

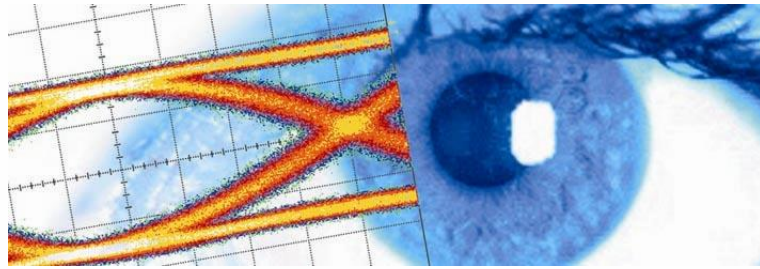


## SHF Communication Technologies AG

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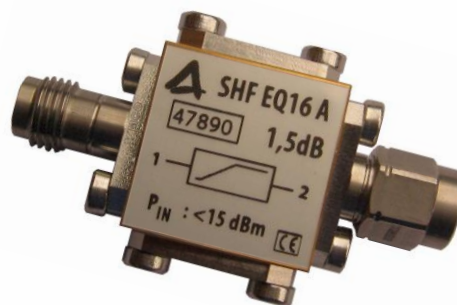
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# Datasheet

## SHF EQ16 A

### Broadband Linear Equalization Filter





## Description

The SHF EQ16 A is a RoHS compliant passive broadband linear equalization filter with a small form factor. It is designed to compensate for linearly increasing insertion loss in the signal transmission path. The Nyquist frequency of the filter has been chosen to be around 16 GHz, covering signal baud rate in the region of 25 to 32 Gbaud. Typical applications include compensation for distortions due to the loss of bandwidth of a DUT, and additional insertion loss due to the inclusion of RF cable(s) in the signal path.

This filter is suitable for both NRZ and PAM4 data formats in the region of 25 to 32 GBaud.

The filter has a DC coupled transmission path. So it can transfer a DC voltage for the DUT. The compensation path to GND is AC coupled. Due to this fact, the compensation operates down to ~ 50 kHz, capable of handling data sequence length of up to  $2^{31}-1$  PRBS.

## Available Configurations

- 1.5 dB<sup>1</sup>
- 3 dB<sup>1</sup>
- 6 dB<sup>1</sup>

## Specifications - SHF EQ16 A

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
<b>Absolute Maximum Ratings</b>						
Maximum RF Input	dBm V	$P_{in\ max}$			15 3.5	peak to peak voltage
DC Voltage at RF Input	V				±12	
DC Voltage at RF Output	V				±12	
DC Current	A				0.5	
Case Temperature	$T_{case}$	°C	10	25	60	
<b>Mechanical Characteristics</b>						
Input Connector						1.85mm (V) female <sup>2</sup>
Output Connector						1.85mm (V) male <sup>2</sup>

<sup>1</sup> Defined as the filter peaking value from low to the Nyquist frequency of 16 GHz.

<sup>2</sup> Other gender configurations are available on request.



## Specifications - SHF EQ16 A Option 1.5 dB

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
<b>Electrical Characteristics</b> (At 25°C case temperature, unless otherwise specified)						
Insertion Loss	dB	$S_{21 \text{ LOW}}$	2.4		2.8	at 1 GHz
Insertion Loss	dB	$S_{21 \text{ PEAK}}$	0.8		1.4	at 16 GHz
Insertion Loss	dB	$S_{21 \text{ HIGH}}$	0.5		1.4	16 ... 32 GHz
Input Reflection	dB	$S_{11}$			-9 -10	40 MHz ... 16 GHz 16 GHz ... 40 GHz
Output Reflection	dB	$S_{22}$			-9 -10	40 MHz ... 16 GHz 16 GHz ... 40 GHz

## Specifications - SHF EQ16 A Option 3 dB

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
<b>Electrical Characteristics</b> (At 25°C case temperature, unless otherwise specified)						
Insertion Loss	dB	$S_{21 \text{ LOW}}$	3.8		4.2	at 1 GHz
Insertion Loss	dB	$S_{21 \text{ PEAK}}$	0.8		1.4	at 16 GHz
Insertion Loss	dB	$S_{21 \text{ HIGH}}$	0.5		1.4	16 ... 32 GHz
Input Reflection	dB	$S_{11}$			-7 -10	40 MHz ... 16 GHz 16 GHz ... 40 GHz
Output Reflection	dB	$S_{22}$			-7 -10	40 MHz ... 16 GHz 16 GHz ... 40 GHz

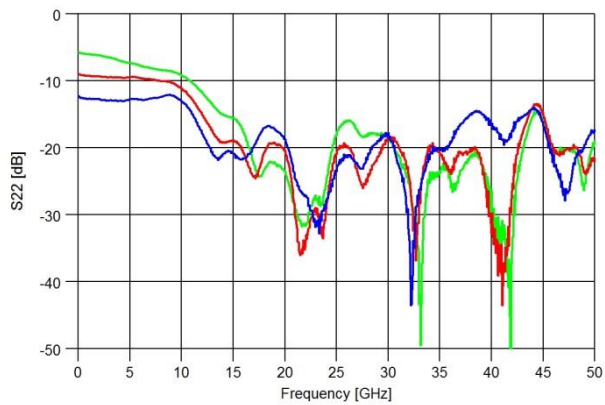
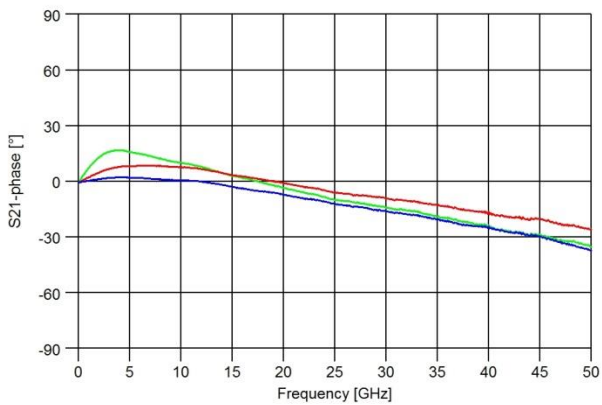
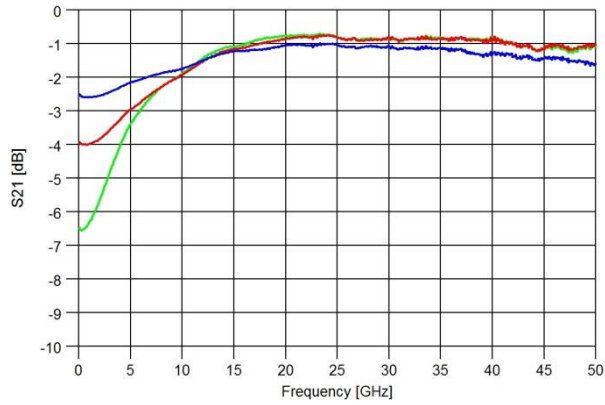
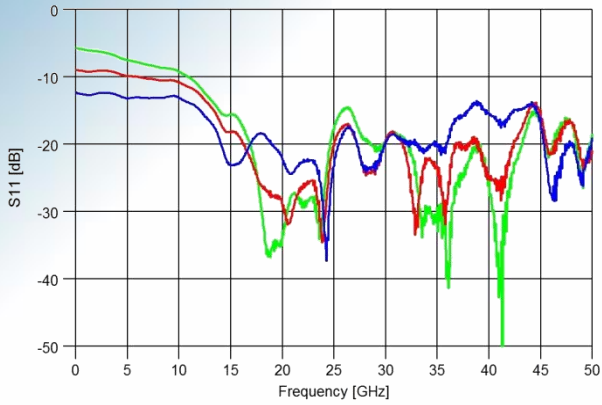
## Specifications - SHF EQ16 A Option 6 dB

Parameter	Unit	Symbol	Min	Typ	Max	Conditions
<b>Electrical Characteristics</b> (At 25°C case temperature, unless otherwise specified)						
Insertion Loss	dB	$S_{21 \text{ LOW}}$	6.0		6.8	at 1 GHz
Insertion Loss	dB	$S_{21 \text{ PEAK}}$	0.8		1.4	at 16 GHz
Insertion Loss	dB	$S_{21 \text{ HIGH}}$	0.5		1.4	16 ... 32 GHz
Input Reflection	dB	$S_{11}$			-4 -10	40 MHz ... 16 GHz 16 GHz ... 40 GHz
Output Reflection	dB	$S_{22}$			-4 -10	40 MHz ... 16 GHz 16 GHz ... 40 GHz



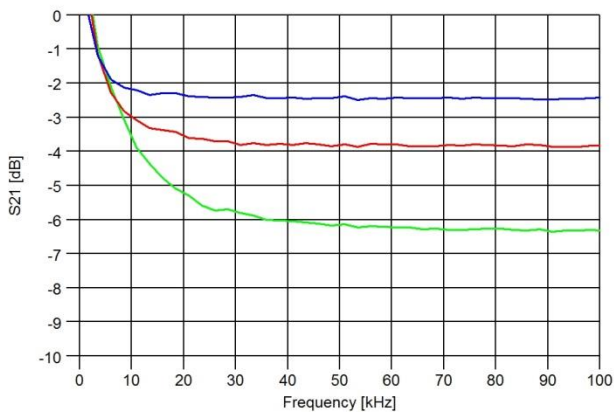
# Typical S-Parameters and Phase Response

blue: EQ16 A-1.5 dB  
red: EQ16 A-3 dB  
green: EQ16 A-6 dB



## Low Frequency Response < 100 kHz

(no DC on Input)

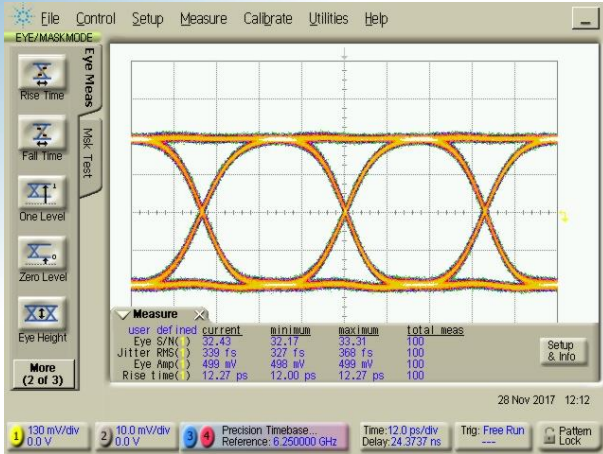




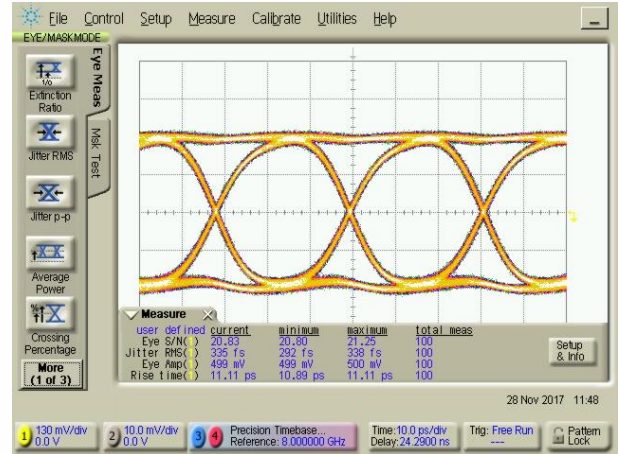
# Binary Eye Diagrams with EQ16 A-1.5 dB

Example to show compensation for ~ 1.5 dB transmission loss at Nyquist frequency. DUT is 1 m Totoku TCF280QR with typical insertion loss of 1.8 dB at 16 GHz.

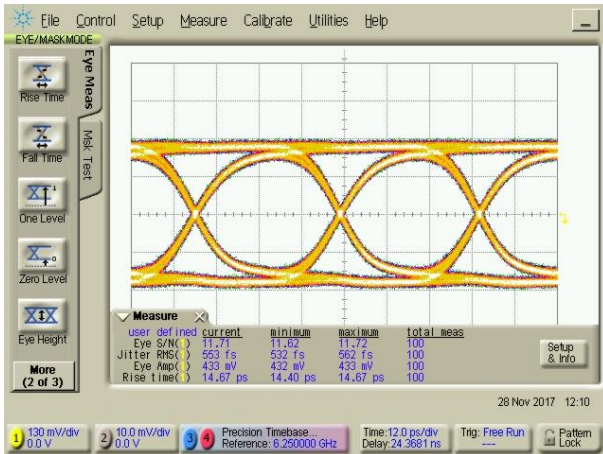
All measurements had been performed using a SHF611 C DAC in binary mode and an Agilent 86100C DCA with Precision Time Base Module (86107A) and 70 GHz Sampling Head (86118A).



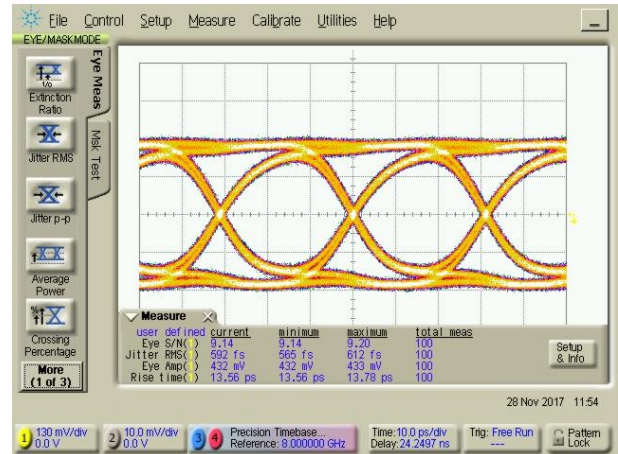
25 Gbps without cable



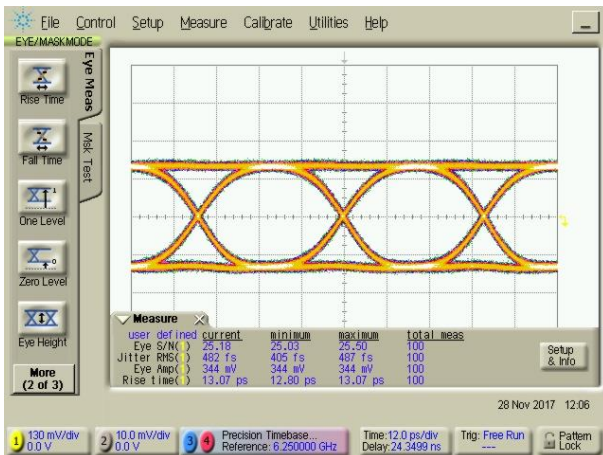
32 Gbps without cable



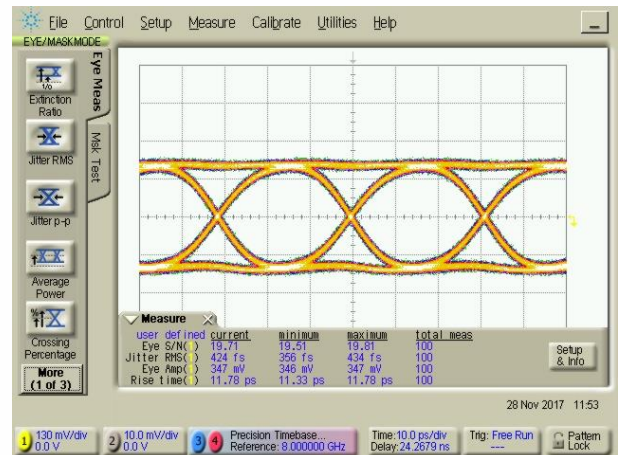
25 Gbps with 1 m TCF280QR



32 Gbps with 1 m TCF280QR



25 Gbps with 1 m TCF280QR and EQ16 A-1.5 dB

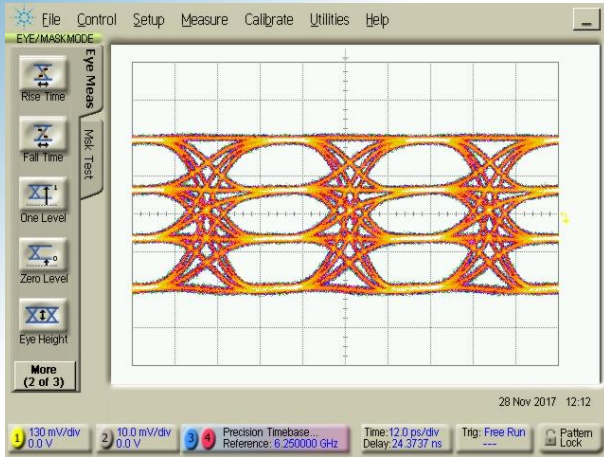


32 Gbps with 1 m TCF280QR and EQ16 A-1.5 dB

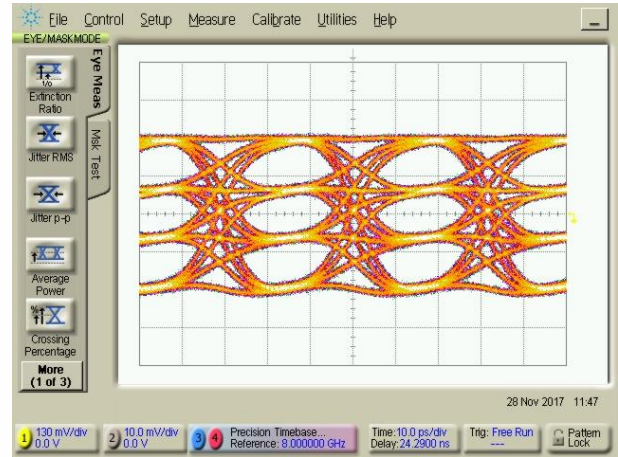


## 4-Level Eye Diagrams with EQ16 A-1.5 dB

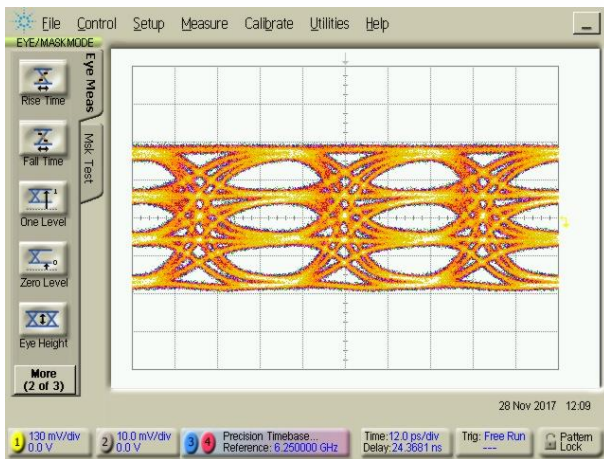
All measurements had been performed using a SHF611 C DAC and an Agilent 86100C DCA with Precision Time Base Module (86107A) and 70 GHz Sampling Head (86118A).



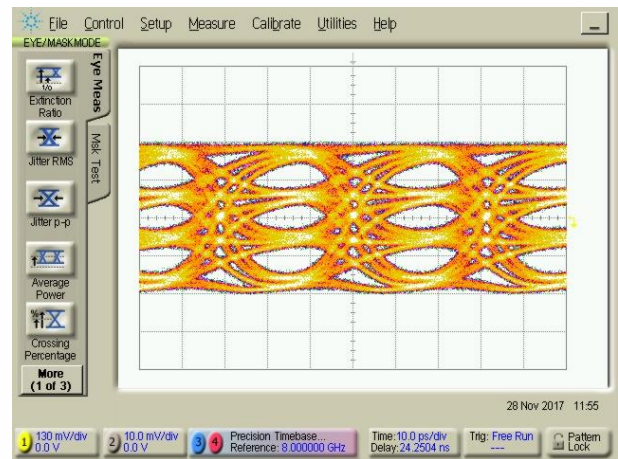
25 GBaud without cable



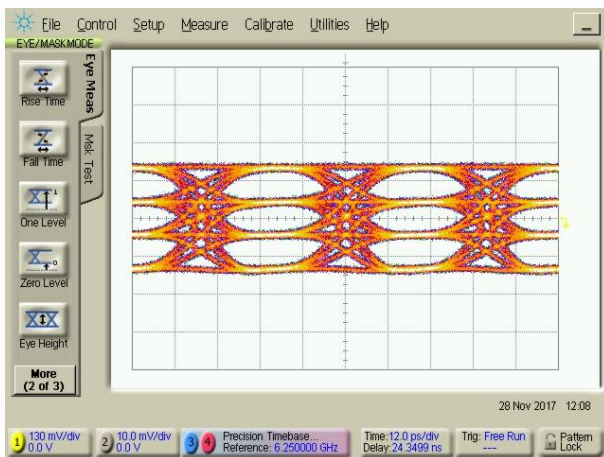
32 GBaud without cable



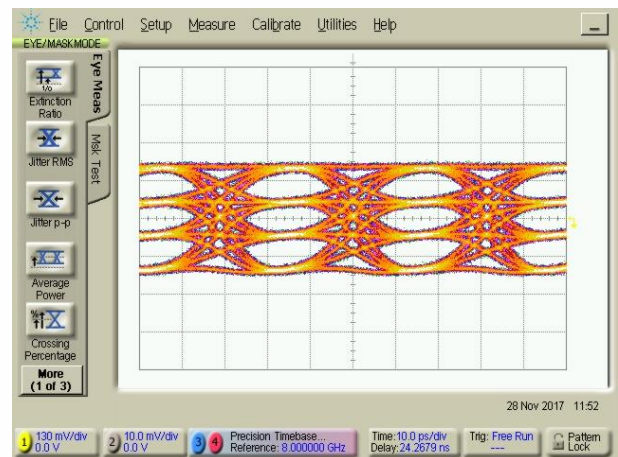
25 GBaud with 1 m Totoku TCF280QR



32 GBaud with 1 m Totoku TCF280QR



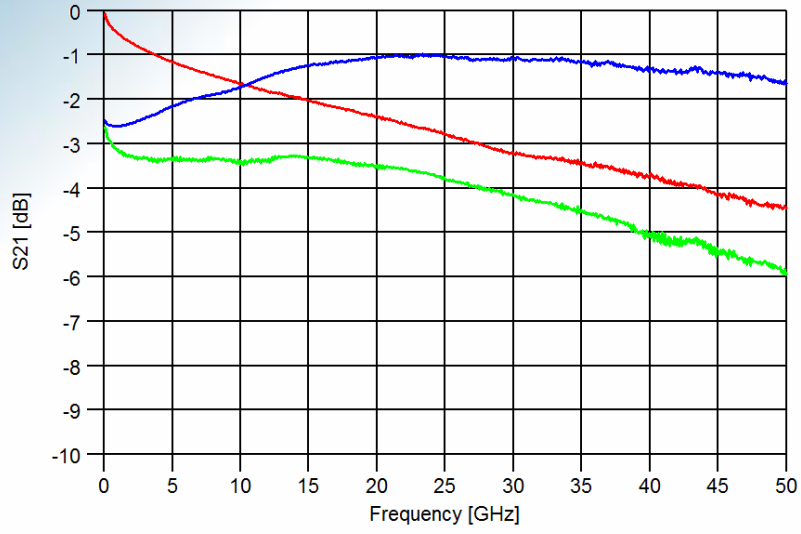
25 GBaud with 1 m TCF280QR and EQ16 A-1.5 dB



32 GBaud with 1 m TCF280QR and EQ16 A-1.5 dB



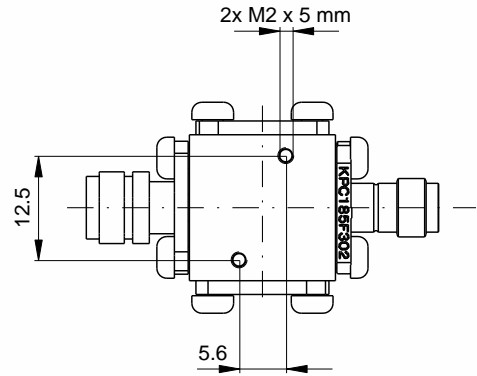
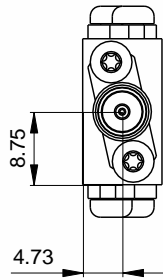
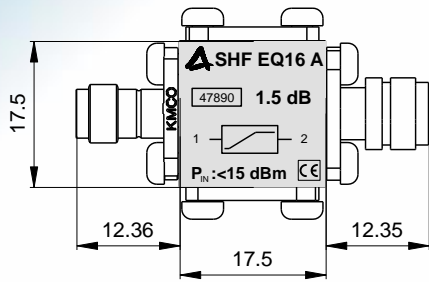
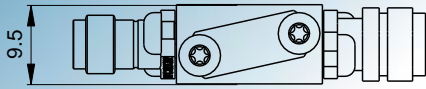
## Frequency Response of 1 m cable and EQ16 A-1.5 dB



blue: EQ16 A-1.5 dB  
red: 1 m cable  
green: 1 m cable and EQ16 A-1.5 dB



## Mechanical Drawing



all dimensions in mm

Input connector: 1.85mm (V) female  
Output connector: 1.85mm (V) male