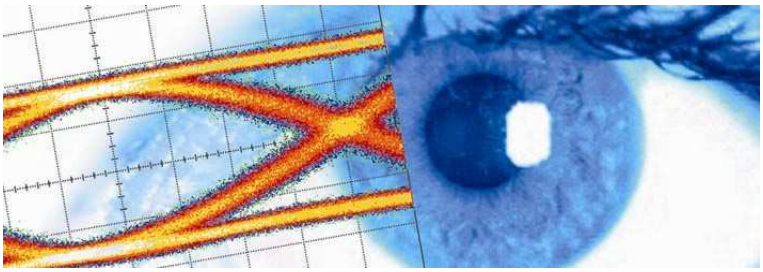
SHF Communication Technologies AG

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

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

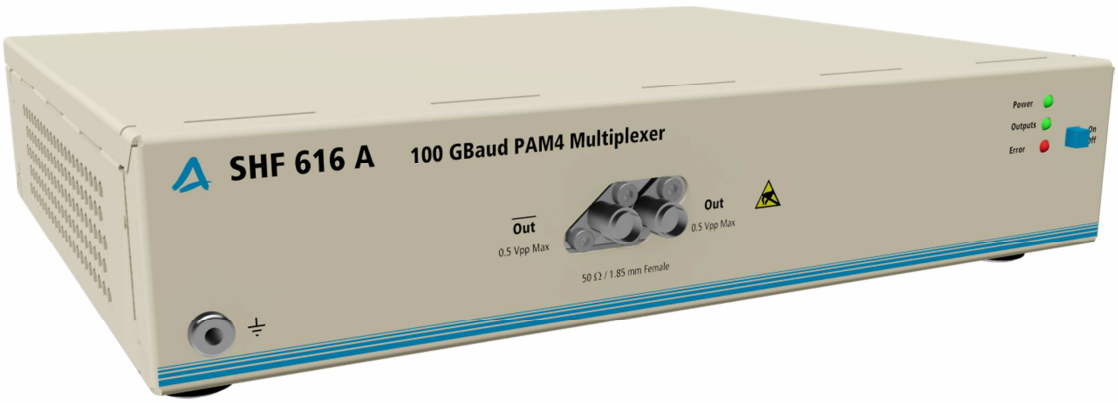
E-Mail: sales@shf.de • Web: http://www.shf.de



Datasheet

SHF 616 A

100 GBaud PAM4 Multiplexer



Description

The SHF 616 A is a PAM4 Multiplexer operating at symbol rates up to 112 GBaud for use in broadband test setups and telecom transmission systems. Four single ended serial data streams are multiplexed and combined into one differential PAM4 signal.

With a programmable SHF BPG (e.g. SHF 12105 A) you have full control of the patterns into the MUX.

A single ended clock signal with the same frequency as the input data rate is required to drive the SHF 616 A. For data regeneration purposes all input data signals are re-sampled to mitigate any signal impairments resulting e.g. from long cables. Therefore, it becomes possible to place the MUX very close to the DUT. Clock input port and data output ports are AC-coupled. Data input ports are DC-coupled.

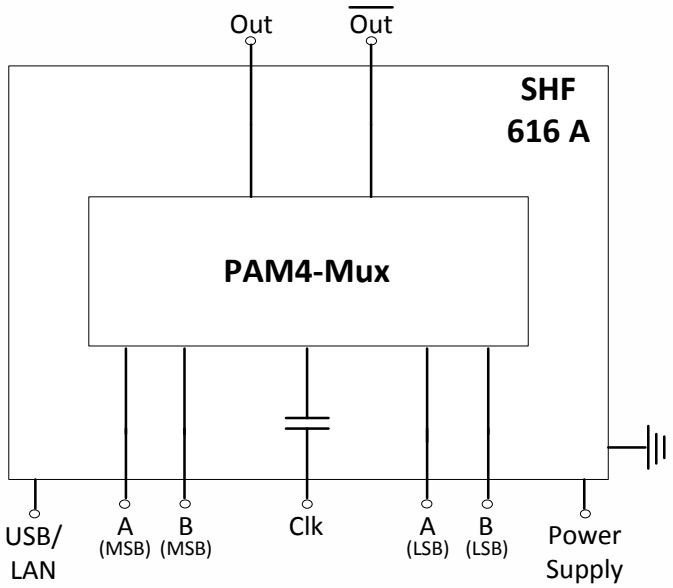
Features

- Broadband operation up to 112 GBaud
- Differential data output, 0.8 V differential output swing (0.4 V in single-ended operation)
- Single ended clock and data inputs
- Latched input ports
- Output amplitude & input threshold level control (remote by software)

Applications

- 100, 200, 400 Gbps and 1 Tbps system evaluation & development
- Broadband test and measurement equipment
- PAM-N, OFDM, Advanced Modulation Experiments

Block Diagram

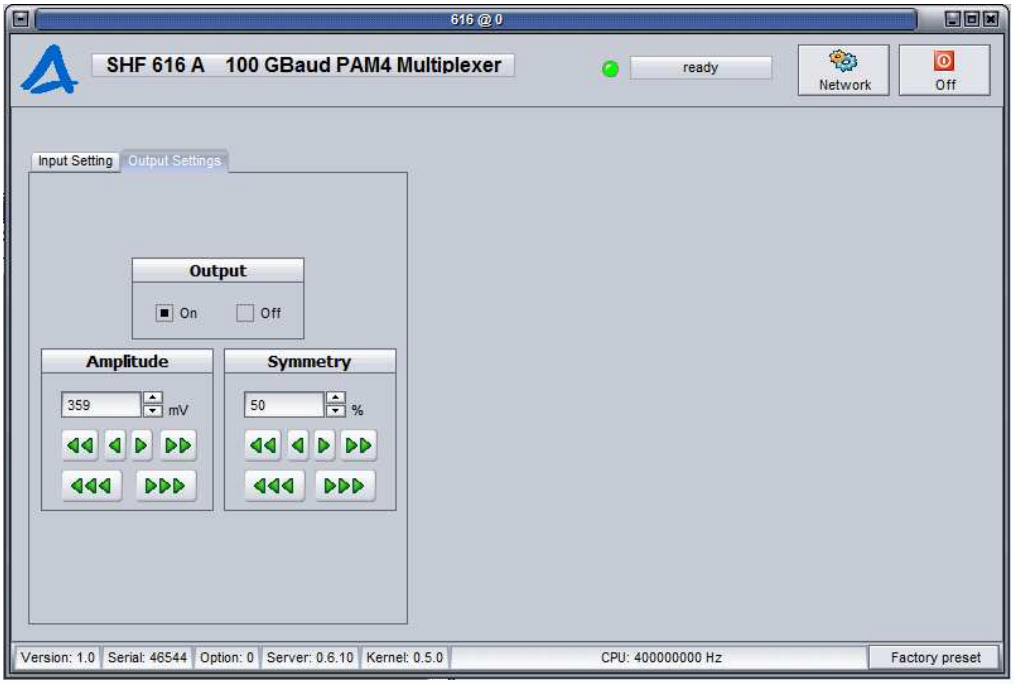


Ease of Use

Housed in a small benchtop case, this remote head can be easily embedded in the customer's test environment close to the DUT.

SHF 616 A

The easy to use software package, SHF BCC Control Center is the most convenient way to control the MUX. The software reads the individual calibration tables of the multiplexers and sets the contribution of the bias voltages accordingly. The symmetry of the output signal can be set and is displayed in the graphical user interface (GUI). The duty cycle (clock bias) of the multiplexer stages as well as the input threshold level for the DC-coupled data inputs can be set. This enables the user to generate a perfect signal just by a few intuitive clicks.



BCC Control Center - SHF 616 A

Absolute Maximum Ratings

Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Input Parameters						
Data Input Voltage	mV	$V_{data\ in}$			900	Peak-to-Peak
Clock Input Voltage	mV	$V_{clk\ in}$			900	Peak-to-Peak
External DC Voltage on RF Clock Input Port	V	V_{DCin}	-10		+10	AC coupled input
External DC Voltage on RF Data Input Ports	V	V_{DCin}	-0.5		0	DC coupled inputs
External DC Voltage on RF Output Ports	V	V_{DCout}	-10		+10	AC coupled outputs
DC Supply Voltage	V	V_{cc}			13.0	

Specifications

Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Input Parameters						
Min. Input Data Rate	Gbps	$R_{in,min}$			1	
Max. Input Data Rate	Gbps	$R_{in,max}$	50	56		
Data Input Voltage	mV	$V_{data\ in}$	300		800	Eye Amplitude; 500 mV recommended
External DC Voltage on RF Data Input Ports	V	V_{DCin}	-0.5		0	DC coupled inputs
Min. Clock Input Frequency	GHz	$f_{in,min}$			1	
Max. Clock Input Frequency	GHz	$f_{in,max}$	50	56		
Clock Input Voltage	mV	$V_{clk\ in}$	300		800	Peak-to-Peak; 500 mV recommended
External DC Voltage on RF Clock Input Port	V	V_{DCin}	-10		+10	AC coupled input

Parameter	Unit	Symbol	Min.	Typ.	Max.	Comment
Output Parameters						
Min. Output Data Rate	GBaud	$R_{out,min}$			2	
Max. Output Data Rate	GBaud	$R_{out,max}$	100	112		
Output Voltage[1]	mV	V_{out}	330	400		Eye Amplitude; Single ended; DC coupled CML; Full scale; Adjustable up to -6 dB
Rise / Fall Time	ps	t_r / t_f		5	6	20%...80%; deconvolved[2]
Equivalent Output Bandwidth	GHz	BW	37	44		Derived from Rise Time using formula[3]; -3 dB bandwidth
Differential Output Skew	ps	t_{skew}		1	2	
General						
Supply Voltage	V	V_c	+11.5	+12	+12.5	2.1 mm DC Power Jack
Supply Current	mA	I_c		1000	1100	
Power Dissipation	W	P_d		12	13.2	@ V_C = +12V
Operating Temperature	°C	$T_{ambient}$	10		35	
Height	mm	H		50.8		
Width	mm	W		221.4		
Depth	mm	D		177		
Weight	g	m		1700		

[1] During start up / shut down of the SHF 616 A and turning on / off the RF outputs, voltage spikes up to +0.7 V can occur at the data output ports

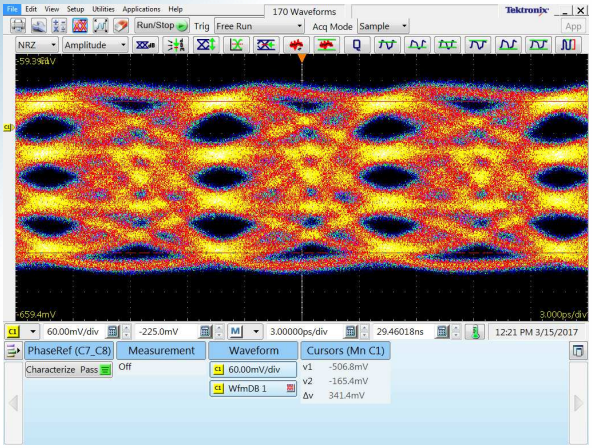
[2] Calculation based on typical rise / fall times from oscilloscope data sheet: $t_{r\ deconvolved} = \sqrt{(t_{r\ measured})^2 - (t_{r\ oscilloscope})^2} = \sqrt{(t_{r\ meas.})^2 - (3.68\ ps)^2}$

[3] Calculation based on formula: $BW = \frac{0,22}{Tr}$

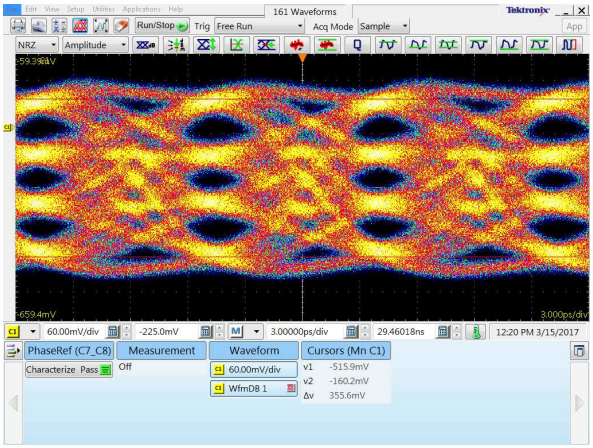
Typical Output Eye Diagrams

The measurements below had been performed using a SHF 12104 A Bit Pattern Generator (PRBS 2^{31}-1) and a Tektronix DSA 8300 Digital Serial Analyzer (DSA) with Phase Reference Module (82A04B-60G) and 70 GHz Sampling Module (80E11). The outputs of the MUX module had been connected directly to the DSA input.

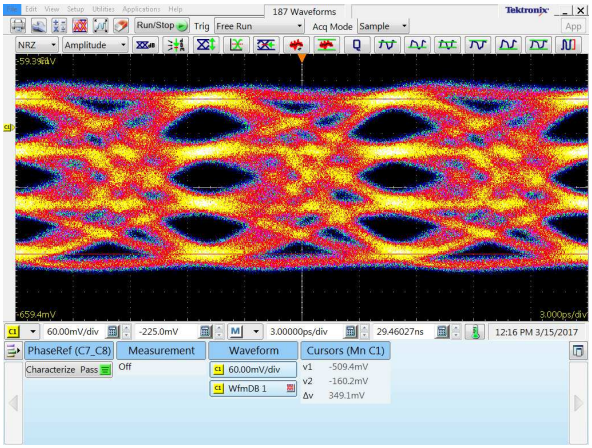
PAM4 Output Signal Measurement



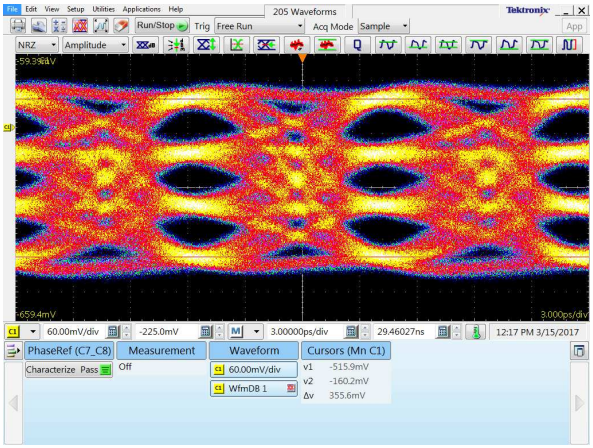
Out @ 112 GBaud



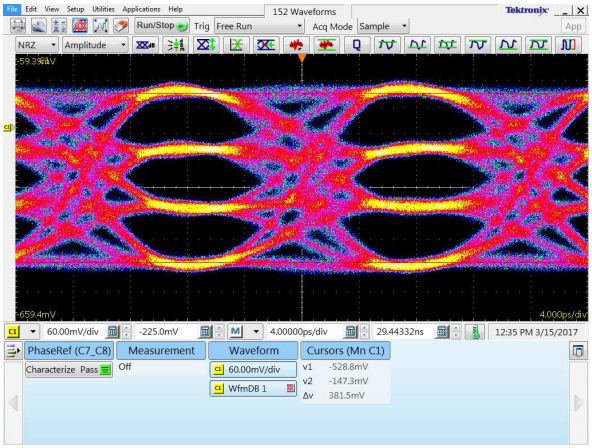
Out! @ 112 GBaud



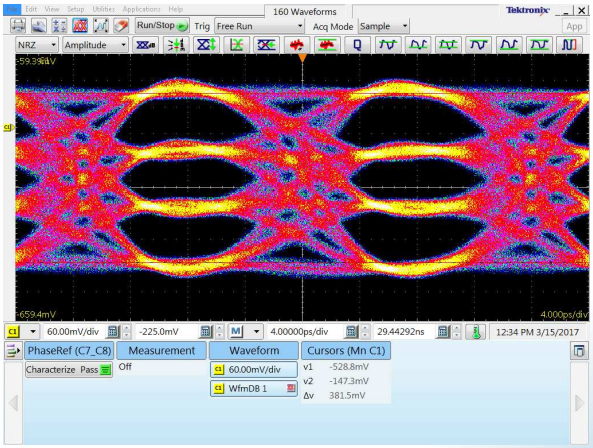
Out @ 100 GBaud



Out! @ 100 GBaud



Out @ 64 GBaud

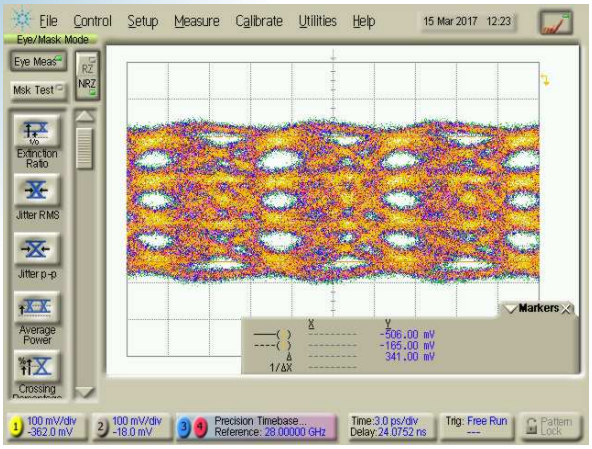


Out! @ 64 GBaud

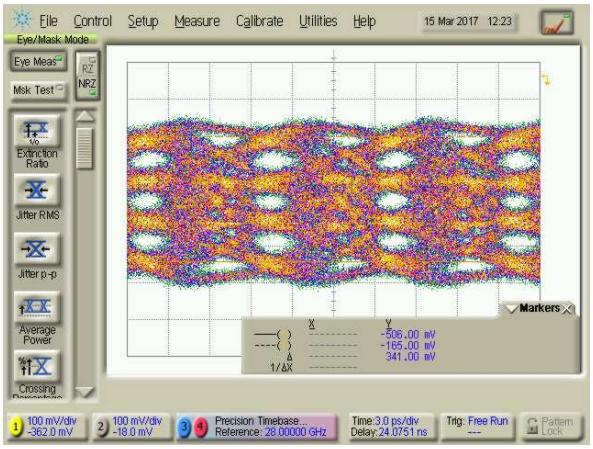
Typical Output Eye Diagrams

The measurements below had been performed using a SHF 12104 A Bit Pattern Generator (PRBS 2^{31}-1) and an Agilent Digital Communication Analyzer (DCA) with Precision Timebase Module (86107A) and 70 GHz Sampling Module (86118A). The outputs of the MUX module had been connected directly to the DCA input.

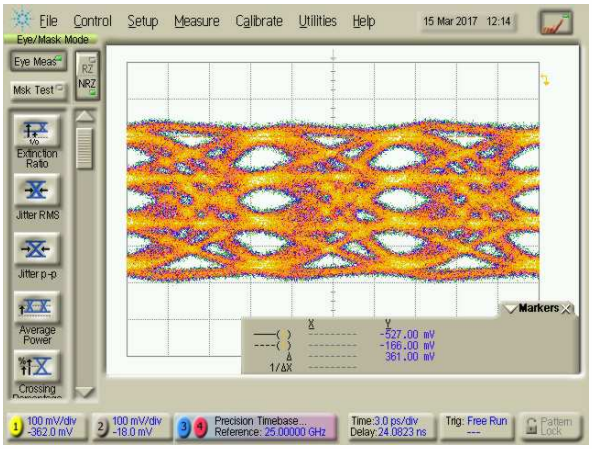
PAM4 Output Signal Measurement



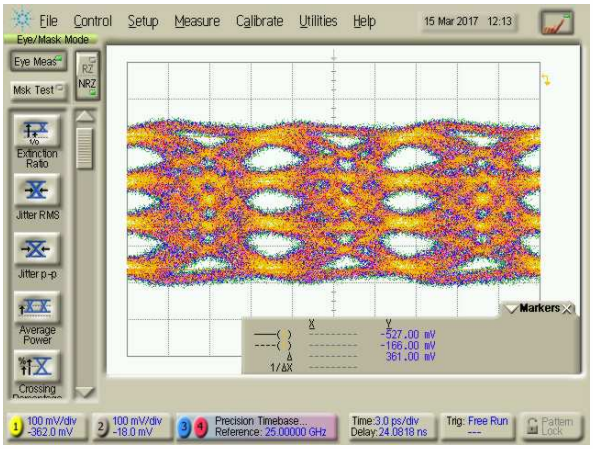
Out @ 112 GBaud



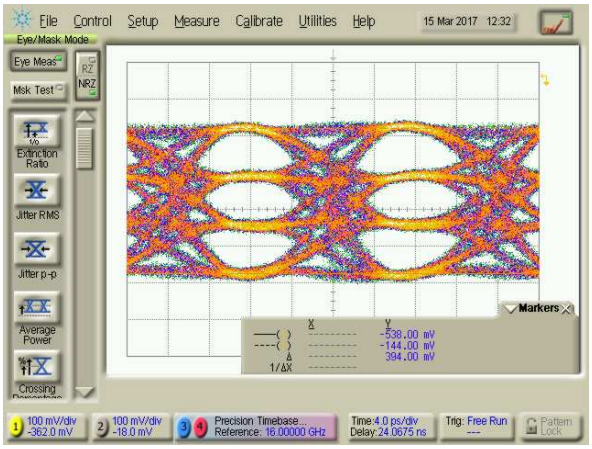
Out! @ 112 GBaud



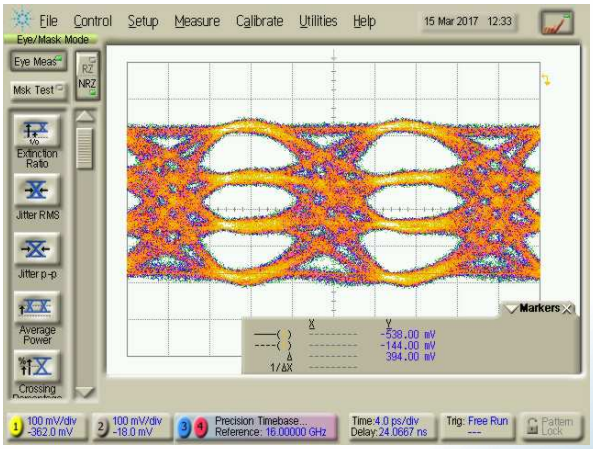
Out @ 100 GBaud



Out! @ 100 GBaud

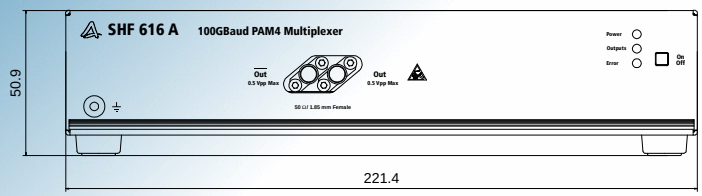


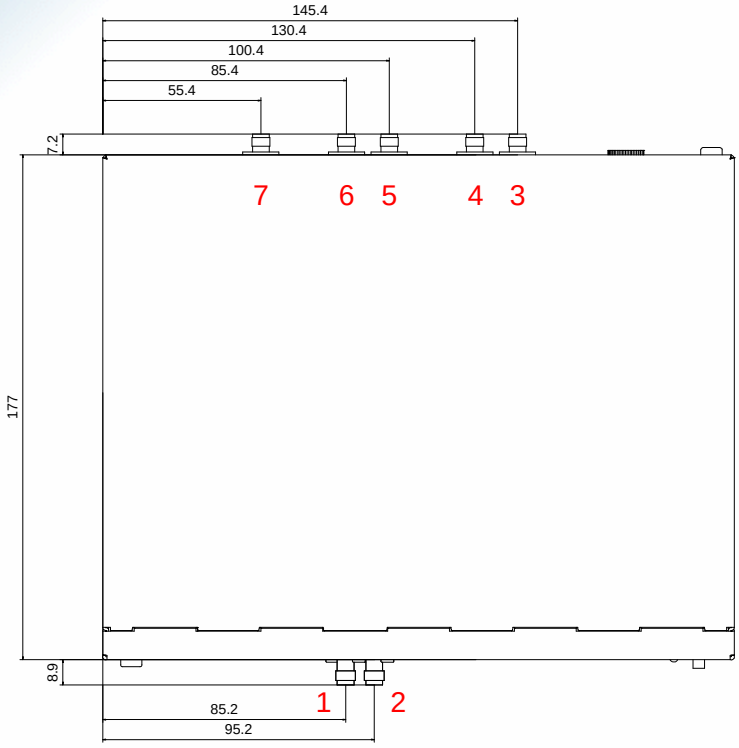
Out @ 64 GBaud

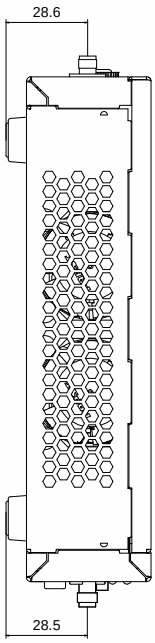


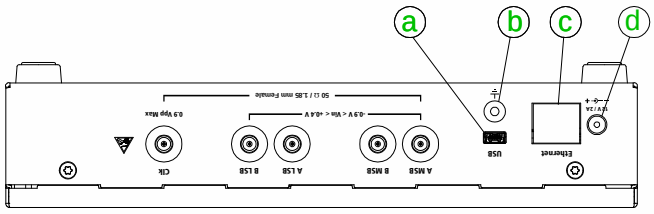
Out! @ 64 GBaud

Outline Drawing – SHF 616 A









Pos.	Designation	Connector
1	$\overline{\text{Output}}$	1.85mm (V) Female
2	Output	1.85mm (V) Female
3	A MSB	1.85mm (V) Female
4	B MSB	1.85mm (V) Female
5	A LSB	1.85mm (V) Female
6	B LSB	1.85mm (V) Female
7	Clock Input	1.85mm (V) Female

Pos.	Designation
a	USB
b	GND
c	Ethernet
d	Power Supply

all dimensions in mm