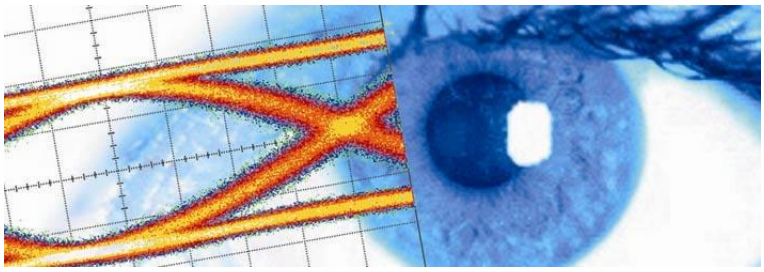
SHF Communication Technologies AG

Wilhelm-von-Siemens-Str. 23D • 12277 Berlin • Germany

Phone +49 30 772051-0 • Fax +49 30 7531078

E-Mail: sales@shf-communication.com • Web: www.shf-communication.com

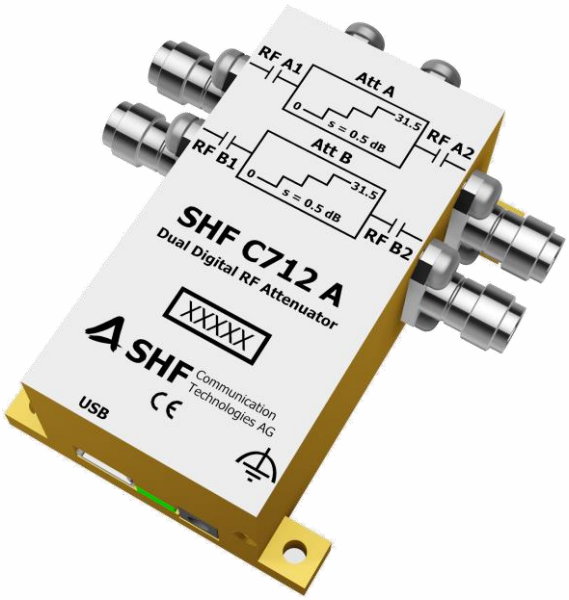


Datasheet

SHF C712 A

40 GHz / 64 Gbps

Dual Digital RF Attenuator



Description

The SHF C712 A is a dual digital broadband RF attenuator, operating from 100 MHz up to 40 GHz for clock signal, and up to 64 Gbps for NRZ Data signal. It offers high quality output signals together with a compact size and ease of operation.

The two attenuators are fully independent RF building blocks, so essentially two attenuators are operated by single software and housed in a single chassis as indicated by the block diagram below. It operates in both directions, i.e. the signal can be applied to or taken from both RF ports (see restrictions of the input power)

The range of the Attenuation is 31.5 dB and can be set with 0.5 dB resolution.

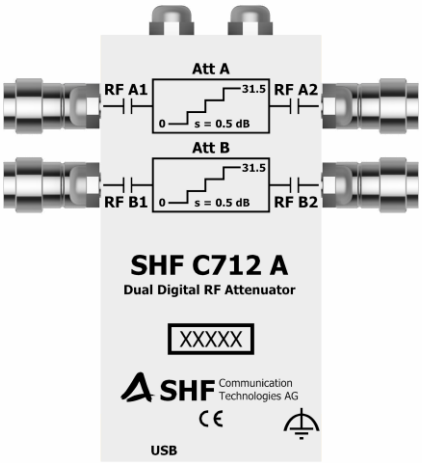
Features

- Broadband operation up to 40 GHz
- Up to 64 Gbps NRZ Data signal
- Attenuation of differential signals
- Bi-directional (see restrictions of the input power)
- Low power consumption
- Single-ended operation
- USB interface
- Simple, easy to use GUI
- Automated measurements by using different software environments easily possible[1]

Applications

- Broadband test and measurement equipment

Block Diagram



[1] To operate the switch, intuitive and well documented plain text commands are sent and received via USB. Thus the device can be operated either by the complementary software or automated by any programming language which can communicate with USB devices.

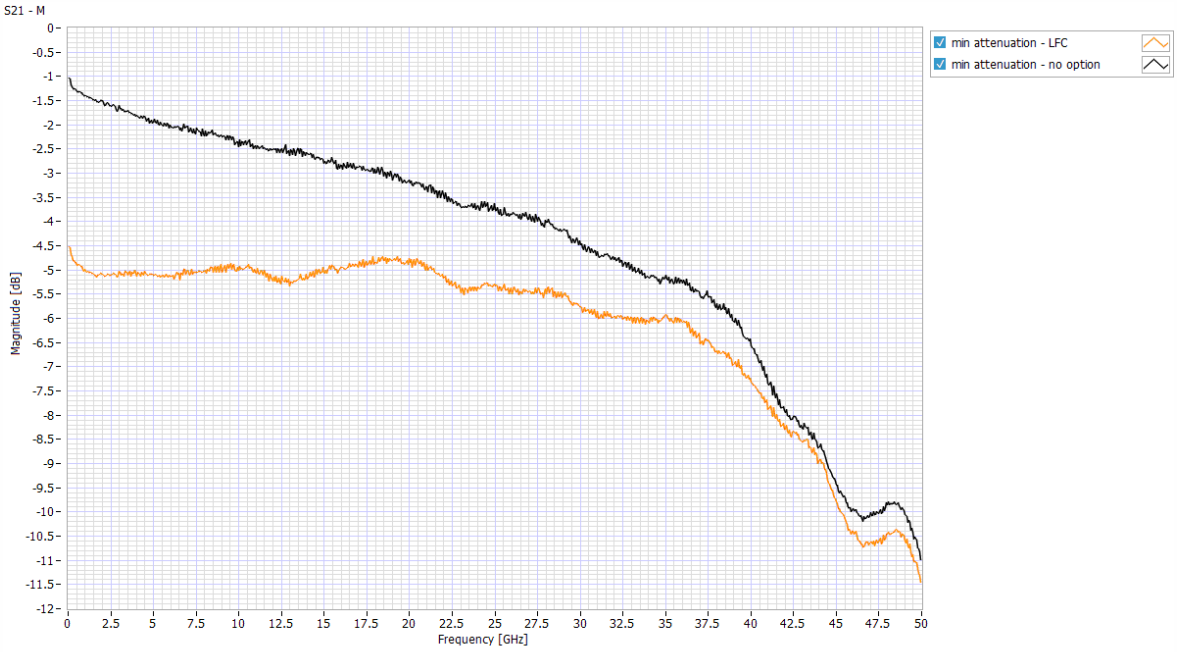
Accessories

- Functional earth cable
- Mini-USB cable

Options

Option – Low Frequency Compensation (LFC)

The Low Frequency Compensation option is offered in order to reduce the frequency response roll-off. Due to a lower loss at the lower frequencies there is a typical role-off of 7 dB between 1 MHz and 40 GHz. The compensation reduces the roll-off to approximately 3 dB over the frequency range, but at the same time increases the insertion loss by roughly 4 dB at the lower frequency range.



Insertion Loss @ min attenuation – option LFC compared to "no option"

Absolute Maximum Ratings

Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Input Parameters						
Input Power RF A1 / B1	dBm	P_{in}			27	
Input Power RF A2 / B2	dBm	P_{in}			18	
External DC Voltage on RF Ports	V	V_{DCext}	-6		+6	AC coupled ports

Specifications – SHF C712 A

Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Performance						
Minimum Input Frequency	MHz	f_{min}			100	Clock Signal
Maximum Input Frequency	GHz	f_{max}	40			Clock Signal
Bandwidth	GHz	f_{3dB} f_{6dB}		26 > 40		Clock Signal
Data Rate	Gbps		64			Data Signal
Attenuation Range	dB			31.5		
Attenuation Resolution	dB				0.5	
Attenuation Accuracy * % of state	dB		±(0.10 + 0.6%*) ±(0.10 + 1.0%*) ±(0.15 + 0.8%*) ±(0.20 + 2.0%*) ±(0.35 + 2.5%*)			100 MHz to 10 GHz 10 GHz to 18 GHz 18 GHz to 26 GHz 26 GHz to 35 GHz 35 GHz to 40 GHz
Insertion Loss @ min att.	dB		1		8	whole frequency range
Insertion Loss @ max att.	dB		32		39	whole frequency range
Return Loss @ min att.	dB		13	20		< 40 GHz, RF A1 / B1
Return Loss @ min att.	dB		11	19		< 40 GHz, RF A2 / B2
Return Loss @ max att.	dB		16	22		< 40 GHz, RF A1 / B1
Return Loss @ max att.	dB		13	20		< 40 GHz, RF A2 / B2

Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Output Parameters						
Jitter RMS	fs	J_{RMS}				See note[2]
Duty Cycle	%	DC				See note[2]
Inter-Channel Skew	ps				TBD	
Power Requirement						
Supply Voltage	V	V_{cc}	+4.40	+5.00	+5.25	Mini USB
Supply Current	mA	I_{cc}		25		
Power Dissipation	mW	P_d		125		@ V_{CC} = +5 V
Mechanical Characteristics						
Attenuator A RF A1	Ω			50		1.85 mm (V) female
Attenuator A RF A2	Ω			50		1.85 mm (V) female
Attenuator B RF B1	Ω			50		1.85 mm (V) female
Attenuator B RF B2	Ω			50		1.85 mm (V) female
Dimensions	mm					See Outline Drawing
Weight	g			90		
Conditions						
Operating Temperature	°C	$T_{ambient}$	15		35	

Specifications – SHF C712 A Option LFC

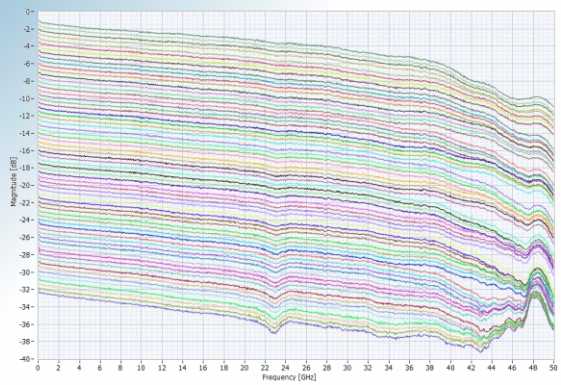
Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Performance						
Bandwidth	GHz	f_{3dB}		> 40		Clock Signal
Insertion Loss @ min att.	dB		5		8	whole frequency range
Insertion Loss @ max att.	dB		36		39	whole frequency range
Return Loss @ min att.	dB		8	13		< 40 GHz, RF A1 / B1
Return Loss @ min att.	dB		10	16		< 40 GHz, RF A2 / B2
Return Loss @ max att.	dB		8	12		< 40 GHz, RF A1 / B1
Return Loss @ max att.	dB		12	20		< 40 GHz, RF A2 / B2

[2] No degradation in jitter or duty cycle performance were observed for sine wave signals with no attenuation settings

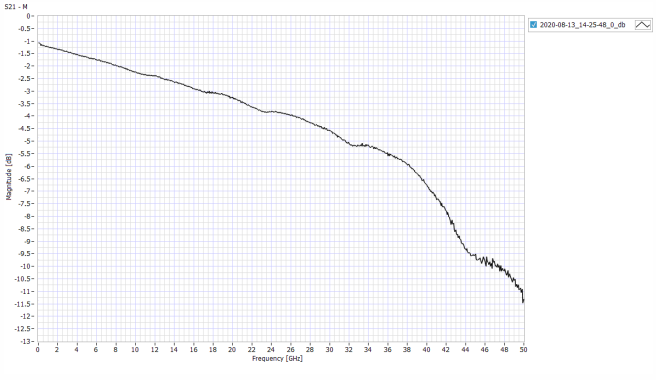
Typical RF Performance @ +25°C

C712 A (no option)

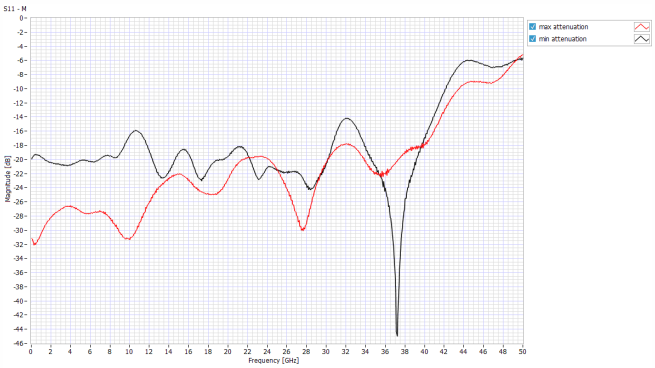
The measurements below had been performed using a VNA.



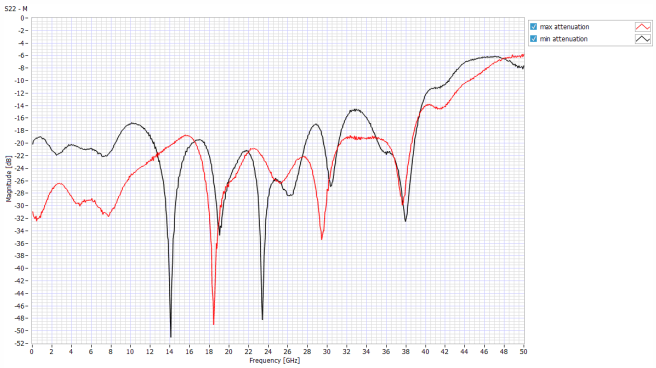
Insertion Loss vs. attenuation



Insertion Loss @ min attenuation



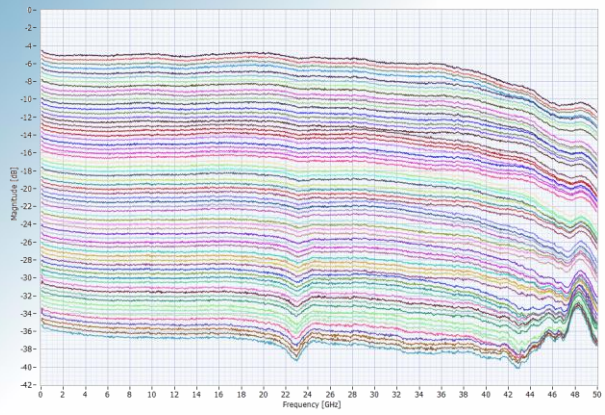
Return Loss (RF A1/B1) @ min / max attenuation



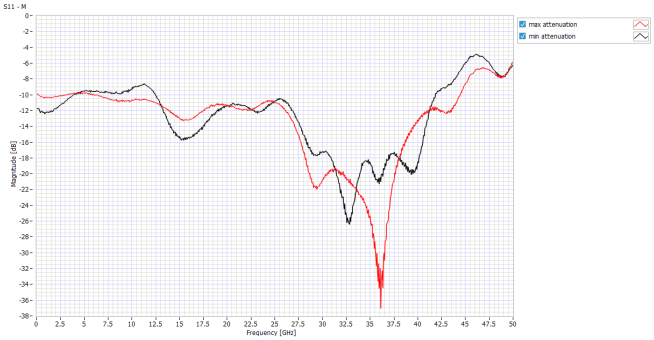
Return Loss (RF A2/B2) @ min / max attenuation

C712 A (option LFC)

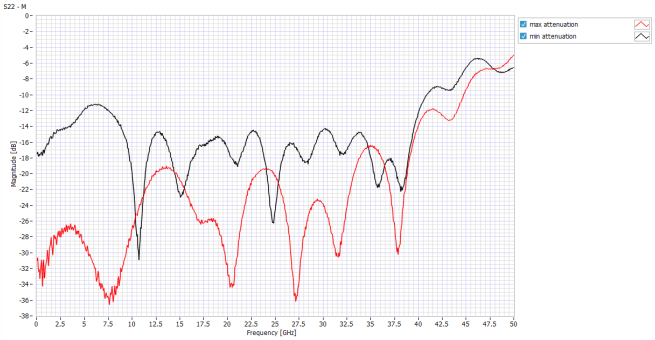
The measurements below had been performed using a VNA.



Insertion Loss vs. attenuation



Return Loss (RF A1/B1) @ min / max attenuation

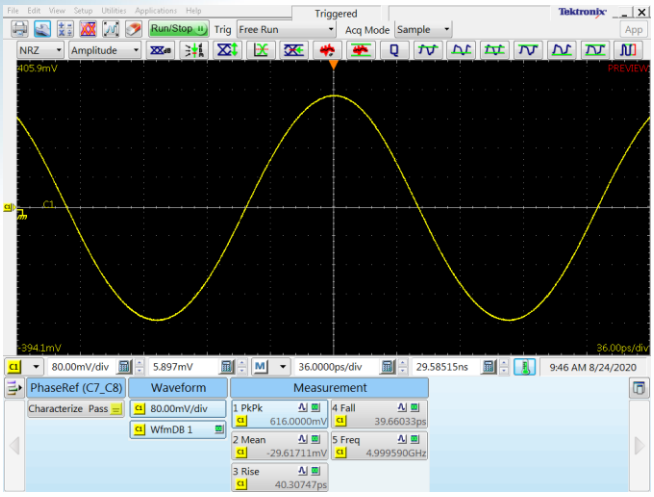


Return Loss (RF A2/B2) @ min / max attenuation

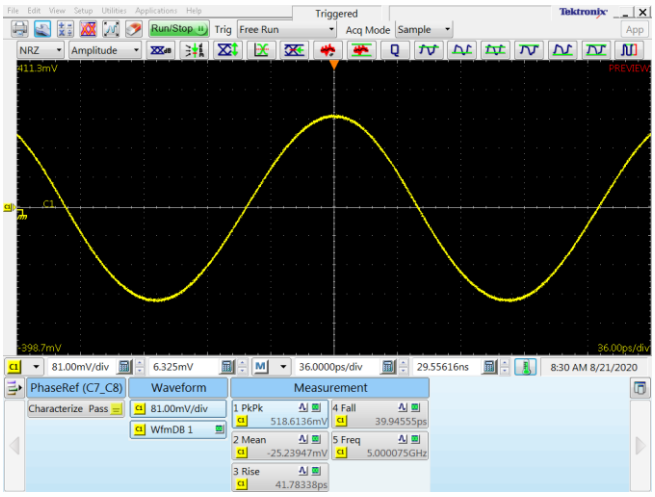
Typical Output Waveforms

Clock Output Signals (no option)

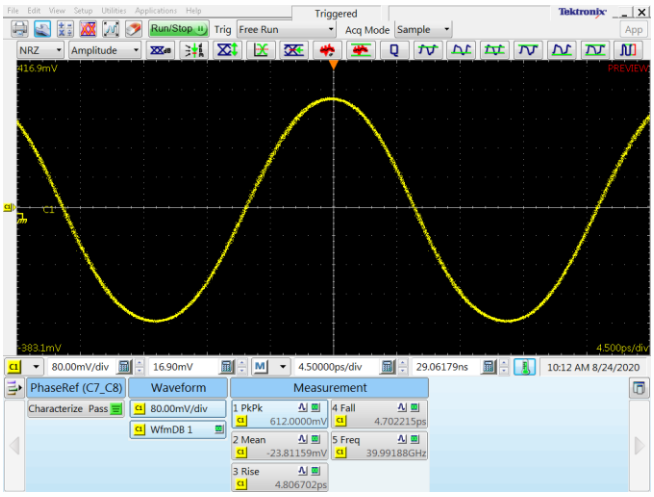
The measurements below had been performed using an Anritsu signal generator (3697C) and a Digital Serial Analyzer (DSA8300) with a Phase Reference Module (82A04B-60G) and a Sampling Module (80X02). The output of the module had been connected directly to the DSA input.
Input power of the clock signal is 0 dBm (630 mV_{pp}).



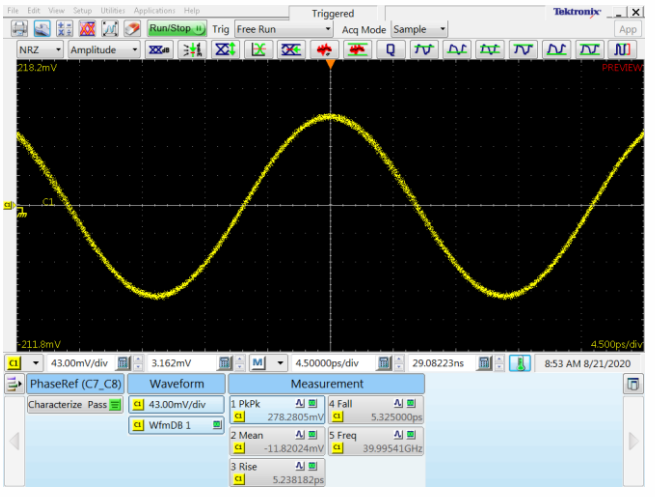
5 GHz input signal



5 GHz output signal @ min attenuation



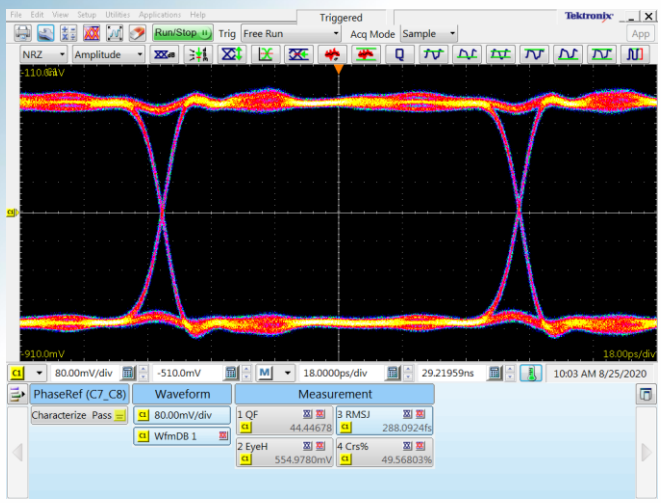
40 GHz input signal



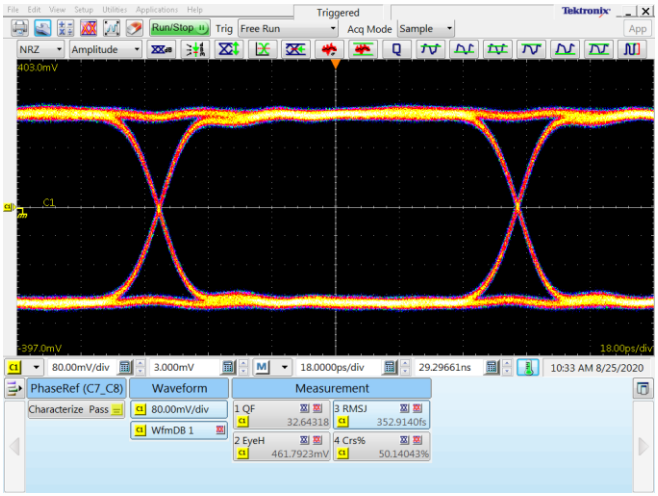
40 GHz output signal @ min attenuation

Data Output Signals

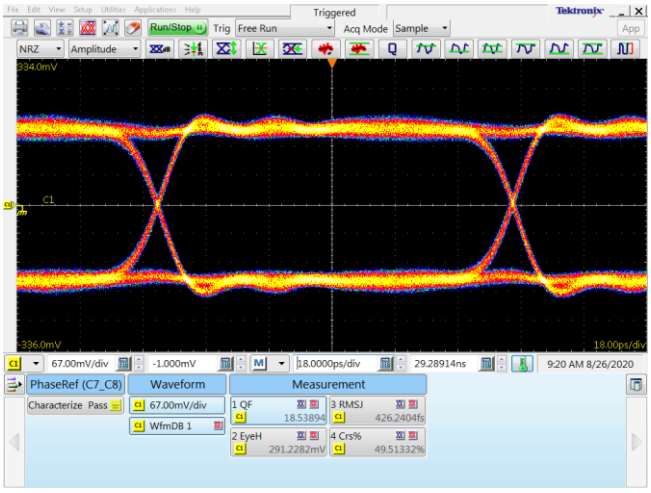
The measurements below had been performed using a SHF 12105 A Bit Pattern Generator (PRBS 2^{31}-1) and a Digital Serial Analyzer (DSA8300) with a Phase Reference Module (82A04B-60G) and a Sampling Module (80X02). The output of the module had been connected directly to the DSA input
Input Data signal had a PRBS 2^{31}-1 pattern.



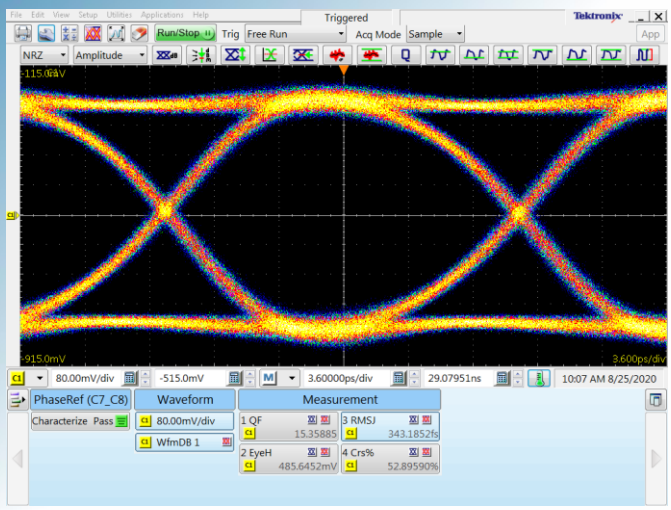
10 Gbps input signal



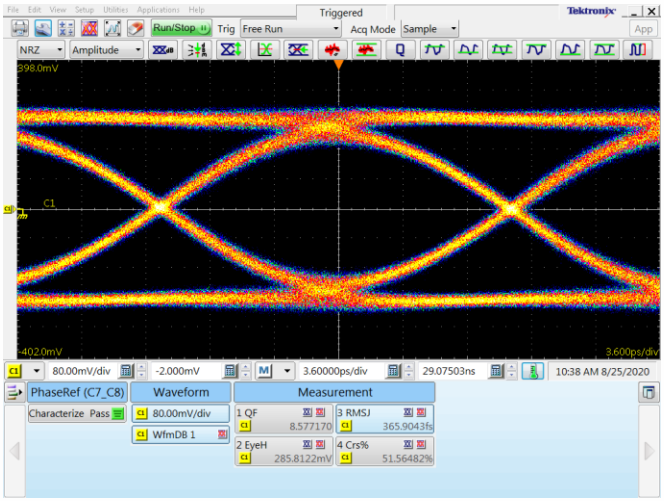
10 Gbps output signal @ min attenuation



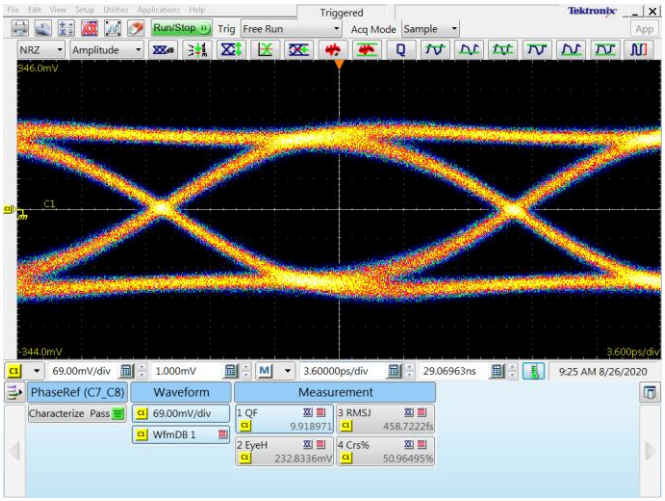
10 Gbps output signal @ min attenuation Option LFC



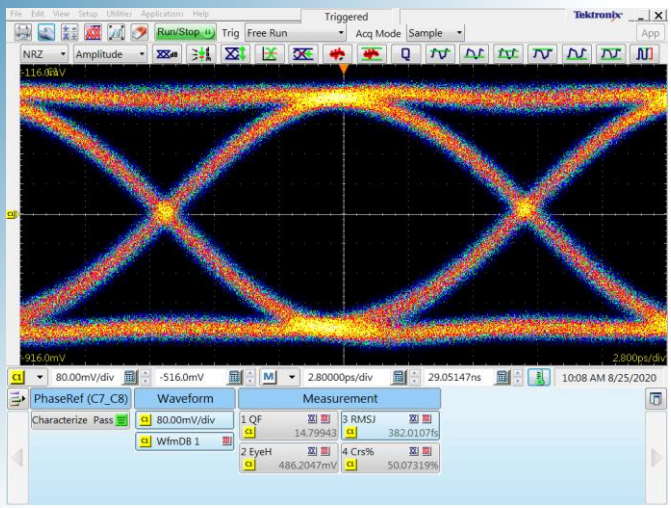
50 Gbps input signal



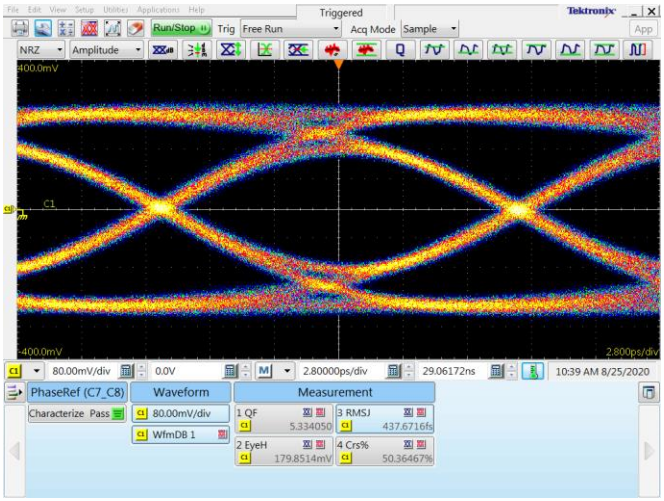
50 Gbps output signal @ min attenuation



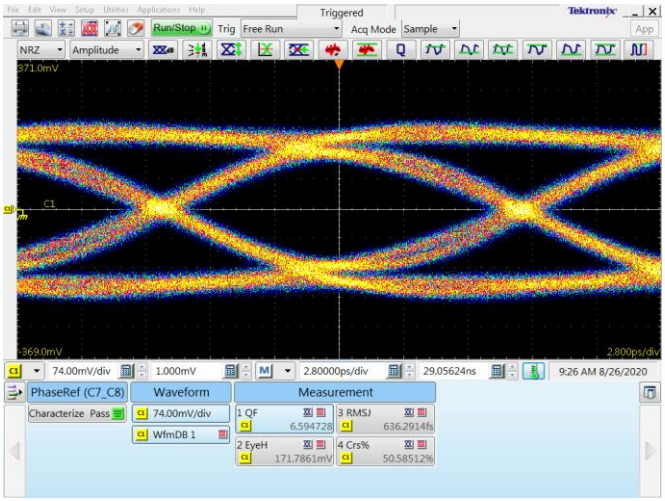
50 Gbps output signal @ min attenuation Option LFC



64 Gbps input signal

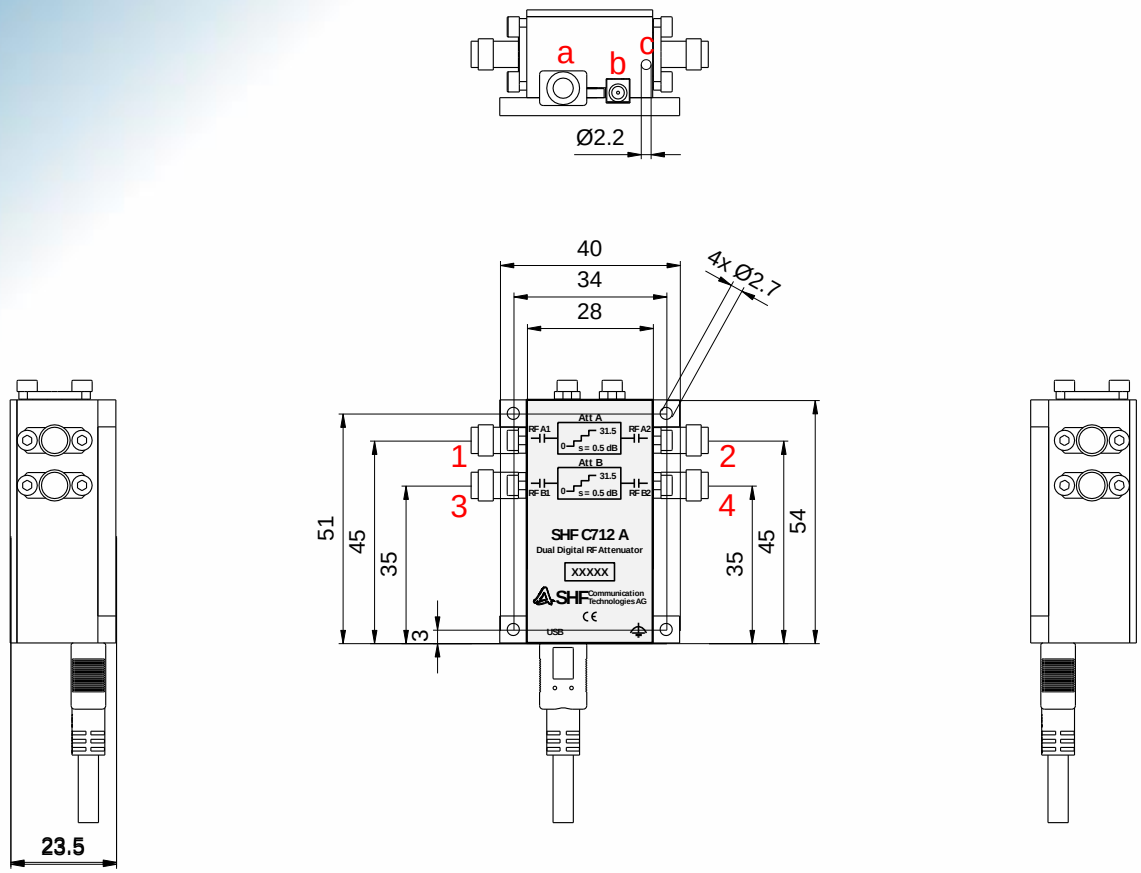


64 Gbps output signal @ min attenuation

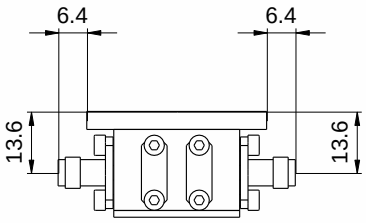


64 Gbps output signal @ min attenuation Option LFC

Outline Drawing – Module



Pos	Port	Connector
1	RF A1 Att A	1.85mm (V) female
2	RF A2 Att A	1.85mm (V) female
3	RF B1 Att B	1.85mm (V) female
4	RF B2 Att B	1.85mm (V) female



All dimensions are in mm

Port	Connector
a	Mini-USB
b	nc
c	Functional earth (FE)

SHF Communication Technologies AG
the bandwidth company