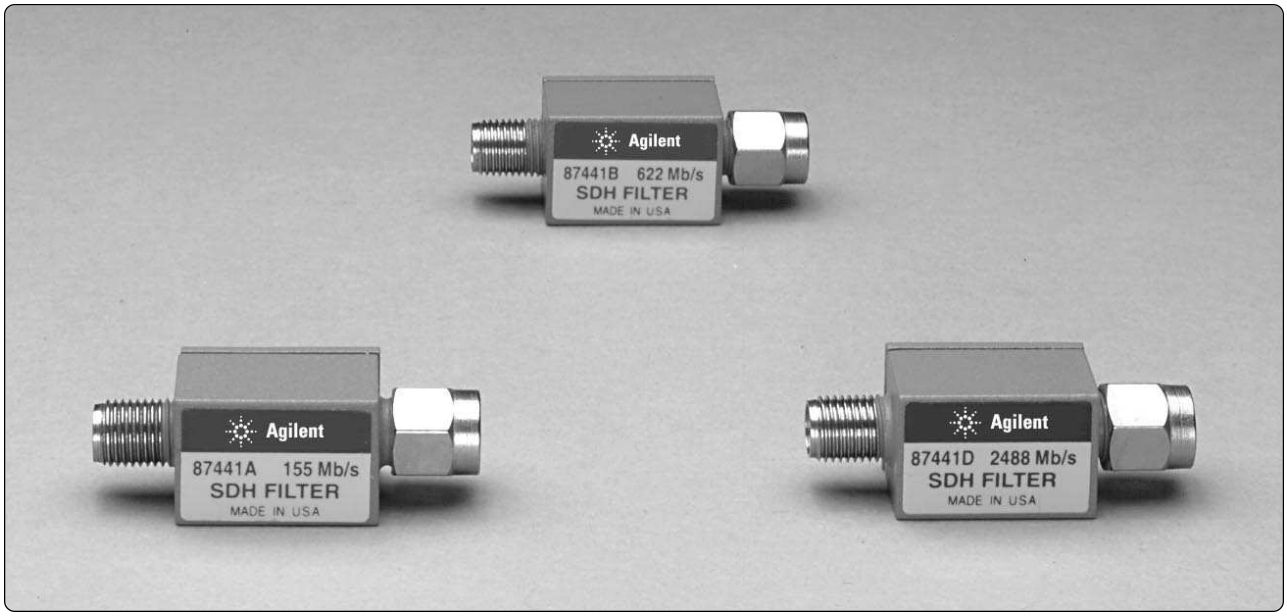
Agilent 87441 Family of Filters

Product Overview

87441S OC-1
87441A STM-1/OC-3
87441B STM-4/OC-12
87441C OC-24
87441D STM-16/OC-48

87441J Fibre Channel 133 MBaud
87441K Fibre Channel 266 MBaud
87441L Fibre Channel 531 MBaud
87441M Fibre Channel 1063 MBaud



The Agilent 87441 family of filters is designed for use with broadband optical/electrical converters used in transmitter eye-pattern conformance testing. The filters are measured to comply with Synchronous Digital Hierarchy (SDH), Synchronous Optical Network (SONET) and Fibre Channel standards. The Agilent 87441 family is fourth-order, Bessel-Thomson, low-pass filters that have –3 dB cutoff frequencies at 0.75 x the data rate of the SDH, SONET, and Fibre Channel rates being used. Each filter is supplied with measured performance data that meets the ITU-TS G.957 standard for frequency response.

Key Features

- Fourth-order Bessel-Thomson response per G.957 and ANSI Fibre Channel ITU-TS
- Easily inserts between optical/electrical conversions and oscilloscopes
- Each filter supplies measured frequency-response data

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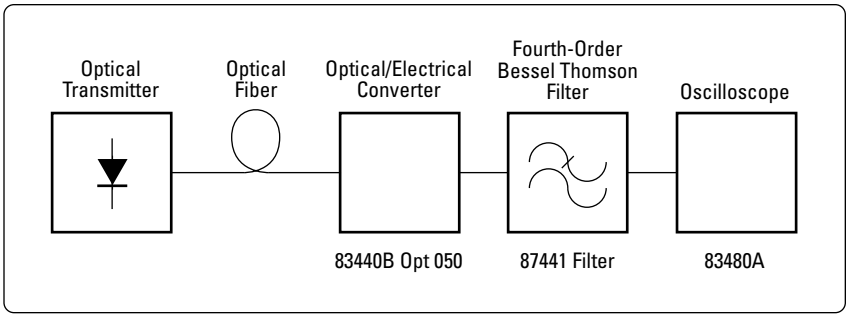
An objective of SDH and SONET is to achieve a multi vender environment within a single optical link. To help achieve this, ITU-TS (International Telegraph and Telephone Consultative Committee) G.957 provides specifications for optical equipment interfaces including transmitter eye-pattern tests for SDH. Similarly, the EIA/TIA OFSTP-4 (Electronics Industry Association/Telecommunications Industry Association Fiber Standard Test Procedure) defines the optical eye-pattern measurement procedure for SONET. Figure 1 shows the recommended measurement set-up for eye-pattern measurements.

When combined with a dc-coupled optical/electrical converter of sufficient bandwidth, the low-pass filter provides the required fourth-order Bessel-Thomson response (Table 1). This filter

- helps the eye-pattern measurement simulate the response of an optical communication system's receiver for a given bit rate,
- eliminates high frequency components that may obscure the actual pattern of interest,
- and helps achieve reproducible measurement results between different measurement setups.

Figure 1. Eye-pattern measurement block diagram



The transfer function characteristics of the Agilent 87441 filter family are designed and specified for operation in a 50-ohm system. They are constructed with discrete, reactive components contained in an extremely compact housing (Figure 2). The filters have a SMA-male connector and a SMA-female connector for easy insertion between the output of a broadband, dc-coupled, optical/electrical converter and the input of the oscilloscope. Frequency response interactions between the receiver and filter together with variations due to SWR between the receiver, filter, any cables or adapters, and the oscilloscope input impedance can cause deviation from the ideal frequency response called for in the SDH/SONET and Fibre Channel standards.

Table 1. Filter electrical characteristics

Filter	–3 dBe Frequency	Bit Rate
87441A	116.64 MHz	155 Mb/s
87441B	466.56 MHz	622 Mb/s
87441C	933 MHz	1244 Mb/s
87441S	37.5 MHz	51 Mb/s

f(0) = Receiver bit-rate
f(r) = 0.75 f(0), 3-dB cutoff frequency

f/f(0)	f/f(r)	Attenuation (dB)	Attenuation Accuracy (dB)
0.15	0.2	0.1	±0.3
0.3	0.4	0.4	±0.3
0.45	0.6	1.0	±0.3
0.6	0.8	1.9	±0.3
0.75	1.0	3.0	±0.3
0.9	1.2	4.5	±0.75
1.0	1.33	5.7	±1.01
1.05	1.4	6.4	±1.13
1.2	1.6	8.5	±1.45
1.35	1.8	10.9	±1.74
1.5	2.0	13.4	±2.00
2.0	2.67	21.5	N/A

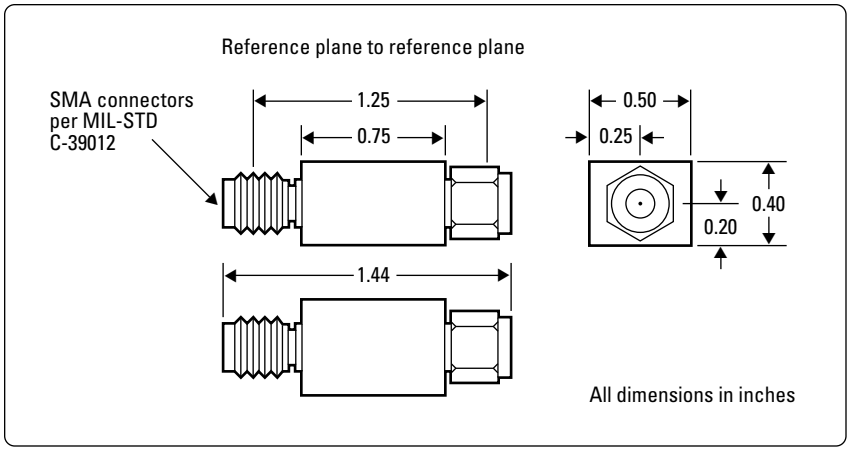


Figure 2. Filter outline drawing

Table 2. Filter electrical characteristics

Filter	–3 dBe Frequency	Bit Rate
87441D	1866.24 MHz	2.488 Gb/s
87441J	99.61 MHz	133 Mb/s
87441K	199.22 MHz	266 Mb/s
87441L	398.44 MHz	531 Mb/s
87441M	796.88 MHz	1063 Mb/s

f/f(0)	f/f(r)	Attenuation (dB)	Attenuation Accuracy (dB)
0.15	0.2	0.1	±0.5
0.3	0.4	0.4	±0.5
0.45	0.6	1.0	±0.5
0.6	0.8	1.9	±0.5
0.75	1.0	3.0	±0.5
0.9	1.2	4.5	±1.16
1.0	1.33	5.7	±1.54
1.05	1.4	6.4	±1.71
1.2	1.6	8.5	±2.20
1.35	1.8	10.9	±2.62
1.5	2.0	13.4	±3.00
2.0	2.67	21.5	N/A

f(0) = Transmission
f(r) = 0.75 f(0), 3 dB cutoff frequency

Recommended Optical Receivers

The Agilent 83440B Option 50 is a 6 GHz bandwidth receiver with a very flat frequency response. Option 50 provides the necessary 50 ohm impedance match for use with the Agilent 87441 filter family. This receiver will work well for the entire filter family. The receiver is unamplified and requires an optical signal of at least –3 dBm to produce an acceptable eye diagram.

The Agilent 11982A is an amplified optical/electrical converter with dc to 15 GHz bandwidth. It provides greater sensitivity for measuring a wider range of signals. The 11982A has variation in its frequency response, particularly at frequencies below 100 MHz, due to these variations, the combination of the Agilent 11982A and an 87441 filter will not exactly comply to SDH/SONET and Fibre Channel standards.

The best solution for accurate SDH/SONET and Fibre Channel compliance measurements are the Agilent 83485A/B and 83481A integrated optical receivers for the Agilent 83480A Digital Communications Analyzer.

General Specifications

RF Connectors: SMA (m) and SMA (f) (Input or output)
Operating Temperature:
0 to +55°C
Storage Temperature:
–40 to +70°C
ESD Susceptibility: 10 kV
Weight:
Net: 0.54 (oz.)
Shipping: 9.04 (oz.)

Ordering Information

87441S for OC-1, 51 Mb/s, –3 dB frequency 37.5 MHz
87441A for STM-1/OC-3, 155 Mb/s, –3 dB frequency 116.64 MHz
87441B for STM-4/OC-12, 622 Mb/s, –3 dB frequency 466.46 MHz
87441C for OC-24, 1244 Mb/s, –3 dB frequency 933 MHz
87441D for STM-16/OC-48, 2488 Mb/s, –3 dB frequency 1866.24 MHz
87441J for Fibre Channel 133 Mb/s, –3 dB frequency 99.61 MHz
87441K for Fibre Channel 266 Mb/s, –3 dB frequency 199.22 MHz
87441L for Fibre Channel 531 Mb/s, –3 dB frequency 398.44 MHz
87441M for Fibre Channel 1063 Mb/s, –3 dB frequency 796.88 MHz

Contents

One Agilent 87441 filter with measured frequency response data and data sheet.

Recommended for use with the following Agilent O/E converters.

Agilent 83440B Option 050 dc to 6 GHz optical-to-electrical converter with internal 50 ohm termination for use with the Agilent 87441 filter family. 18 V/W nominal gain. Product overview literature number 5091-5536E.

Agilent 11982A dc to 15 GHz amplified converter. 300 V/W gain. Product overview literature number 5966-1583E.

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