

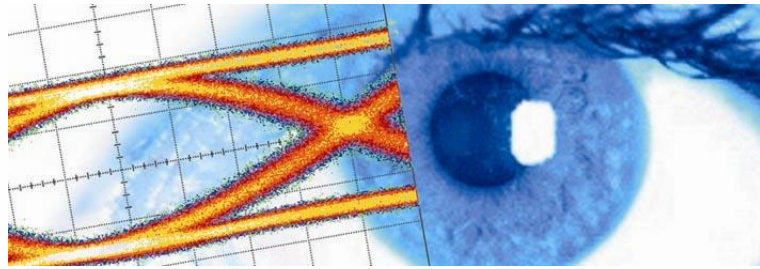


## SHF Communication Technologies AG

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

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

E-Mail: [sales@shf.de](mailto:sales@shf.de) • Web: <http://www.shf.de>



# Datasheet

## SHF 11220 A

### 60 GBaud PAM4 Sampler





## Description

The SHF 11220 A is a PAM4 sampler operating at symbol rates up to 58 GBaud for use in broadband test setups and telecom transmission systems. The module features a high sensitivity D-type flip-flop (DFF) with wide dynamic range. Through the software GUI, the threshold and time delay position can be controlled to explore the error characteristics of the input PAM4 signal. At each position, the DFF outputs a NRZ signal to be further processed by an error analyzer.

For BER measurements, the module is intended to operate with the SHF 11104 A Error analyzer.

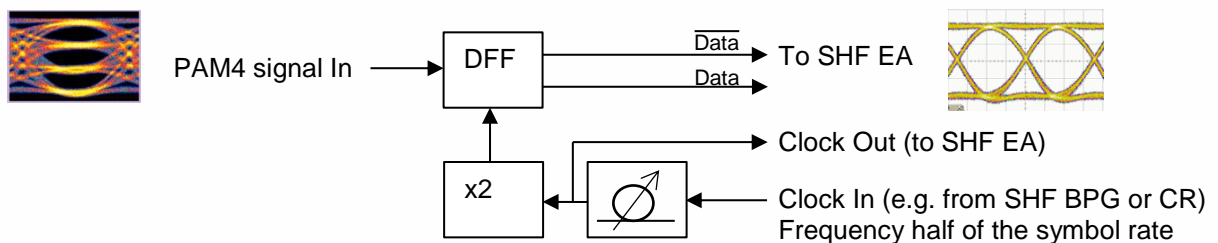
## Features

- Operation at least up to 58 GBaud (116 Gbps) @ PAM4
- Key element is an high speed, high sensitivity D-type flip-flop (DFF) with wide dynamic range
- Samples a 'vertical slice' of input PAM4 signal
- Outputs a NRZ signal for error analysis at the corresponding vertical threshold value
- Actual error counting is done in the SHF 11104 A Error Analyzer (EA)
- Using SHF's existing 3-pass approach (samples the three PAM4 eyes, one at a time)<sup>1</sup>
- Bert Control Center (BCC) unifies the Sampler and the EA to virtually one single EA-Instrument.

## Applications

- 100, 200, 400 Gbps and 1 Tbps system evaluation & development
- Broadband test and measurement equipment

## Block Diagram

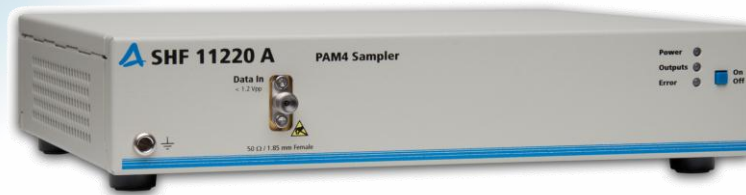


<sup>1</sup> For details on the 3-pass approach, please be referred to the data sheet of the SHF 11104 A Error Analyzer.



## Ease of Use

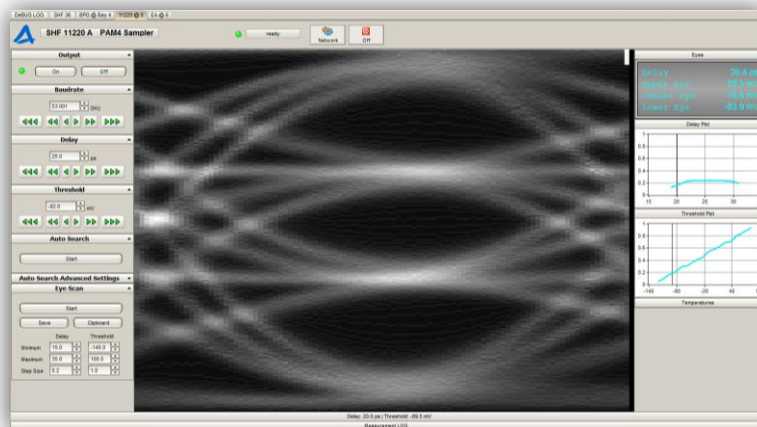
Housed in a small benchtop case, this remote head can be easily embedded in the customer's test environment close to the DUT.



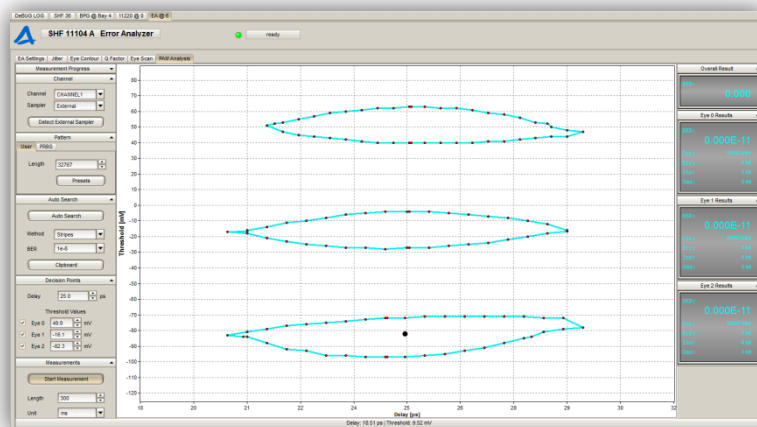
SHF 11220 A

The SHF 11220 A requires a clock signal at half of the input baud rate as master clock. Its operation can be controlled either through the PAM4 Sampler GUI or the PAM analysis window under the SHF 11104 A Error Analyzer. In the PAM4 Sampler GUI, the built-in eye scan function has the capability to map out an eye pattern of the input PAM4 signal, as well as executing a fast "Auto-search" to determine the threshold values and delay of the input signal.

For actual BER measurements, the EA PAM Analysis GUI is used. This features the same fast "auto-search" function for thresholds and delay, and deploys the 3-pass BER measurement approach to calculate the total BER of the PAM4 signal.



BCC SHF 11220 A PAM Sampler GUI, showing the eye scan of a 53 GBaud PAM4 signal



BCC SHF 11104 A EA GUI, showing the eye contours and error rates of a 53 GBaud PAM4 signal



## Absolute Maximum Ratings

| Parameter                                  | Unit | Symbol         | Min. | Typ. | Max. | Comment          |
|--|------|----------------|------|------|------|------------------|
| <b>Input Parameters</b>                    |      |                |      |      |      |                  |
| Data Input Voltage                         | mV   | $V_{data\ in}$ |      |      | 1200 | Peak-to-Peak     |
| Clock Input Voltage                        | mV   | $V_{clk\ in}$  |      |      | 1200 | Peak-to-Peak     |
| External DC Voltage on RF Clock Input Port | V    | $V_{DCin}$     | -3   |      | +3   | AC coupled input |
| External DC Voltage on RF Data Input Ports | V    | $V_{DCin}$     | -3   |      | +3   | AC coupled input |
| External DC Voltage on RF Output Ports     | V    | $V_{DCout}$    | -3   |      | +3   | AC coupled input |
| DC Supply Voltage                          | V    | $V_{cc}$       |      |      | 13   |                  |

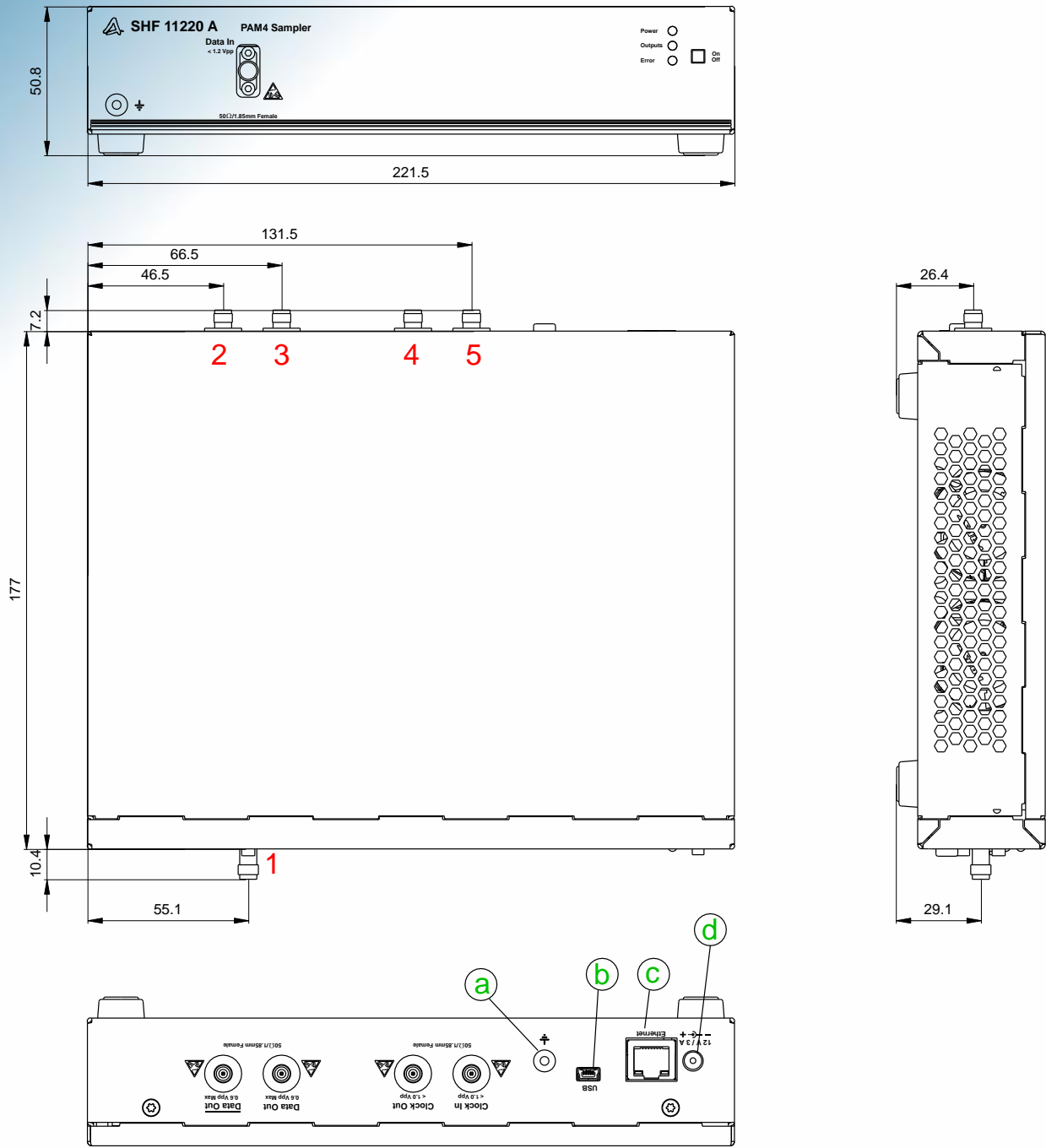
## Specifications

| Parameter   | Unit             | Symbol        | Min.       | Typ.            | Max.            | Comment  |
|---|------------------|---------------|------------|-----------------|-----------------|--|
| <b>Input Parameters</b>                                 |                  |               |            |                 |                 |  |
| Min. Input Data Rate                                    | GBaud            | $R_{in,min}$  |            |                 | 30              | BER < 1E-11  |
| Max. Input Data Rate                                    | GBaud            | $R_{in,max}$  | 58         | 60              |                 | BER < 1E-9   |
| PAM4 Sensitivity <sup>2</sup><br>individual eye heights | mV               |               |            | 20<br>40<br>150 | 30<br>50<br>200 | Up to 53 GBaud<br>Up to 56 GBaud<br>Up to 60 GBaud |
| Delay /<br>Clock Phase Adjustment                       | ps               |               | 0          |                 | 70              | Adjustable in 0.1 ps steps                         |
| Max. Input Amplitude                                    | mV <sub>pp</sub> | $V_{in}$      |            |                 | 800             | AC coupled   |
| Clock Input Voltage                                     | mV <sub>pp</sub> | $V_{clk\ in}$ | 300        |                 | 800             | Peak-to-Peak;<br>500 mV recommended                |
| <b>Output Parameters</b>                                |                  |               |            |                 |                 |  |
| Data Output Voltage                                     | mV <sub>pp</sub> | $V_{Out}$     | 300<br>600 |                 |                 | Single-ended<br>Differential                       |
| Clock Output Voltage                                    | mV               | $V_{Clkout}$  | 300        |                 |                 | Peak-to-Peak                                       |
| Connectors  |                  |               |            |                 |                 | 1.85 mm (V) male                                   |

<sup>2</sup> Value corresponds to the measured individual eye heights of a symmetric PAM4 signal on an Agilent 86100 C with 70 GHz samplers using 2<sup>23</sup>-1 PRBS at a BER limit of 10<sup>-9</sup>.



# Outline Drawing – SHF 11220 A



| Pos. | Designation | Connector          |
|------|-------------|--------------------|
| 1    | Data In     | 1.85 mm (V) Female |
| 2    | Data Out    | 1.85 mm (V) Female |
| 3    | Data Out    | 1.85 mm (V) Female |
| 4    | Clock Out   | 1.85 mm (V) Female |
| 5    | Clock In    | 1.85 mm (V) Female |

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

All dimensions in mm