File No	RDPS-POTS438	
Revision	R1	
System Application	Asymmetric Digital Subscriber Line	
Product Type	POTS Splitter	
Product Name	CPF121F	
Date	Dec. 25th, 2002	
Issued By	Sundi Lin - Design Engineer, R&D_1 Sundi@ycl.com.tw	
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Issued Date		

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1. Introduction:

The CPF121F is a splitter module that has been specifically designed to implement the functionality of low pass filter in POTS over ADSL application.

Asymmetric Digital Subscriber Line (ADSL) technology is dedicated , point to point , public network access technology that allow multiple forms of data , voice , and video to be carried over twisted-pair copper wire on the local loop between a network service provider ' s(NSP' S) central office and the customer site or on local loops created either intra-building or intra-campus. Best of all , ADSL delivers this high speed performance over existing copper telephone line all while allowing traditional voice service to coexist without interruption through POTS low pass filters. The POTS-splitter on the customer premises side consists of a lowpass section(installed in aseparated plastic box).

The CPF121F integrate low pass filter that block the high frequency energy from reaching the POTS device and provide isolation from impedance effects of the POTS device on ADSL.In addition , these filter will also attenuate any wideband impulse noise generated by the POTS device due to the interruption of loop current(e.g. pulse dialing or on hook / off hook transfer) Because the POTS 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 POTS splitter to protect against line overstress which could damage the splitter itself. The electrical and transmission specification is based on ETSI TR 101 728 and castomer requird .

2. Reference:⚠

Ref. 1 : ETS 300 019

Environmental conditions and environmental tests for telecommunications equipment

Ref. 2 : ETSI 101 728

Network and Customer Installation

Ref. 3 : ITU-T K44

Resistibility test for telecommunication to overvoltages and overcurrents

Ref. 4 : ITU-T K21

Resistibility of subscribers terminal to overvoltage and overcurrents

Ref. 5 : ETSI TS 101 952-1-1

Specifications of the olw pass part of ADSL / POTS splitters

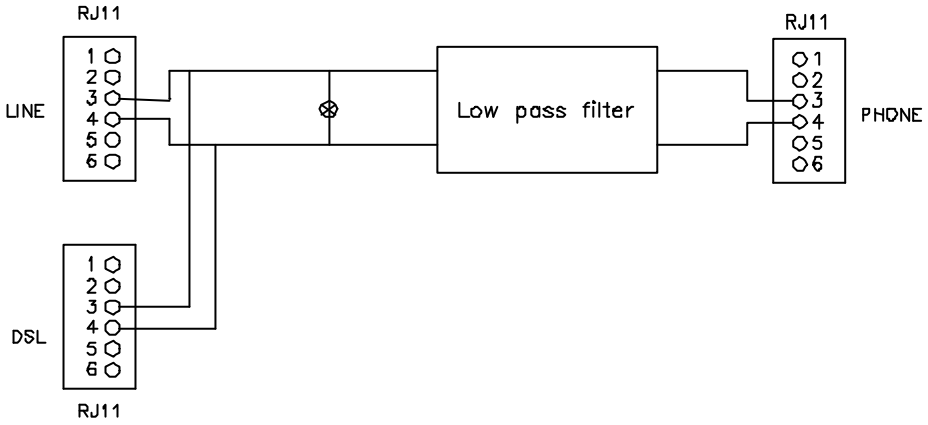
3. Abbreviations:

ADSL	Asymmetric Digital Subscriber Line
CO	Central Office
CPE	Customer Premise Equipment.
POTS	Plain Old Telephone Service
RT	Remote Terminal
ADSL-NT	Network termination of ADSL

4. Technical requirements :

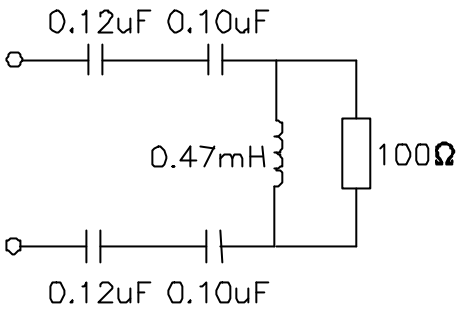
4.1. Schematic :

The following drawing illustrates the schematic of this product.



4.2. ZHP-r definition :

To facilitate the test of the splitter , the high pass data have to be taken into consideration. Capacitors of 0.1uF on the NT-side are connected in series with 0.12uF capacitors in the tip-And ring-line of the ADSL-output of the splitter itself (see block diagram above). The equivalent circuit diagram of the NT-side is shown below :



4.3. Electrical specification : ⚠1

Item	Splitter parameter	Electrical requirements	
		Range	values
	Frequency range		
	Splitter bandwidth		DC to 3.4KHz
	Nominal voice band		0.3KHz to 3.4KHz
	Ringing frequency		25Hz to 50Hz
	ADSL band		30KHz to 1104KHz
	Line Impedance ZL		270ohm + (750ohm ‖ 150nF)
	CO impedance ZTc		270ohm + (750ohm ‖ 150nF)
	RT impedance ZTr		270ohm + (750ohm ‖ 150nF)
	Modem impedance	30KHz< f< 1104KHz	100 ohm
	Operation voltage voice band		
	Nominal signal		21mVpp to 5.4 Vpp
	Billing tone		10Vpp to 30.2Vpp
	Ringing signal	25Hz	100Vrms
	DC voltage		45V to 52V
	Max. AC voltage		150Vrms with -105VDC offset
	Current voice band		
	Loop current		<=80mA
1	Polarity independence	All	All other electrical performance requirements shall be met for both DC polarities
2	Shunt capacitance between A-wire and B-wire terminals	DC or low freq.<=50Hz	<=150nF
3	Resistance between each line terminal and earth at 250 V DC	DC	>=10Megohm
4	Resistance between A-wire and B-wire terminals at 250V DC	DC	>=10Megohm
5	Series resistance at POTS port with line port S/C (Clause 6.2.3 Ref. 5)	DC	<=50ohm

Item	Splitter parameter	Electrical requirements	
		Range	values
6	Ringing signal impedance at line port and POTS port (Clause 6.3 Ref. 5)	25Hz & 50Hz	<=2 V RMS
7	Ringing signal impedance at line port and POTS port (Clause 6.3 Ref. 5)	25Hz & 50Hz	>=40kohm
8	Insertion loss(Off-hook) (Clause 6.5.1 Ref. 5)	1KHz	<1dB with source & load impedance = Z_R
			<1dB with source & load impedance = 600 ohm
8(a)	Insertion loss (On-hook) (Clause 6.4.2.1 Ref. 5)	1KHz	<1dB with source & load impedance = 600 ohm
8(b)	On-hook high-impedance voltage gain(Clause 6.4.1 Ref. 5)	200Hz to 2800Hz	Voltage gain shall be within range of – 4dB to +4 dB with source impedance =Z_R & load impedance =Z_{ON}
9	Insertion loss distortion (magnitude of difference of insertion loss at 1 kHz and that at another frequency) (Off-hook) (Clause 6.5.2 Ref. 5)	200Hz to 4000Hz	<1 dB with source & load impedance = Z_R
			<1 dB with source & load impedance =600 ohm
9(a)	Insertion loss distortion(On-hook) (Clause 6.4.2.2 Ref. 5)	200Hz to 2800Hz	<±1dB with source & load impedance = 600 ohm
10	Return loss at line port and POTS port (Off-hook) (Clause 6.6 Ref. 5)	300Hz to 3400Hz	>=12 dB with termination & reference impedance Z_R
		3400Hz to 4000Hz	>=12 dB with termination & reference impedance Z_{SL}
11	Longitudinal conversion loss(LCL) Measured at POTS port (Test Port = POTS port) (a) with S2 open & (b) with S2 closed Measured at Line port (Test Port = line port) with S2 closed (Test method only- as per Clause 6.8 Ref. 5)	50Hz to 600Hz	>=46 dB with R = 300 ohm & S1 closed
		600Hz to 3400Hz	>=52 dB with R = 300 ohm & S1 closed
		3400Hz to 4000Hz	>=46 dB with R = 300 ohm & S1 closed
		4000Hz to 30kHz	>=40 dB with R = 50 ohm & S1 closed
		30kHz to 1104kHz	>=50 dB with R = 50 ohm & S1 closed
		1104kHz to 5MHz	>=30 dB with R = 50 ohm & S1 closed

Item	Splitter parameter	Electrical requirements	
		Range	values
12	Isolation (Off-hook) (Clause 6.9.2 Ref. 5)	32 kHz to 1104 kHz	>=55dB
12(a)	Isolation (On-hook) {= On-hook loss} (Clause 6.9.1 Ref. 5)	25 kHz to 1104 Hz	Mask of Fig. 1 below
13	Voice band noise at both line port and POTS port (Off-hook)(Clause 6.10.1 Ref. 5)	300Hz to 4000 Hz	<-75 dBmp
14	ADSL band noise at both ADSL port and line port (Off-hook & On-hook) (Clause 6.10.2 Ref. 5)	26 kHz to 1104 kHz	<-125 dBm/Hz in any 10kHz bandwidth
16	Intermodulation noise (Off-hook & On-hook) (Clause 6.11 Ref. 5)	4 Tones	2^{nd} harmonic <= -57 dB wrt fundamental
			3^{rd} harmonic<=-60 dB wrt fundamental
17	Group delay distortion (Off-hook & On-hook) (Clause 6.12 Ref. 5)	200 Hz to 600 Hz	<=250 us with source & load impedance = 600 ohm
			<=250 us with source & load impedance = Z_R
		600 Hz t m o 3200 Hz	<=200 us with source & load impedance = 600 ohm
			<=200 us with source & load impedance = Z_R
		3.2 kHz to 4.0 kHz	<=50 us with source & load impedance = 600 ohm
			<=50 us with source & load impedance = Z_R
18	Immunity to high-level POTS signals	Simulated transients	Peak – to – peak volts <2 V
			Resonant frequency <15 kHz

Note :

Applying an input test signal of – 6 dBv emf to either the POTS or LINE port of the splitter , the maximum output voltage level measured over the load impedance shall be below the template of figure 1.

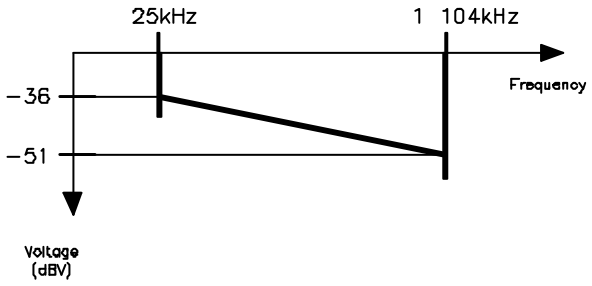
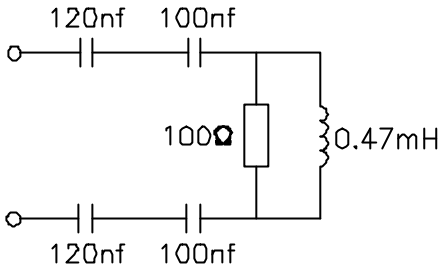


Figure 1 : On – hook voltage gain template
(maximum allowed output voltage with input of – 6dBV)

4.4. Z_{ADSL} defined (Clause 5.2.1) : ⚠1

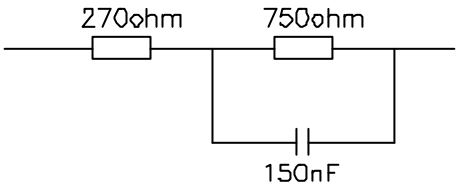
This substitute circuit shown in below is a model which shall be applied to a POTS splitter when verifying requirements of the low pass filter.

The purpose of this model impedance is for splitter specifications ,it is not a requirement on the input impedance of the ADSL transceiver.

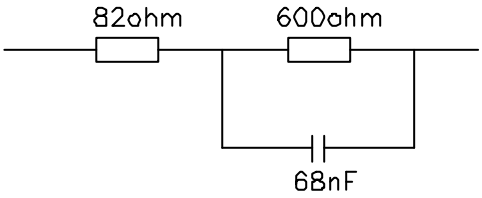


4.5. Z_R and Z_{RL} defined (clause 5.2.2) : ⚠1

For most requirements relating to voice band frequencies described in the present document, either the terminating impedances Z_R or Z_{SL} is used to terminate the POTS port or the Line port. Z_R is the European harmonized complex impedance, Z_{SL} is an impedance used in TBR 038 [1] to simulate a short line terminated in 600Ω .



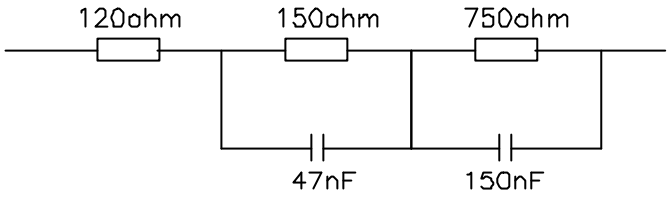
Impedance Z_R



Impedance Z_{SL}

4.6. Z_{RHF} defined (clause 5.2.3) : ⚠1

For requirements relating to ADSL frequencies described in the present document, the terminating impedance Z_{RHF} is used to terminate POTS and line ports of the low pass filter. This is the European harmonized complex impedance Z_R with the modification proposed in TR 102 139 [2]. This network is shown in below.

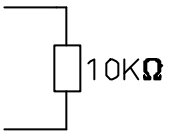


Impedance Z_{RHF}

4.7. Z_{on} defined (clause 5.2.4) :⚠1

For some on - hook requirements (as defined in clause 5.1.2) described in the present document, the terminating impedance Z_{ON} is used.

Actual impedances will vary greatly especially over the ADSL frequency range and thus the impedance model adapted here is just intended for the verification of splitters. It is not intended to be an equivalent circuit for a POTS TE.



Impedance model to be used for some on-hook requirements

4.8. Test method :

4.8.1. Insertion loss : ⚠1

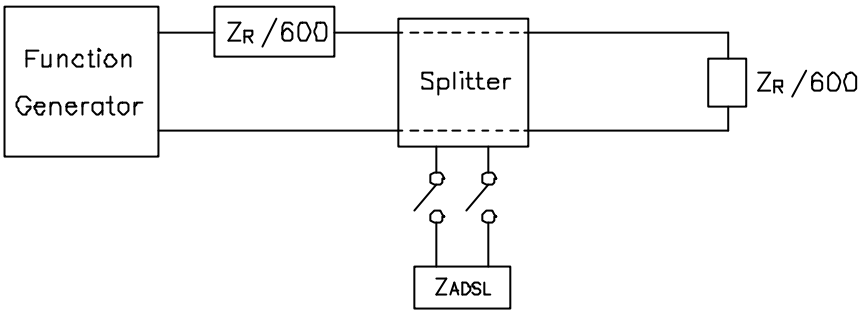
The insertion loss of a device connected into a given transmission system is defined as the ratio, expressed in dB, of the load power available (before and after insertion) delivered to the output network beyond the point of insertion at a given frequency. In general , the insertion loss of a device 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. :



4.8.2. Return loss : ⚠1

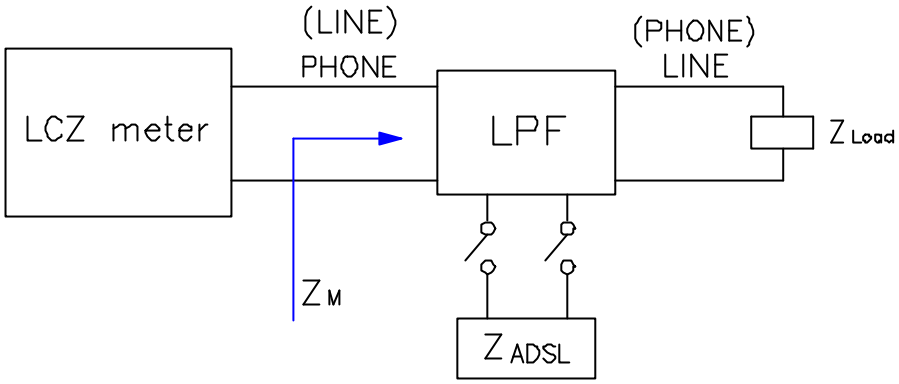
Return loss measure the amount of energy that is lost due to reflection which resulted from impedance mismatching at the interface. Return loss is essentially defined as the ratio of the power incident upon a given transmission system to the power reflected caused by impedance mismatch with respect to 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 :



Note:

Z_{Load} defined :

Z_R=270 ohm+(750ohm//150nf)

Z_{SL}=82 ohm+(600ohm//68nf)

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)

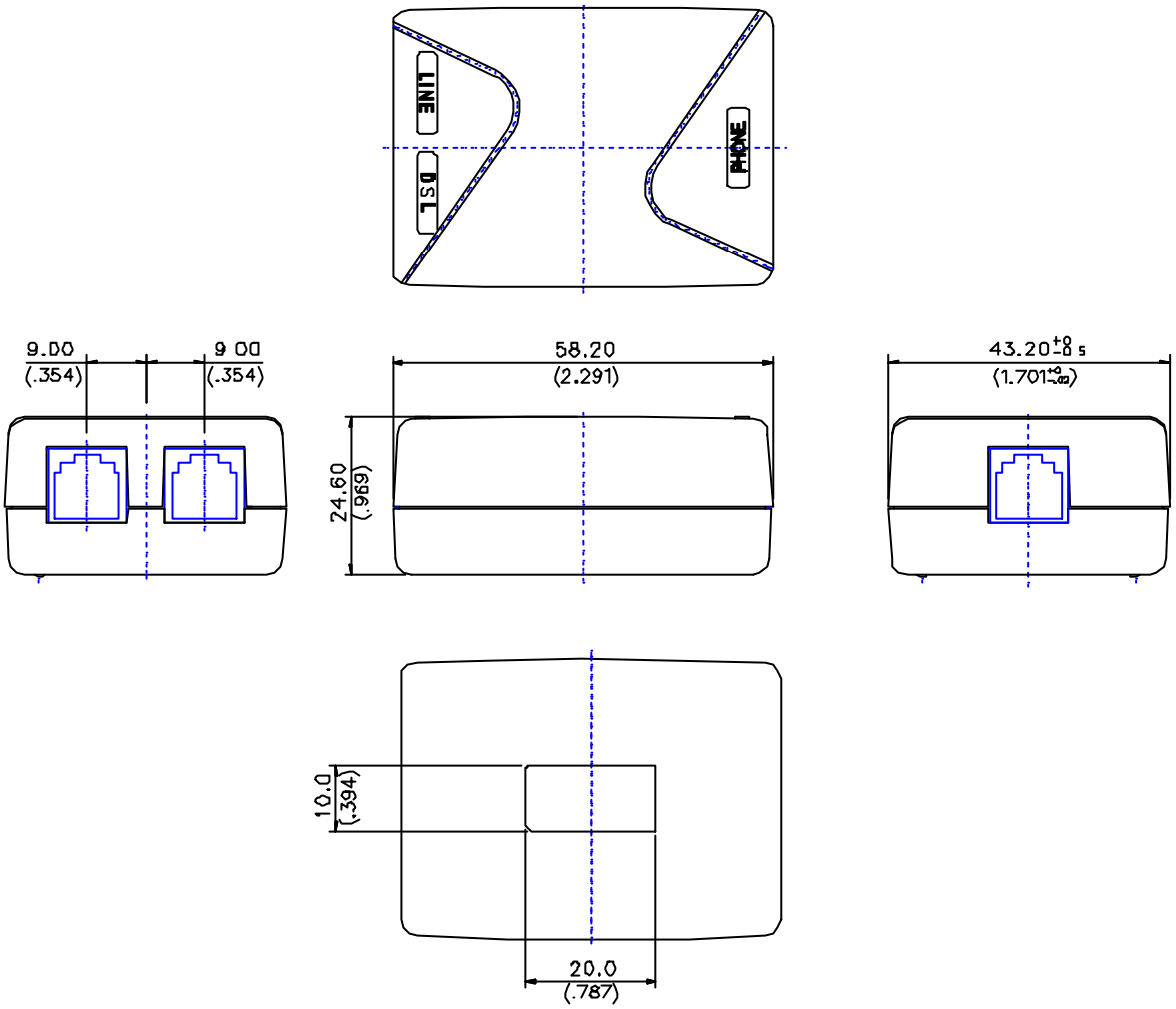
6.3. Vibration test :

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. Mechanical :



Note : (1)all tolerance : ± 0.25mm(0.001)inch
(2) color code for case:91H301B0