

File No	RDPS-MF060	
Revision	R0	
System Application	High Speed Digital Services	
Product Type	Dual In-Line filter	
Product Name	MF623A	
Date	Oct. 16 <sup>th</sup> , 2002	
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Issued Date	Oct. 16 <sup>th</sup> , 2002	



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## 1. Introduction:

The Dual In-Line 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 1.5 Mbps downstream and 512 kbps 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 premise based POTS splitter. Recent field trials of ADSL Lite equipment jointly carried out by a group of manufacturers and a North America network operator has proved the technology, achieving maximum data rate for distance up to 15000 feet, 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. The Dual In-Line filter for phones or telephone equipment sharing a two-line phone jack. The low pass filters provide protection from ADSL signal which may impact through non-linear or other effects remote devices ( telephone sets, facsimile machine, answering machine, voice band modem, etc. ) individually or in groups on both line 1 and line 2. It also provides a second Jack that is unfiltered for connecting ADSL and / or HPN. For ADSL signal, it also provides protection from the high frequency transients and impedance effects that occur during POTS operation ( ringing transients, on / off hook transients and so on ). This Dual In-Line filter provides one filtered jack for any single or two-line phone devices.

Because the Dual In-Line filter 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 the Dual In-Line filter to protect against line overstress which could damage the Dual In-Line filter itself. The electrical and transmission specifications are designed electronically to isolate the high speed DSL and HPN data streams from the voice band Plain Ordinary Telephone Service ( POTS ). This design effectively blocks the ADSL, HPN and other radio frequencies up to 10 MHz.

## 2. Compatibility:

- \* This Dual In-Line filter complies with 47 CFR 68 302 ( b ), ( c ), UL 1950, CSA C22.2 No. 950-95, GR 1089-Core, ITU-T K.21 etc. electrical safety requirements for network telecommunication equipment.
- \* This Dual In-Line filter complies with all necessary requirements applicable to voice band equipment for FCC CFR 47 part 68 registrations.
- \* This Dual In-Line filter is compatible with central office POTS line metallic test equipment for voice band testing.
- \* This Dual In-Line filter meets all requirements in this product specification regardless of the Tip-to-Ring polarity.
- \* This Dual In-Line filter allows transmission of caller ID information to a connected POTS device when the connected device is in the On-hook or Off-hook state.
- \* This Dual In-Line filter allows transmission of voice and voice band data, including cordless telephone sets, V.90 modems and facsimile machines in the Off-hook state.

## 3. References:

Ref. 1 :	<b>ETS 300 001</b>	Attachments to the Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to analogue subscriber interface in the PSTN.
Ref. 2 :	<b>ANSI T1.413</b>	Network and Customer Installation Interfaces - Asymmetric Digital Subscriber Line (ADSL) Metallic Interface
Ref. 3 :	<b>ITU-T G.992.1</b>	Asymmetrical Digital Subscriber Line (ADSL) Transceiver
Ref. 4 :	<b>ITU-T G.992.2</b>	Splitterless Asymmetric Digital Subscriber Line ( ADSL ) Transceivers
Ref. 5 :	<b>T1E1.4/2001-007R3</b>	In-Line Filter Standard
Ref. 6 :	<b>ITU-T K.21</b>	Resistibility of Telecommunication Equipment Installed in Customer Premises to Overvoltages and Overcurrents
Ref. 7 :	<b>ITU-T K.44</b>	Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents - Basic Recommendation
Ref. 8 :	<b>47 CFR Part 68</b>	Connection of terminal equipment to the telephone network, Federal Communications Commission, code of Federal regulations
Ref. 9 :	<b>UL 1950</b>	Underwriters Laboratories, the Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment
Ref. 10 :	<b>GR 1089-Core</b>	Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment

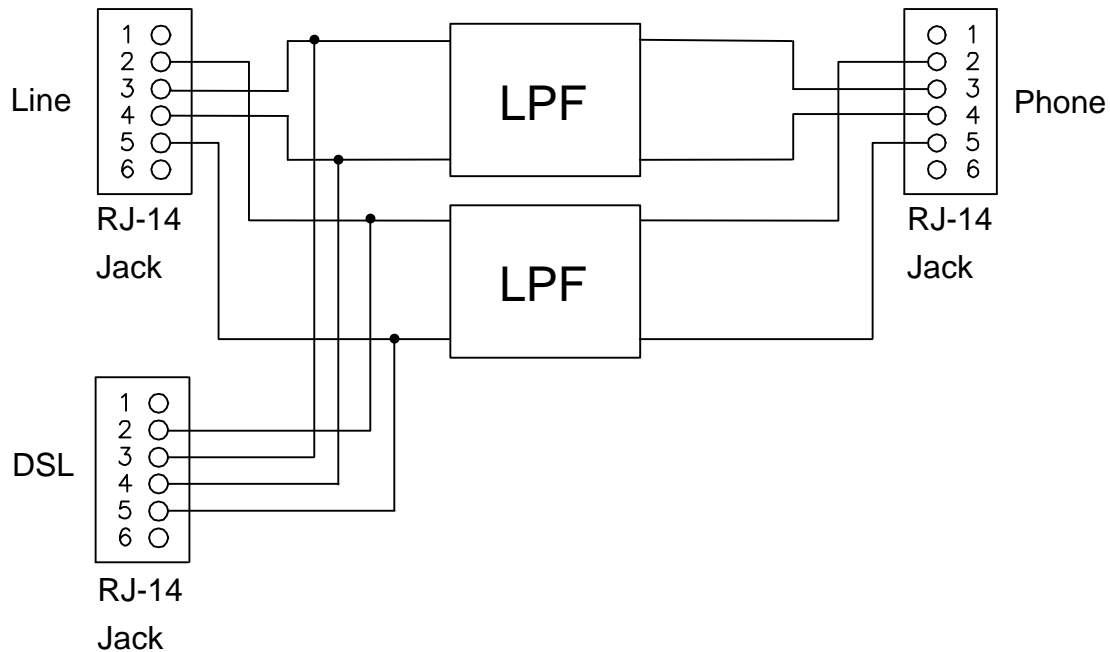
#### 4. Abbreviations:

ADSL	Asymmetric Digital Subscriber Line
CO	Central Office
CPE	Customer Premise Equipment.
POTS	Plain Old Telephone Service
ATU-C	ADSL Transceiver Unit - Central
ATU-R	ADSL Transceiver Unit - Remote

#### 5. Technical requirements:

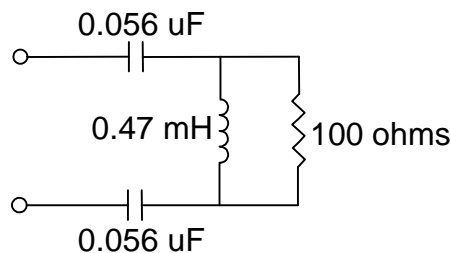
##### 5.1. Schematic:

The following drawing illustrates the schematic of this product.



##### 5.2. ZHP-r definition:

To facilitate testing of the In-Line Filter independently of the actual modem or specific vendor, ZHP-r is defined to allow proper termination of the Line port during voice band testing. The ZHP-r is valid only for voice band frequency. The combination of capacitors in the ZHP-r is only representative. The input shall be 27nF however derived. ZHP-r equivalent circuit is shown below.



**5.3. Electrical Specification:**

The low pass filter shall satisfy the following parametric limits with the voice terminals  $Z_L=600$  ohms and complex impedance **ZNL-r** shown in this table.

Splitter parameters	Electrical requirements	
	Range	Values
Splitter bandwidth		DC to 10 kHz
Nominal voice band		0.3 kHz to 3.4 kHz
Ringing frequency		15.3 Hz to 68 Hz
ADSL band		30 kHz to 1104 kHz
Line Impedance $Z_L$	200 Hz to 4 kHz	600 ohms
Modem impedance	25 kHz to 1104 kHz	100 ohms
<b>Operation voltage voice band</b>		
Nominal signal		21 mVpp to 5.4 Vpp
Ringing signal		40 Vrms to 150 Vrms ( 113 Vpp to 424 Vpp )
DC voltage		0 V to 105 V
Max. AC voltage		150 Vrms with -105 VDC offset
Max. differential		320 V
<b>Operation current voice band</b>		
Loop current		< 100 mA
<b>DC resistance</b>		
DC resistance	Tip to Tip / Ring to Ring	< 12 ohms
Isolation resistance	Tip to Ring	> 10 Mohms
<b>Differential input blocking impedance</b>		
Line side	20 kHz	> 2 kohms
	30 kHz	> 3 kohms
	5 MHz to 10 MHz	> 2 kohms
	10 MHz to 400 MHz	N / A
<b>Voice band characteristics</b>		
Insertion loss between 600 ohms resistive single filter	1004 Hz	< 0.3 dB
With 5 filters	1004 Hz	< 0.5 dB

Splitter parameters	Electrical requirements	
	Range	Values
Attenuation distortion between 600 ohms resistive single filter ( relative to 1004 Hz )	200 Hz to 3.4 kHz	< 0.5 dB
	3.4 kHz to 4 kHz	< 0.75 dB
With 5 filters	200 Hz to 3.4 kHz	< 2.5 dB
	3.4 kHz to 4 kHz	< 4 dB
600 ohms Return loss single filter	SRL-L	> 30 dB
	ERL	> 20 dB
	SRL-H	> 17 dB
With 5 filters	SRL-L	> 20 dB
	ERL	> 13 dB
	SRL-H	> 7 dB
Complex* <b>ZNL-r</b> Return loss single filter	SRL-L	> 25 dB
	ERL	> 15 dB
	SRL-H	> 7 dB
With 5 filters	SRL-L	> 15 dB
	ERL	> 7 dB
	SRL-H	> 1.5 dB
*1330 ohms in parallel with the series connection of a 348 ohms resistor and a 100 nF capacitor		
Longitudinal conversion loss ( LCL )	200 Hz to 1 kHz	> 58 dB
	1 kHz to 3 kHz	> 53 dB
Delay distortion	200 Hz to 4 kHz	< 100 $\mu$ s
Harmonic distortion	2nd	> 65 dB
	3rd	> 65 dB
Inter-Modulation distortion	2nd	> 60 dB
	3rd	> 65 dB
<b>ADSL band characteristics</b>		
Common mode rejection	40 kHz	> 45 dB
	1.1 MHz	> 45 dB
ADSL band attenuation	30 kHz	> 26 dB
	1 MHz	> 65 dB

## 6. Environmental conditions:

### 6.1. Resistibility to overvoltages and overcurrents:

The Dual In-Line filter has to comply with requirements as per ITU-T K.21, 47 CFR 68 302 ( b ), ( c ), UL 1950, CSA C22.2 No. 950-95, GR 1089-Core etc. electrical safety requirements for network telecommunication equipment.

### 6.2. Climatic conditions:

#### 6.2.1. Operating temperature:

Operation guarantee temperature ( -40 °C to +85 °C )

#### 6.2.2. Storage and transportation:

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

( According to MIL-STD-202 method 107 )

#### 6.2.3. 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

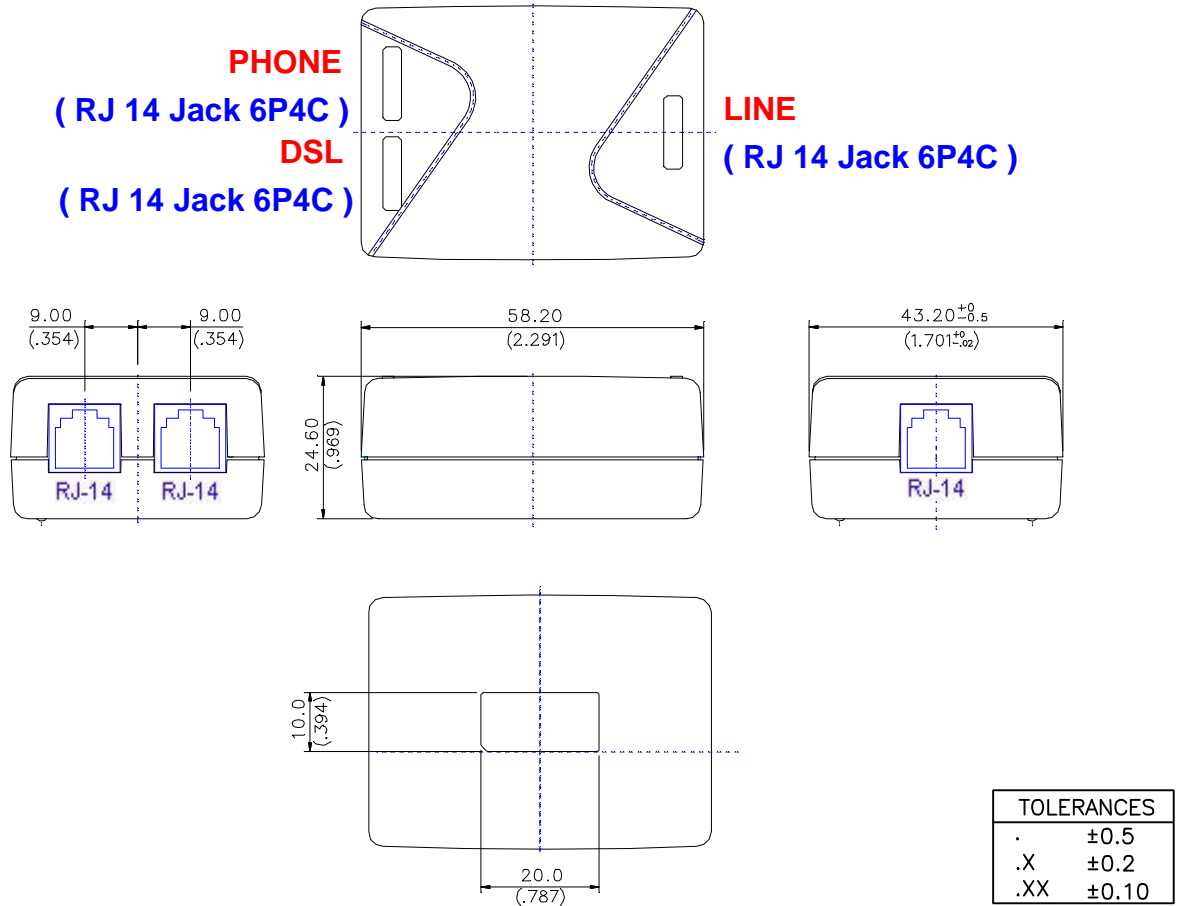


**7. Reliability conditions:**

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.	No cracking, broken, marking color changing and lose marking after washing.	2	4
		Reference:QC-0-12&QC-0-22			
2	Electrical Characteristic	According to clause 5.3 Electrical Specification, pp. 6-7.	No electrical failure.	2	4
		Reference: QC-0-16			
3	Thermal Shock	-20 °C →+85 °C, 5 cycles ( 25 , 50, 100 cycles for D.V.T )	No electrical failure.	1	2
		Reference: MIL-STD-202 method 107 / QC-0-20			
4	Temperature Humidity Exposure	+50 °C / 95 RH, 96 hrs. ( 168, 500 hrs. for D.V.T. )	No electrical failure.	1	2
		Reference: MIL-STD-202 method 103 / QC-0-11			
5	Vibration Test	Random vibration / Overall : 1.15 g rms Freq. ( Hz ) : 1 → 4 → 100 → 200 PSD ( g <sup>2</sup> /Hz ) : 0.0001 → 0.01 → 0.01 → 0.001 Test Axis / Time : Top / 30 mins Bottom / 10 mins X axis : 10 mins Y axis : 10 mins	No electrical failure & mechanical faults.	1 box	1 box
		Reference: ISTA PROJECT 2A / QC-0-21			

## 8. Mechanical conditions:

### 8.1. Outline dimension:



Note:

1. Connect the Line side of the Dual In-Line filter to the wall jack, the phone side of the Dual In-Line filter to the telephone sets and the DSL side of the Dual In-Line filter to the ADSL modem.
2. Incorrect connection will significantly affect the performance and operation.
3. Unless otherwise specified, all tolerances are mm ( inch ) ± 0.25 ( 0.010 ).
4. Unit: mm

### 8.2. Pin assignment:

Position	Type	Tip	Ring
Line 1	RJ 14 Jack	Pin 3	Pin 4
Phone 1	RJ 14 Jack	Pin 3	Pin 4
DSL 1	RJ 14 Jack	Pin 3	Pin 4
Line 2	RJ 14 Jack	Pin 2	Pin 5
Phone 2	RJ 14 Jack	Pin 2	Pin 5
DSL 2	RJ 14 Jack	Pin 2	Pin 5