hz to 28Hz
ADSL band		160KHz to 1104KHz
Line Impedance ZL		270ohm + (750ohm ‖ 150nF)
CO impedance ZTc		270ohm + (750ohm ‖ 150nF)
RT impedance ZTr		270ohm + (750ohm ‖ 150nF)
Modem impedance	160KHz< f< 1104KHz	100 ohm
Operation voltage voice band		
Nominal signal		21mVpp to 5.4 Vpp
Billing tone		10Vpp to 30.2Vpp
Ringing signal		40Vrms to 80Vrms(113Vpp to 227 Vpp)
DC voltage		0V to –72V
Max. AC voltage		70Vrms with –72VDC offset voltage
Max. differential		190V
Current voice band		
Loop current		<100mA
Transient current(on/off hook)		<400mA
DC Resistance		
DC Resistance		<=12.5 ohm
Isolation resistance tip/ring		>5 Mohm
Voice –band characteristic		
Splitter parameter	Rang	Value
Insertion Loss	200HZ<f<3.4KHz (Refer to 1KHz)	<±1dB
	16KHz±1KHz	<3.0dB
	1KHz	<1 dB
Return Loss	300Hz<f<3.4KHz	>12 dB
	3.4kHz<f<4KHz	>8 dB

4.2.3. DC characteristic :

All requirement of this specification can be met in the presence of all POTS loop currents from 0mA to 100mA. This POTS splitter can pass POTS tip-to-ring dc voltages of 0V to 72V and ringing signals of 40V to 80Vrms at any frequency from22Hz 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 25 ohms. The DC resistance from tip-to-ground and from ring-to-ground at the POTS 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 Return loss test for ISDN function.

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 A/R mode.
b . Connecting the Analyzer to the ISDN sides of splitter through the North Hills Balun 0303LB. While Z_{ADSL} load can be terminated with load, or open.
c . Set frequency of interest given in specification.
d . Calibrating the HP4395A network Analyzer via the thru, open, load calibration. being performed for Return loss.
e . Measurement Return loss.

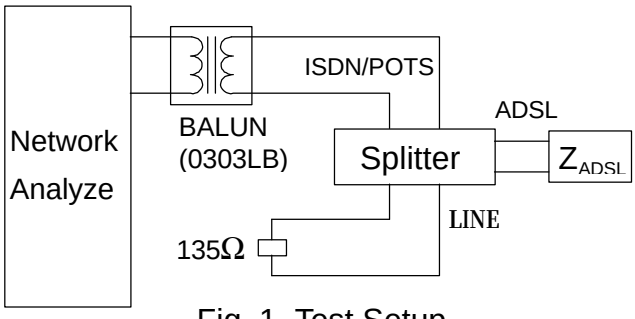


Fig. 1. Test Setup

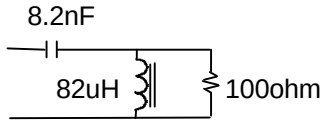


Fig. 1-a. Z_{ADSL} load

Note : Z_{ADSL} load can be terminated with load, or open

4.3.2. Filter Insertion Loss and attenuation test for ISDN function.

4.3.2.1. Test Equipment :

a . HP4395A Network / Spectrum / Impedance Analyzer

b . HP87512A Transmission / Reflection test set

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

4.3.2.2. Test setup: is shown in Fig. 2 .

4.3.2.3. Test Procedure :

a . Set HP4395A in B/R mode for attenuation test.

b . Connecting the Analyzer to the ISDN and line side of splitter 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

e . Measurement Insertion Loss and attenuation.

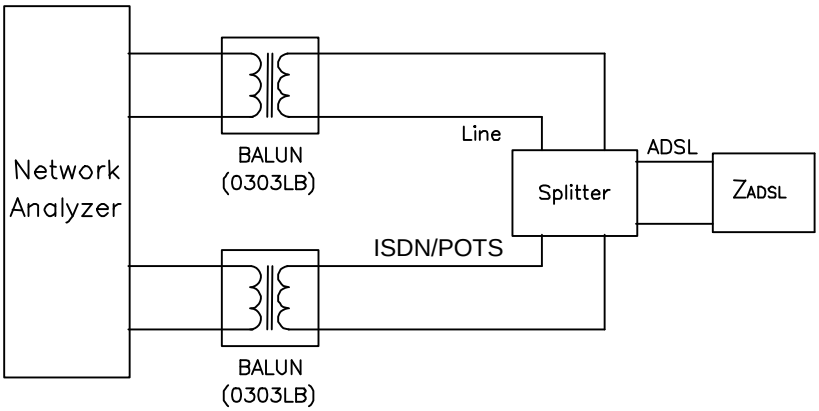


Fig. 2. Test Setup

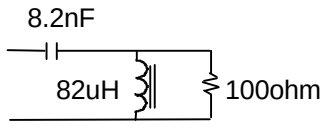


Fig. 2-a. Z_{ADSL} load

Note : Z_{ADSL} load can be terminated with load, or open

4.3.3. Filter Insertion loss test For POTS Function:

4.3.3.1. Description :

Insertion loss /Attenuation mentioned herein is defined as below :

IL = 20 log $_{10}$ | Vo/Vi | dB

Vi = the voltage value measured is shown in Fig. 3

Vo = the voltage value measured across the Line side shown in Fig. 4

4.3.3.2. Apparatus :

a . Function generator or equivalent

b . Readout oscilloscope or equivalent.

c . Complex load ZL =270 ohm + 750 ohm //150nF

4.3.3.3. Test procedure :

a . Set the measurement Frequency of interest

b . Connecting the source to the Phone side of splitter with the complex load ZL=270 ohm + 750 ohm //150nF across the Line side.

c . Measure the voltage value and calculate the Insertion loss expressed in decibel from the equation Insertion loss = 20 $\log_{10}$ |Vo / Vi| dB

d . Change another frequency of interested the repeat step a~d.

4.3.3.4. Insertion loss test set up measurement :

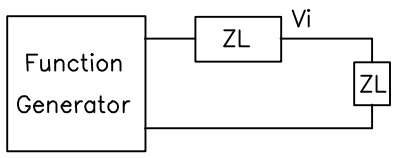


Fig. 3

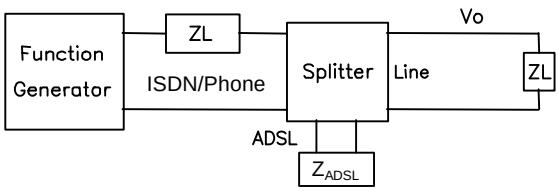


Fig. 4

4.3.4. Filter Return Loss Test For POTS Function:

4.3.4.1. Description :

Return loss is essentially defined as the ratio of the power incident upon a given transmission system to the power reflected caused by an impedance mismatch with respect to reference impedance at the interface between source and device.Return loss is generally expressed in decibels. General Return Loss equation as below:

Return loss = 20 log $| Z_R + Z_M / Z_R - Z_M |$ dB

Z_R = the reference impedance is shown in Fig. 5

Z_M = the measured impedance is shown in Fig. 6

4.4.2.2. Test Equipment :

a : HP 16047A Transformer Test Fixture

b : HP HP 4192A Analyzer or equivalent

c : Complex load ZL = 270ohm +750ohm //150nF

4.3.2.3. Test Setup : is shown in below

4.3.2.4. Test Procedure :

a : Set the measurement Frequency of interest

b : Calibrating the HP4192A L.C.Z. impedance Analyzer via the short . open, load

c : Connecting the Analyzer to the POTS(ISDN) side of splitter with the complex load 270ohm+750ohm//150nf across the Line side. While Z_{ADSL} load can be terminated with Z_{ADSL} load or open.

d : Measure the impedance value R +jX and calculate the Return loss expressed in decibel from the equation Return loss = 20 log $|Z_R + Z_M / Z_R - Z_M|$ dB

e : Change another frequency of interest, then repeat step b~e.

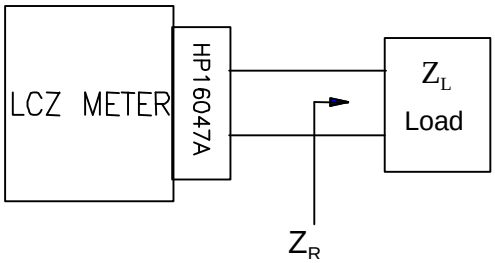


Fig. 5

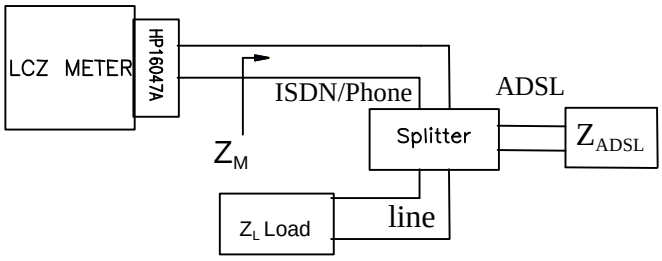


Fig. 6

5. Environmental condition:

5.1. Resistibility to overvoltages and overcurrents:

The splitter has to comply with requirements as per ITU-T K.21.
The test voltage of lightning surge simulation is up to 10 kV.

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 / QC-0-20)

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:

Test Item	Description of Testing	Test Condition	Acceptance	Sampling Quantities	
				D.V.T. Pilot Run	Mass Product
1	Visual/Mechanical Examination	By Visual Examination or by using X-Ray, Microscope etc. to Examine sample. Reference:QC-0-12&QC-0-22	No cracking , broken, marking color changing and lose marking after washing.	2	4
2	Electrical Characteristic	According to clause 4.5 Electrical Specification, pp. 16-17. Reference: QC-0-16	No electrical failure.	2	4
3	Thermal Shock	-20 ^{0}C → +85 ^{0}C, for 5 cycles. Reference: MIL-STD-202 method 107 / QC-0-20	No electrical failure.	1	2
4	Temperature Humidity Exposure	+50 ^{0}C / 95 RH, 96 hrs. Reference: MIL-STD-202 method 103 / QC-0-11	No electrical failure.	1	2
5	Vibration Test	Random vibration / Freq. : 5 ~ 500 Hz / Sweep time : 1 hr. / axis / Force : 2.4 grams Reference: MIL-STD-202 method 204 / QC-0-21	No electrical failure & mechanical faults.	1 box	1 box

7. Mechanical condition: