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| File No | RDPS-POTS281 | |
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| System Application | Asymmetric Digital Subscriber Line | |
| Product Type | POTS Splitter | |
| Product Name | CPF105G | |
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1. Introduction:

The CPF105G 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 a separated plastic box.

The CPF105G 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.

2. Reference:

| | |
|------------------------------|--|
| Ref. 1 : ETS 300 001 | Attachment to Public Switched Telephone Network |
| Ref. 2 : AS/ACIF S002 : 2001 | Analogue inter working and non-interference requirements for Customer Equipment for connector to the Public switched Telephone Network |
| Ref. 3 : ITU-T K20 | Resistibility of telecommunication switching equipment to overvoltages and overcurrents |
| Ref. 4 : ITU-T K21 | Resistibility of subscribers terminal to overvoltage and overcurrents |

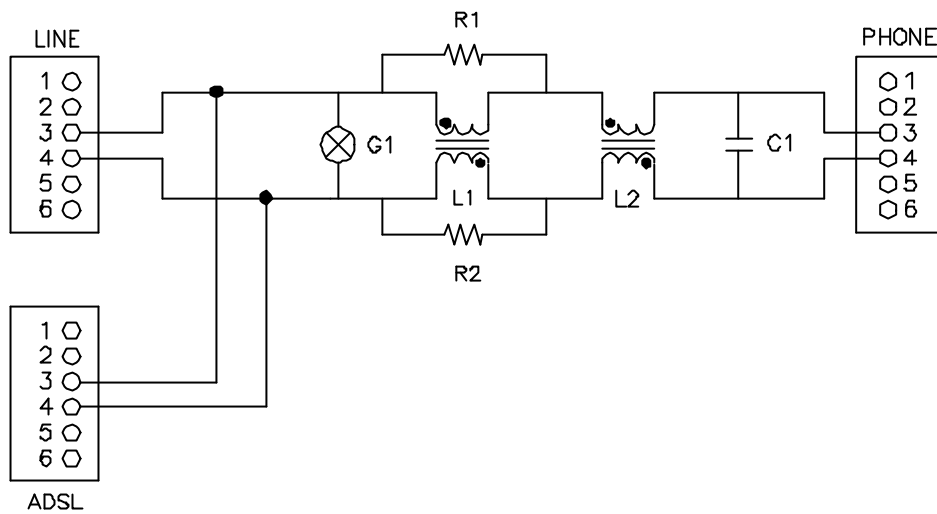
3. Abbreviations :

| | |
|---------|------------------------------------|
| 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 illustrate the block diagram of this product.



4.2. Electrical specification:

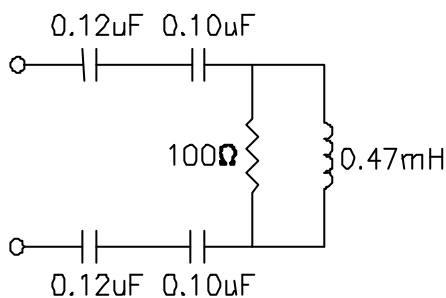
The low pass filter shall satisfy the following parametric limits with a complex impedance ZL shown in this table across the Line side of this device . The following requirement is specified for a single splitter.

| Splitter parameters | Electrical requirements | |
|-------------------------------------|-------------------------|-------------------------------------|
| | Range | Values |
| Frequency range | | |
| Nominal voice band | | 0.3KHz to 3.4KHz |
| Ringing frequency | | 22Hz ±28Hz |
| ADSL band | | 30KHz to 1104KHz |
| Line Impedance ZL | | 220ohm + (820ohm 115nF) |
| CO impedance ZTc | | 220ohm + (820ohm 115nF) |
| RT impedance ZTr | | 220ohm + (820ohm 115nF) |
| 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 | | 40Vrms to 80Vrms(113Vpp to 227 Vpp) |
| DC voltage | | 0V to -72V |
| Max. AC voltage | | 70Vrms with -72VDC offset |
| Max. differential | | 190V |
| Current voice band | | |
| Loop current | | <120mA |
| Transient current(on/off hook) | | <400mA |
| | | |

| Splitter parameters | Electrical requirements | |
|--|--------------------------------------|----------------------------|
| | Range | Values |
| DC Resistance | | |
| DC Resistance | | ≤ 25 ohm |
| Isolation resistance tip/ring | | > 5 Mohm |
| Voice –band characteristic | | |
| Insertion loss | 1004Hz | < 1.5 dB |
| Attenuation distortion(relative to 1004Hz) | $200\text{Hz} < f < 3.4\text{KHz}$ | < 3.5 dB |
| Delay distortion | $200\text{Hz} < f < 4\text{KHz}$ | 150u sec |
| Return loss | $300\text{Hz} < f < 2000\text{Hz}$ | ≥ 15 dB |
| | $2000\text{Hz} < f < 3.4\text{KHz}$ | ≥ 12 dB |
| | $3.4\text{KHz} < f < 10\text{KHz}$ | ≥ 8 dB |
| Longitudinal conversion loss LCL | 600Hz to 3.4KHz | ≥ 45 dB |
| ADSL modem interface | | |
| Isolation voltage | | > 2000 Vrms for 1 minute |
| ADSL band characteristic | | |
| Stop band attenuation | 30KHz | > 18 dB |
| | $100\text{KHz} < f < 300\text{KHz}$ | > 30 dB |
| | $300\text{KHz} < f < 1104\text{KHz}$ | > 40 dB |

4.3. 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 :



4.4. DC characteristic:

All requirement of this specification can be met in the presence of all POTS loop currents from 0mA to 120mA. This in line filter can pass POTS tip-to-ring dc voltages of 0V to 105V and ringing signals of 40 V to 150 Vrms at any frequency from 15.3Hz to 68Hz with a dc component in the range from 0V to 105V. 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 for one splitter. 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 esistance should exceed 10MΩ.

4.5. Test method:

4.5.1. Insertion loss:

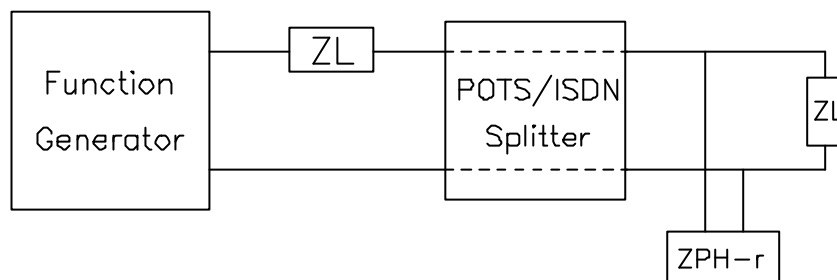
The insertion loss of a device connected into a given transmission system is defined as the ratio, expressed in dB, of the load power available (before and after insertion) delivered to the output network beyond the point of insertion at a given frequency. In general, the insertion loss of a device inserted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

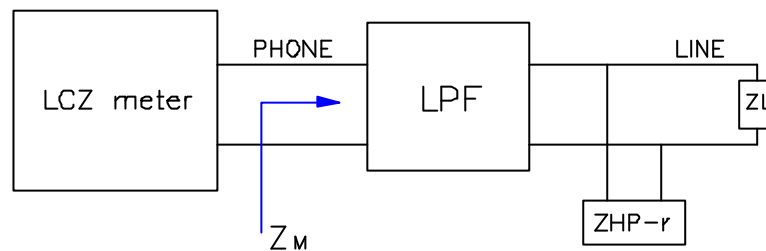


4.5.2. Return loss:

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:

$$\text{Return loss} = 20 \log \left| \frac{Z_L + Z_M}{Z_L - Z_M} \right| \text{dB}$$

Where Z_L = the reference impedance
 Z_M = the measured impedance



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 °C)
Short time operation guarantee temperature (0 to 50 °C)
(According to ETS 300 019, class 3.2)

5.2.2. Storage and transport:

Low ambient temperature - 20 °C
High ambient temperature +85 °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 :

