Agilent N4916A De-Emphasis Signal Converter

Data Sheet

Version 1.1

De-emphasis signal converter N4916A

De-Emphasis Signal Injection Enables Robust Receiver and Board Designs:

- Industry-first de-emphasis signal converter
- Variable de-emphasis post-cursor up to 12 dB in 0.1 dB steps
- Differential outputs
- Supports data rates up to 13.5 Gb/s
- Convenient operation with integrated user interface for the Agilent J-BERT N4903A and the 81141/81142A serial pulse data generators
- Worst-case testing with jitter feed-through capability
- Simple upgrade for installed Agilent equipment

Agilent Technologies

Industries First De-Emphasis Signal Converter

Robust Receiver Designs

The Agilent N4916A de-emphasis signal converter enables design and test engineers to accurately characterize gigabit serial ports and channels that operate with de-emphasized signals. This results in more robust receiver designs, with reliable operation in real PC board environments.

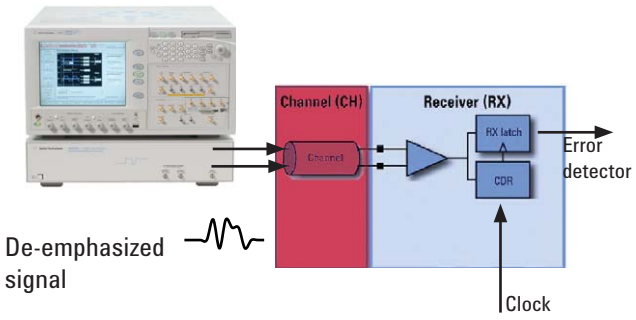

Figure 1: The de-emphasis signal converter allows emulating a transmitter by varying the de-emphasis in a wide range. This enables to check if the receiver works properly with a real–world channel that generates ISI (Inter Symbol Interference) effects. Alternatively injecting de-emphasized signals allows minimizing the ISI effects caused by the test board environment, helpful when testing receivers with most ideal inputs signal conditions.

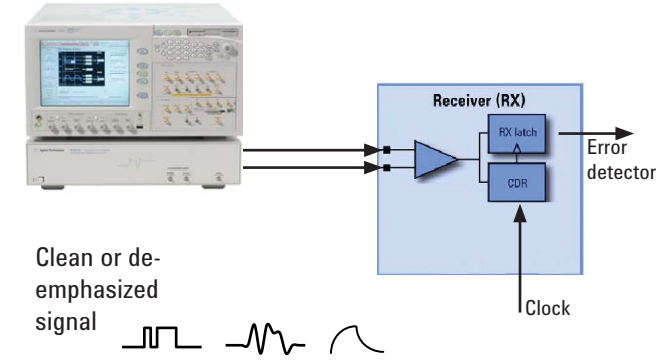

Figure 2: When the receiver is tested directly, the de-emphasized signal can be used to characterize if the receiver works properly with over- and under-compensation of channel effects. Jitter can be added on top for worst case stress testing of the receiver port.

De-emphasis is a commonly used technique for transmitting electrical signals at gigabit data rates to compensate for signal degradations caused by printed circuit boards, e.g. by motherboards, add-in cards or backplanes.
The most popular high-speed electrical standards require transmitter de-emphasis, sometimes also called pre-emphasis. These standards are: PCI Express, SATA 3 Gb/s, fully buffered DIMM, Hypertransport, CEI, and 10 Gb Ethernet.

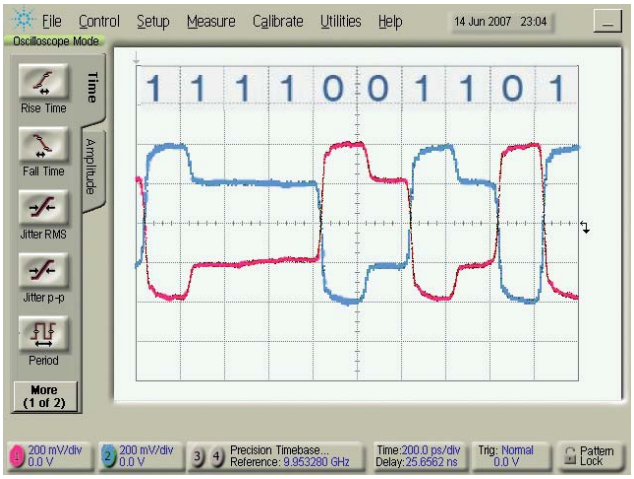

Figure 3: De-emphasized differential signal generated with the N4916A and the J-BERT N4903A at 5 Gb/s data rate, 400 mV, 6 dB de-emphasis. Screen shot captured with an Agilent 86100C DCA-J with 70 GHz remote sampling module 86118A.

User Interface

The N4916A de-emphasis signal converter can be controlled from the graphical user interface of the J-BERT N4903A high-performance serial BERT and the 81141A/81142A serial pulse data generators.

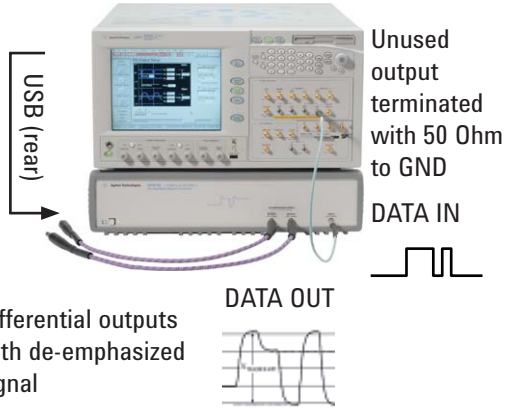

Figure 4: A configuration example for generating a differential de-emphasis signal when controlling the N4916A with the J-BERT N4903A.

The de-emphasis signal parameters can be controlled via the user interface of the Agilent J-BERT N4903A or 81141/81142A serial pulse data generators.

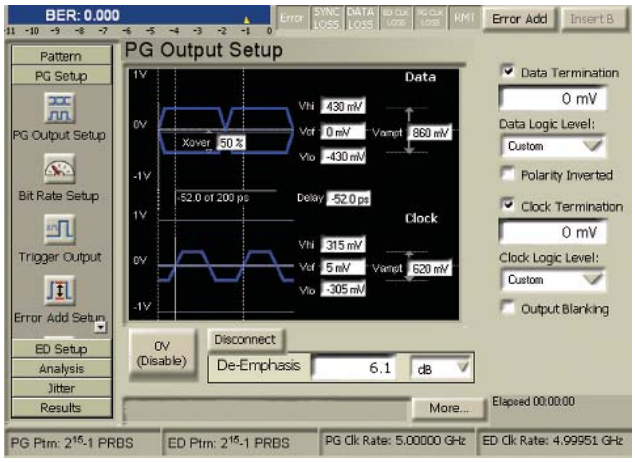

Figure 5: The de-emphasis amplitude can be set conveniently as dB or % value in the pattern generator output setup window.

Specifications

Figure 6: Front panel connectors of N4916A

De-emphasized Signal Output (OUTPUT)
Table 1: Output characteristics. All timing parameters are measured at ECL levels.

Range of operation	1.5 Gb/s to 13.5 Gb/s (12.5 Gb/s max. with J-BERT N4903A)
Format	NRZ
Output amplitude	Single-ended: 100 mV to 0.8 V, 5 mV resolution Differential: 200 mV to 1.6 V, 10 mV resolution
Output voltage window	-1.2 V to +1.8 V if terminated to GND. Addresses PECL (3.3 V) terminated to +1.3 V, ECL terminated to -2 V, LVDS, CML.
De-emphasis amplitude ratio of post-cursor	0 dB to 12.0 dB in 0.1 dB steps. Entry in dB or %.
Transition time	< 30 ps (20% to 80%) typical
Total jitter	< 30 ps peak-peak typical (with jitter injection disabled in J-BERT and 81141/81142A)
External termination voltage	-2 V to +3V [1)]
Jitter feed-through	Yes
Interface	Differential or single-ended, DC-coupled, 50 Ω. Terminate unused output.
Connector	2.4 mm, female

1) For positive termination voltage or termination GND, external termination voltage must be less than 3 V below VOH. For negative termination voltage, the external termination voltage must be less than 2 V below VOH. The external termination voltage must be less than 3 V above VOL.

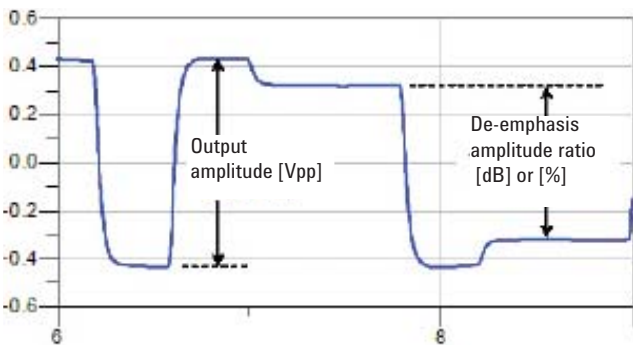

Figure 7: Definition of nominal output voltage and de-emphasis amplitude

Data Input (INPUT)
Signals have to be used from DATA OUT of the J-BERT N4903A or the 81141/2A serial pulse data generator. The unused output has to be terminated with 50 Ω to GND.

Table 2: Input characteristics

Levels	Automatically handled by generator
Mark density of input pattern	45 % to 55 %
Interface	Single-ended, DC-coupled, 50 Ω to Ground
Connector	2.4 mm, female

General Characteristics

Table 3: Mainframe characteristics

Operating temperature	5 °C to 40 °C
Storage temperature	-40 °C to + 70 °C
Operating humidity	95 % relative humidity non-condensing
Storage humidity	50% relative humidity
Power requirements	100-240 Vac, ± 10%, 50-60 Hz; 100-120 Vac, ± 10%, 400 Hz.
Power consumption	170 VA max.
Physical dimensions	Width: 426 mm Height: 89 mm Depth: 521 mm
Weight (net)	10 kg
Weight (shipping max)	12.5 kg
Sound power level	LWA < 55 dB (A) according to ISO 77795
Recommended re-calibration period	1 year. See order instructions for calibration services.
Warranty period	1 year return to Agilent. See order instructions for extended warranty.

Rear Panel Connectors
USB 2.0, power

Figure 8: Rear panel of the N4916A

Remote Control Interfaces
Via USB 2.0 to the controlling instruments N4903A or 81141/2A. These offer GPIB (IEEE 488), LAN, and USB 2.0

Remote Control Languages
SCPI or via the web server of the Agilent J-BERT N4903A or the 81141/2A.

Regulatory Standards
Safety
IEC 61010-1:2001; EN 61010-1:2001;
CAN/CSA-C22.2 No. 61010-1-04; ISA – 82.02.01: 2004
UL 61010-1: 2004

EMC
IEC 61326-1:1997 + A1: 1998;
EN 61326-1:1997 + A1: 1998

Quality Management
ISO 9004, ISO 14000

Software Control
These software revisions are a pre-requisite to control the N4916A de-emphasis signal converter:
J-BERT N4903A requires SW revision 4.8 or later.
81141/2A requires SW revision 4.8 or later.
See www.agilent.com/find/n4916 for software downloads.

Specification Assumption
The specifications in this document describe the instrument's warranted performance. Non-warranted values are described as typical. All specifications are valid in a temperature range from 5°C to 40 °C ambient temperatures after a warm-up phase of 30 minutes. If not otherwise stated, all inputs and outputs need to be terminated with 50 Ω to Ground. All specifications, if not otherwise stated, use the recommended cable set N4910A (2.4 mm, 24" matched pair) and the N4915A-004 2.4 mm cable from the generator output to the de-emphasis signal converter input.

Order Instructions

De-emphasis signal converter **N4916A**
Includes one 50 Ω termination (SMA), one 2.4 mm to SMA adapter, a USB cable, a commercial calibration report and certificate ("UK6"), and a getting started guide.

Warranty
Extended warranty **R1280A**

Calibration
Calibration services **R1282A**

Productivity assistance
Remote or on-site **R1380-N49xx**
Productivity assistance **PS-S20 and PS-S20-02**

Recommended accessories
One 2.4 mm cable (m-m) **N4915A-004**
2.4 mm cable kit (matched pair) **N4910A**
Rack mount kit **81110A-1CM**

Figure 9: 2.4 mm cable N4915A-004 for connecting N4916A

Related Literature

	Pub. No.
J-BERT N4903A Data Sheet	**5989-2899EN**
81141/2A Serial Pulse Data Generator Data Sheet	**5989-3052EN**
De-emphasized Signal Generation with the Agilent N4916A De-Emphasis Signal Converter Product Note	**5989-7193EN**

www.agilent.com/find/n4916

Product specifications and descriptions in this document are subject to change without notice.

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