File No	RDPS-MF033	
Revision	R1	
System Application	Mirco Filter For ADSL CPE Side	
Product Type	Micro filter	
Product Name	MF602F	
Date	Mar . 04th, 2002	
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1.Introduction:

The in-Line Micro filter has been specifically designed to implement the functionality of low pass filter in G.Lite system.G.Lite technology is similar to full rate ADSL in using DMT technology but operates at a lower data rate of up to 1.5Mbps downstream and 512Kbps upstream ,depending on line conditions and lengths.ADSL Lite is proposed as a lower speed version of ADSL that will eliminate the need for telecom to install and maintain a premises based POTS splitter. It was found necessary to include one or more low pass filters in series with the POTS terminals in order to reliably achieve maximum data rates. For POTS voice band service , the low pass filter provide protection from ADSL signal which may impact through non-line or other effects remote devices(handset, fax, voice band modem etc)and central office operation . For ADSL signal , it also provide protection from the high frequency transient and impedance effect that occur during POTS operation(ringing transients , on-hook, off-hook transient and so on).

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 :   ANSI T1E1.4 G.992.2   Network and Customer Installation Interface
Ref. 3 :   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 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 and with three added parallel filters.

Splitter parameter	Electrical requirements	
	Range	values
Frequency range		
Splitter bandwith		DC to 4KHz
Nominal voice band		0.3KHz to 3.4KHz
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
Ringing signal		40Vrms to 150Vrms(113Vpp to 424 Vpp)
DC voltage		0V to -60V ANSI 6.98
Max. AC voltage		150Vrms with -105VDC offset
Max. differential		320V
Current voice band		
Loop current		<100mA
Transient current(on/off hook)		<150mA
DC Resistance		
DC Resistance		<=25 ohm
Isolation resistance tip/ring		>5 Mohm
Voice –band characteristic		

Splitter parameter	Electrical requirements	
	Range	values
Insertion loss single filter	1004Hz	<1.0dB
Attenuation relative to 1004Hz	300Hz<f<4KHz	<±1.0 dB
Insertion loss with five filters	1004Hz	<2.0dB
Attenuation relative to 1004Hz	300Hz<f<4KHz	<4.6 dB
Delay distortion	200Hz<f<4KHz	<100 usec
Return loss single filter	200 Hz <f<500Hz	>=14.0dB
	500Hz<f<2KHz	>=18.0dB
	2KHz<f<3.4KHz	>=14.0dB
Return loss with five filters	200Hz<f<500Hz	>=14.0dB
	500Hz<f<2KHz	>=8.0dB
	2KHz<f<3.4KHz	>=6.0dB
Isolation voltage		>2000Vrms for 1 minute
ADSL band characteristic		
Stop band attenuation	25KHz<f<50KHz	>15 dB
	50KHz<f<1MHz	>25 dB
Longitudinal conversion loss LCL	200Hz<f<1KHz	>58 dB
	1KHz<f<3.4KHz	>53 dB

4.3 : DC characteristic :

All requirement of this specification can be met in the presence of all POTS loop currents from 0mA to 100mA. This in line filter can pass POTS tip-to-ring dc voltages of 0V to 105V and ringing signals of 40V to 150Vrms at any frequency from15.3Hz 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 15 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 to5 Megohms. The ground point shall be local building or green wire ground. As an objective , the DC resistance should exceed 10MΩ.

4.4 : Test method :
4.4.1 : 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 is defined as the ratio, expressed in dB of the power delivered to a load with the circuit in place and the power delivered to a load without the circuit in place.The added insertion loss shall be measured using the test up in figure 3. For measuring POTS band insertion loss for single filter module also a single filter wit four added parallel load filters.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. :
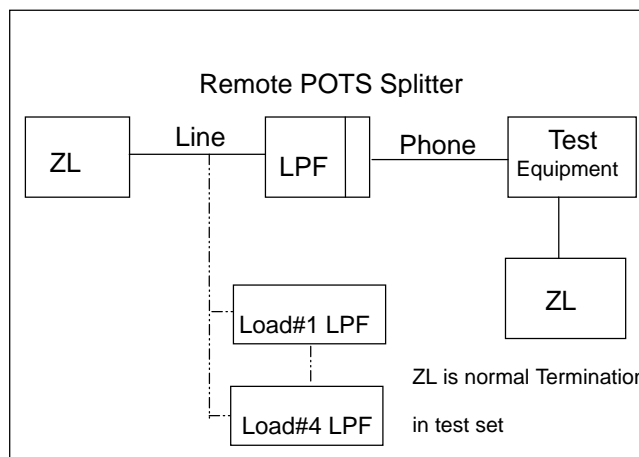
4.4.2 : Return loss :

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:
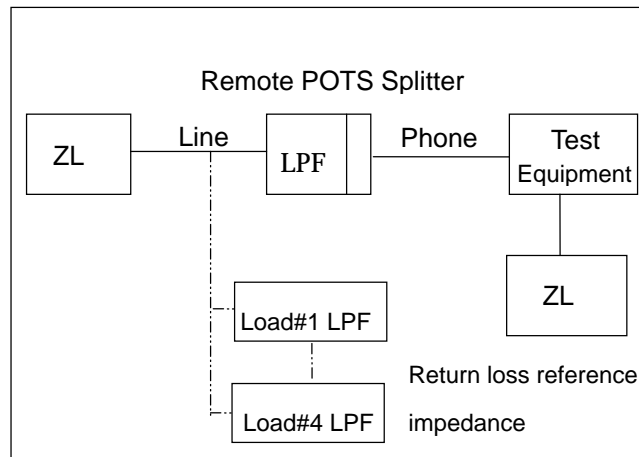
5. Environmental condition:

5.1. EMC , surge and power- contact:

The splitter has to comply with EMC Requirements as per ITU-T K21, so the following requirements must be taken into consideration:

No.	Test item	Test specification	Number of tests
1	Lightning surge simulation	1500V , 10/700μs ,200ms	10
2	Power induction	600V, 1s	5
3	Power contact	230V , 15 minutes	1

5.2. Climatic condition:

5.2.1. Operating temperature:

Application   indoor
Low ambient temperature   -5^{0}C
High ambient temperature   +45^{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 ETS 300 019, transport: class 2.3, storage: class 1.2)

6. Reliability condition:

6.1. Operation:

Test	Test specification
Vibration sinusoidal	IEC 68 Part 2-6 10 to 58Hz 0,075mm 58 to 500Hz $10m/S^2$, 1octaver/minute 3 axis; every 10 cycles
Shock(half sine)	IEC 68 Part 2-27 $\leq$100kg $100m/S^2$ 11ms 6 directions; every 3 shocks

6.2. Handling:

Test	Test specification
Freefall	IEC 68 Part 2-32 Stand alone:<10kg 75mm Built in:2x ground area

6.3. Storage and transport:

Test	Test specification
Vibration(random)	IEC 68 Part 2-64
Bump	IEC 68 Part 2-29
Freefall	IEC 68 Part 2-32 <10kg 800mm Twice at any possible Transport position on concrete floor

6.4. Product safety:

Test	Test specification
Electrical hazard	EN 60950 (A4), ($\equiv$VDE 0805)
Mechanical hazard	EN 60950 (A4), ($\equiv$VDE 0805)
Fire hazard	EN 60950 (A4), ($\equiv$VDE 0805)

7. Mechanical condition:

7.1. Mechanical :
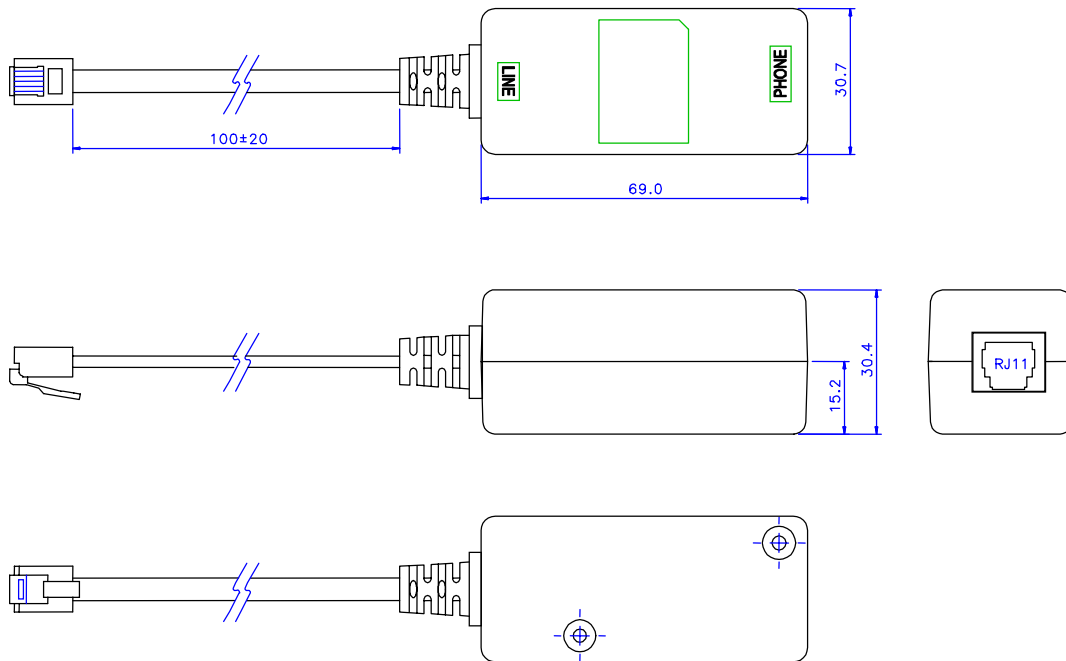
Unless otherwise specified , all tolerance are mm±0.25

7.2. Connector in formation :

Function	Style	Tip	Ring
Line	RJ 11 Plug	Pin 3	Pin 4
Phone	RJ 11 Jack	Pin 3	Pin 4