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Revision History

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1. Introduction:

The CPPF0001 is a splitter module that has been designed to implement the functionality of low pass filter in POTS over ADSL application. The electrical specifications are based on ETSI TS 101 952-1-1 v1.1.1 and customer requirements.

Asymmetric Digital Subscriber Line (ADSL) technology is dedicated, point to point, public network access technology that allows 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 filter. The POTS splitter on the customer premises side consists of a low pass section.

The CPPF0001 integrates low pass filter that blocks the high frequency energy from reaching the POTS device and provide isolation from impedance effects of the POTS device on ADSL. In addition, this 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/off hook transfer). Because the POTS splitter connects to the subscriber loop media directly, 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. References:

[1] ETSI 300 019: "Environmental conditions and environmental tests for Telecommunications equipment".
[2] ETSI TR 101 728: "Access and Terminals (AT); Study for the specification of low pass filter section of POTS/ADSL splitters".
[3] ETSI TS 101 952: "Access network xDSL transmission filters; Part1: ADSL splitters for European deployment; Sub-part1: Specification of the low pass part of ADSL/POTS splitters".
[4] ITU-T K21: "Resistibility of Telecommunication Equipment Installed in Customer Premises to Overvoltages and Overcurrents".

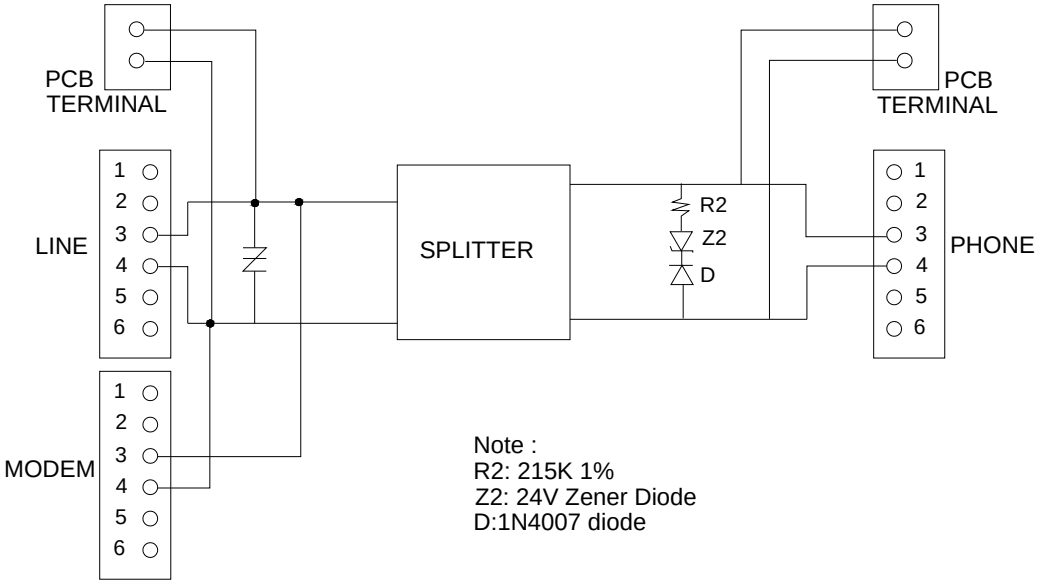
3. Abbreviations:

ADSL	Asymmetric Digital Subscriber Line
ATU-R	ADSL Transmission Unit at Remote side
CO	Central Office
CPE	Customer Premise Equipment
POTS	Plain Old Telephone Service
RT	Remote Terminal

4. Technical requirements:

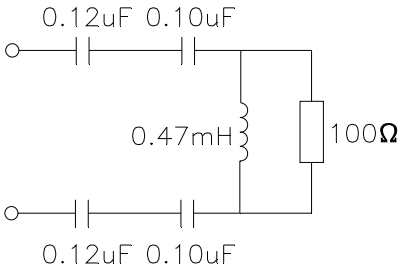
4.1. Schematic:

The following drawing illustrates the schematic of this product.



4.2. Z_{ADSL} definition:

To facilitate the test of the splitter, the high frequency signal has to be taken into consideration. Capacitors of 0.1 uF on the RT-side are connected in series with 0.12 uF capacitors in the tip and ring line of the ADSL output of the splitter itself (see block diagram above). The equivalent ATU-R circuit diagram of the RT-side is shown below.



4.3. Electrical Specification:

The low pass filter shall satisfy the following parametric requirements with corresponding impedances shown in this table across terminals of this device. The following requirements are specified for a single splitter.

Splitter parameter		Electrical requirements	
		Range	**Values**
Impedance and Frequency range			
Splitter bandwidth			DC to 3.4 kHz
Nominal voice band			0.3 kHz to 3.4 kHz
Ringing frequency			25 Hz to 50 Hz
ADSL band			30 kHz to 2208 kHz
Impedance at voice band	Z_R		270 Ω + (750 Ω ‖ 150 nF)
	Z_{SL}		82 Ω + (600 Ω ‖ 68 nF)
Impedance at ADSL band Z_{RHF}			120 Ω + (150 Ω ‖ 47 nF) + (750 Ω ‖ 150 nF)
On hook impedance Z_{ON}			10 kΩ
Modem impedance		30 kHz< f<2208 kHz	100 Ω
Operation voltage at voice band			
Nominal signal			21 mV_{P-P} to 5.4 V_{P-P}
Billing tone			3.53 V_{rms}
Ringing signal			100 V_{rms}
DC voltage			45 V to 52 V
Max. AC voltage			150 V_{rms} with –105 V_{DC} offset
Current at voice band			
Off hook loop current			13 mA~80 mA
On hook loop current			0.4 mA~2.5 mA
Voice band characteristics			
DC resistance to earth		With 100 V_{DC}	>=20 MΩ
Insulation resistance tip/ring		With 100 V_{DC}	>=5 MΩ
DC series resistance			<=50 Ω
On hook insertion loss for high impedance		200 Hz<f<2.8 kHz	-4 dB~+4 dB
On hook for low impedance	Insertion loss	1 kHz	<1.0 dB
	Distortion	200 Hz<f<2.8 kHz	<±1.0 dB

Splitter parameter		Electrical requirements		
		Range	Values	
Off hook for Z_R and 600 Ω	Insertion loss	1 kHz	<1.0 dB	
	Distortion	200 Hz<f<4 kHz	<±1.0 dB	
Off hook return loss of Z_R		300 Hz<f<3.4 kHz	>=12 dB	With and without ATU-R
		3.4 kHz<f<4 kHz	>=8 dB	
Off hook return loss of Z_{SL}		300 Hz<f<3.4 kHz	>=12 dB	With and without ATU-R
		3.4 kHz<f<4 kHz	>=8 dB	
Metering pulse		12 kHz	3 dB~5 dB max.	
Longitudinal conversion loss LCL		50 Hz<f<600 Hz	>=40 dB	R=300 Ω
		600 Hz<f<3.4 kHz	>=46 dB	
		3.4 kHz<f<4 kHz	>=40 dB	
		4 kHz<f<30 kHz	>=40 dB	R=50 Ω
		30 kHz<f<2208 kHz	>=45 dB	
		2208 kHz<f<5 MHz	>=30 dB	
On-hook isolation		25 kHz	>=36 dBV	With –6 dBV emf
		2208 kHz	>=51 dBv	
Off-hook isolation		32 kHz<f<2208 kHz	>=55 dB	With and without ATU-R
Intermodulation distortion		2^{nd} harmonic	>=57 dB	
		3^{rd} harmonic	>=60 dB	
Group delay distortion		200 Hz<f<600 Hz	250 μs	
		600 Hz<f<3.2 kHz	200 μs	
		3.2 kHz<f<4 kHz	250 μs	
Transient effect		Peak of main lobe in frequency domain		<=15 kHz
		Voltage in time domain		<=2 V_{p-p}

5. Environmental conditions:

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

Operation guarantee temperature -20 ^{0}C to +65 ^{0}C

5.2.2. Storage and transportation:

Low ambient temperature - 40 ^{0}C

High ambient temperature +85 ^{0}C

(According to MIL-STD-202 method 107)

5.2.3. Operation humidity:

Operation guarantee relative humidity 0 to 95% (non-condensing)

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 / Overall: 1.15 g rms

Freq. (Hz): 1 → 4 → 100 → 200

PSD (g^2 / Hz): 0.0001 → 0.01 → 0.01 → 0.001

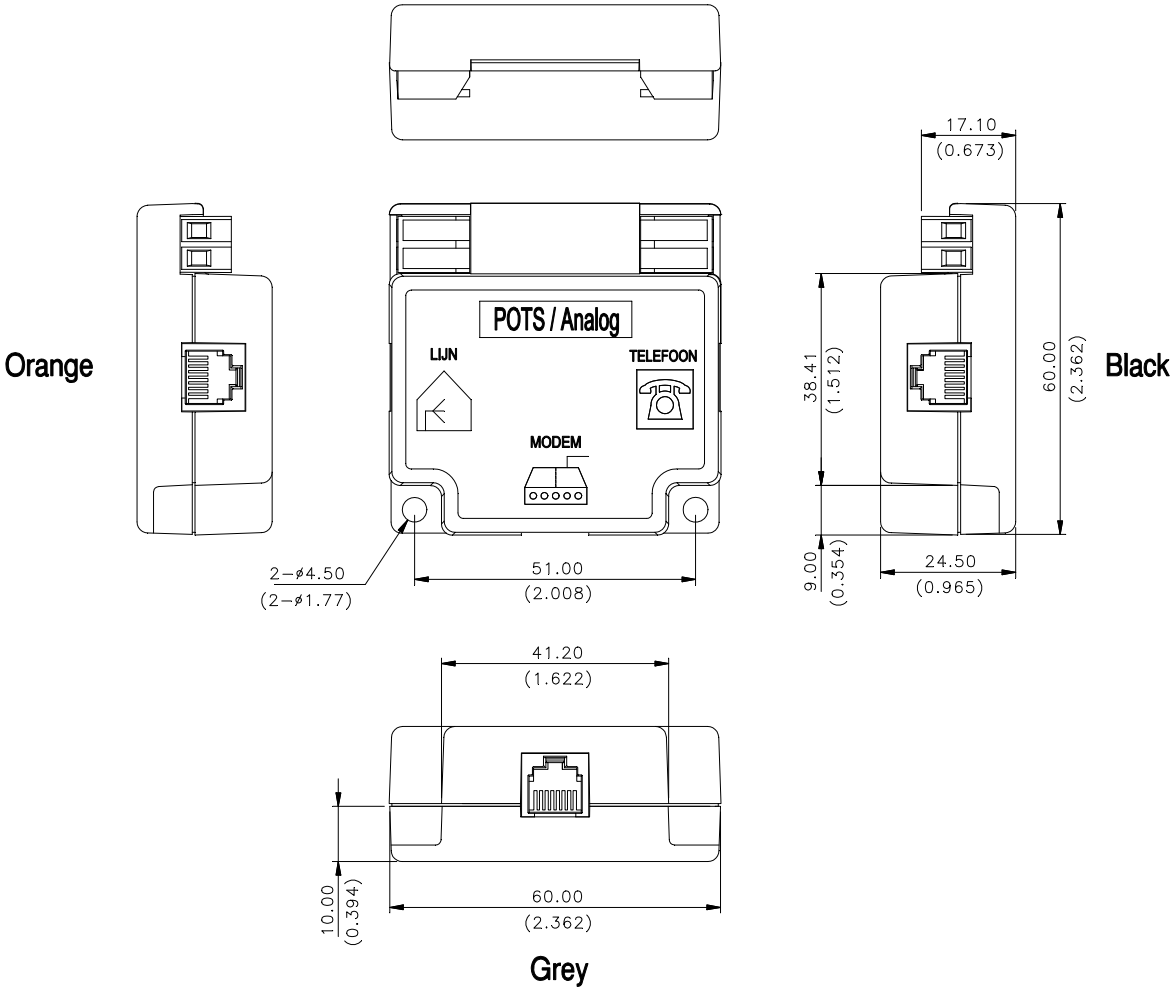
Test Axis / Time: Top / 30 mins Bottom / 10 mins

X axis / 10 mins Y axis / 10 mins

(According to ISTA PROJECT 2A)

7. Mechanical conditions:

7.1. Dimensions:



Notes:

1. Unless otherwise specified, all tolerances are mm (inch) ± 0.25 (0.010).
2. Unit: mm (inch)