File No	RDPS-MF054	
Revision	R0	
System Application	Asymmetric Digital Subscriber Line	
Product Type	POTS Splitter	
Product Name	MF600SWE	
Date	Sep. 23th, 2002	
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Table of contents

1. Introduction:

The MF600SWE 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 MF600SWE 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 K20   Resistibility of telecommunication switching

                             Equipment to overvoltages and overcurrents

Ref. 4 :   ITU-T K21   Resistibility of subscribers terminal to overvoltage and
                             overcurrents

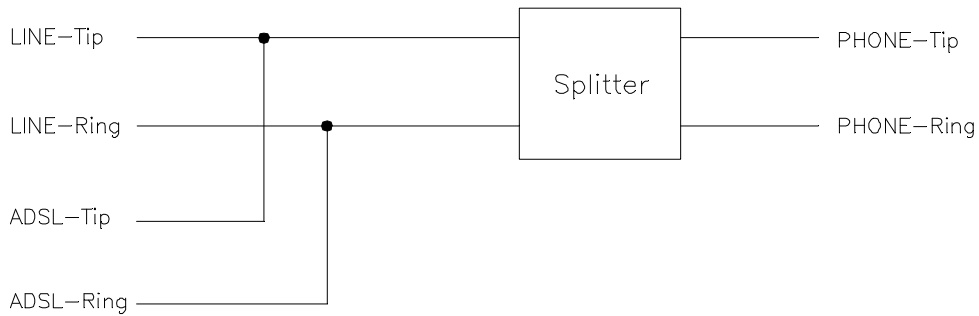## 3. Abbreviations:

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 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 :
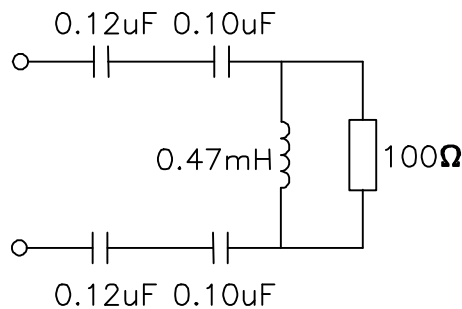
4.3. Electrical specification :

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 parameter	Electrical requirements	
	Range	values
Frequency range		
Splitter bandwidth		DC to 3.4KHz
Nominal voice band		0.3KHz to 3.4KHz
Billing tone		12KHz±80Hz
Ringing frequency		15.3Hz to 68Hz
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
Max. differential		320V
Current voice band		
Loop current		<=30mA
DC Resistance		
DC Resistance		<=50 ohm
Isolation resistance tip/ring		>5 Mohm
Voice –band characteristic		
Insertion loss	1004Hz	<1.0 dB
Attenuation distortion(relative to 1004Hz)	200Hz<f<4KHz	<±1.0 dB

Splitter parameter	Electrical requirements	
	Range	values
Delay distortion	300Hz<f<600Hz	<250 usec
	600Hz<f<3200Hz	<200 usec
	3200Hz<f<4000Hz	<250 usec
Return loss from POTS Port	300Hz<f<3400Hz	>=14 dB
	3400Hz<f<4KHz	>=12 dB
from line Port	300Hz<f<3400Hz	>=14 dB
	3400Hz<f<4KHz	>=12 dB
Longitudinal conversion loss LCL	30KHz to 1MHz	>50 dB
	1MHz to 5MHz	>30 dB
ADSL modem interface		
Isolation voltage		>2000Vrms for 1 minute
ADSL band characteristic		
ADSL Insertion loss	26-1100KHz	<0.3 dB
Stop band attenuation	32KHz<f<1104KHz	>45 dB

4.4. DC characteristic :

All requirement of this specification can be met in the presence of all POTS loop currents from 0mA to 30mA. This filter can pass POTS tip-to-ring dc voltages of 45 to 52V and ringing signals of 100Vrms at any frequency from15.3Hz to 68Hz with a dc component in the range from 45 to 52V. The dc resistance from tip-to-ring at the line port interface with the phone interface shorted, shall be less than or equal to 50 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 resistance should exceed 20MΩ.

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. :
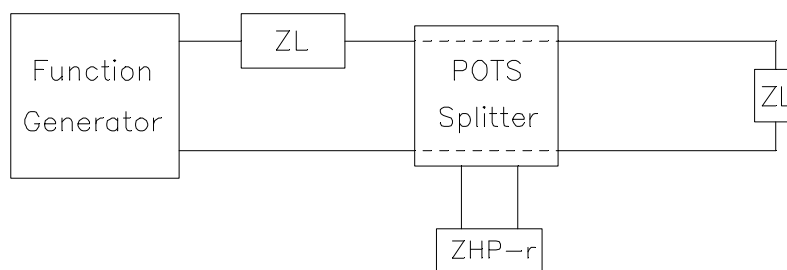
4.5.2. Return loss :

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:

Return loss = $20 \log \left| Z_L + Z_M / Z_L - Z_M \right|$ dB

Where Z_L = the reference impedance Z_M = the measured impedance

The test setup is shown in drawing below:
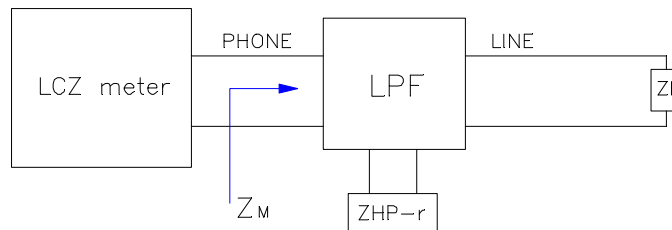
5. Environmental condition:

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 $^\circ$C to +85 $^\circ$C for 5 cycles

(According to MIL-STD-202 , method 107)
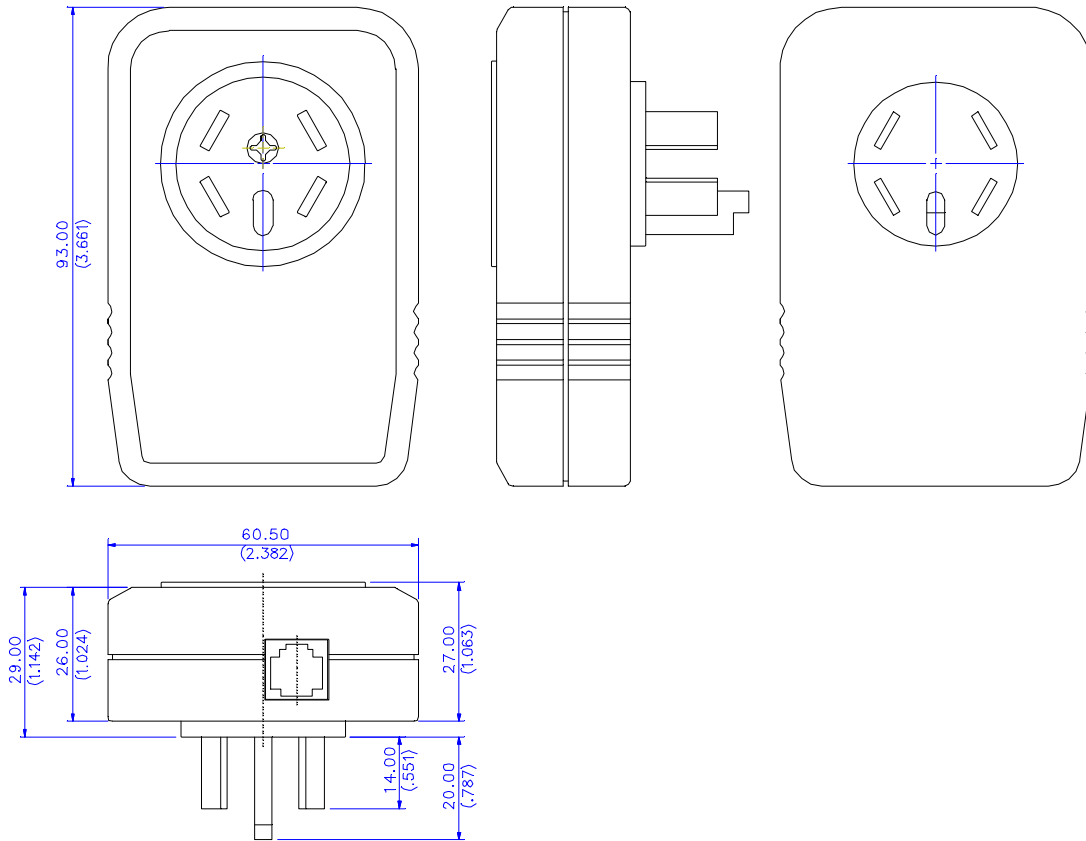
6.2. Temperature humidity exposure :
+50 $^\circ$C /95RH , 96hrs

(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 :
Unit : mm