

# Agilent N4877A Clock Data Recovery and Demultiplexer 1:2 Agilent N1075A Optical Pick-Off/Converter Agilent N1070A Optical Clock Recovery Solution

Version 1.0  
Data Sheet



Figure 1. N1070A optical clock data recovery solution consisting of N4877A clock data recovery and demultiplexer 1:2 and N1075A optical pick-off/converter

## Electrical and Optical Clock Data Recovery Solutions up to 32 Gb/s

- Synchronization for receiver bit-error-ratio (BER) testing and transmitter waveform analysis
- Continuous tuning from 50 Mb/s to 32 Gb/s
- Ultra-low residual random jitter: < 100 fs RMS
- Optical and electrical configurations
- Golden phase-locked loop (PLL) operation with a tunable loop bandwidth from 15 kHz to 20 MHz for configurable industry-standard compliant test



## Electrical and optical clock data recovery solutions

Agilent's clock data recovery solutions offer an excellent data rate range from 50 Mb/s to 32 Gb/s making them ideal for many transmitter and receiver test setups for computer, datacom as well as communication standards.

The N4877A clock data recovery (CDR) and demultiplexer 1:2 is the core product of Agilent's CDR offering. Adjustable loop bandwidth and selectable peaking combined with high sensitivity and low intrinsic jitter performance, ensure accurate measurements. The built-in demultiplexer simplifies receiver testing with Agilent's BER testers (BERT) for data rates above 12.5 Gb/s.

The N1075A optical pick-off/converter provides an optical coupler that picks off optical energy to create an electrical signal for the N4877A CDR and demultiplexer. Together, the two instruments form the N1070A optical clock recovery solution. N1075A and N1070A are available as single-mode and multimode versions.

## PLL and jitter spectrum analysis

Use 86100DU-400 software to make fast, accurate and repeatable measurements of phase-locked loop (PLL) bandwidth/jitter transfer. A hardware clock data recovery like the N4877A, N1070A and 83496B can be configured as a jitter receiver which can be combined with a precision jitter source like the J-BERT N4903B to create a PLL stimulus-response test system. PCI Express® approved PLL bandwidth compliance tests and SONET/SDH jitter transfer measurements are preconfigured, with automatic report generation. The 86100DU-400 software also provide insights into the root causes of jitter through phase noise and jitter spectrum analysis on both clock and data signals.

## Agilent N4877A Clock Data Recovery and Demultiplexer 1:2



Figure 2. The N4877A recovers clock and demultiplex data from 50 Mb/s to 32 Gb/s

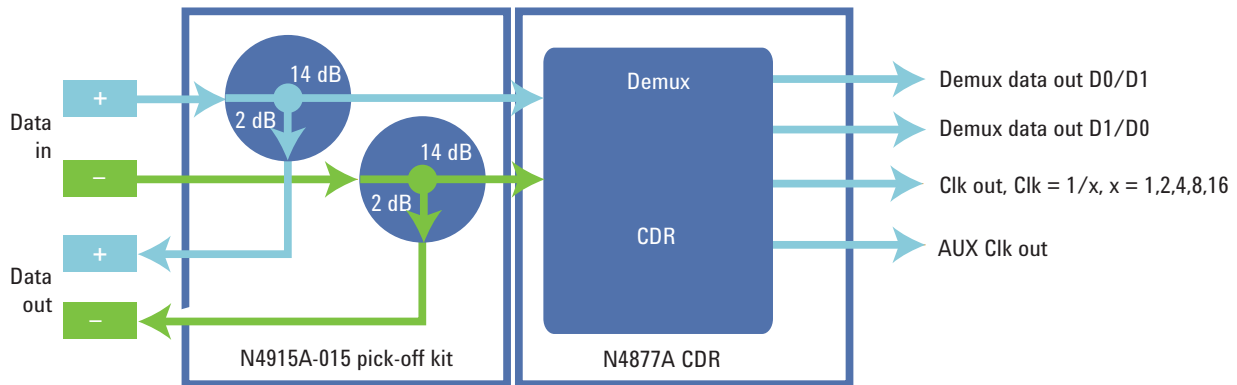


Figure 3. The N915A-015 pick-off kit is especially designed to be used with the N4877A and offers a bandwidth of 50 GHz. The demultiplexer data outputs can swap between even and odd bits.

### Accurate Clock Data Recovery and Demultiplexer for High-Speed Applications

- Recovers clock from data streams up to 32 Gb/s (Option 232)/16.5 Gb/s (Option 216)
- Demultiplexes data streams of up to 32 Gb/s (Option 232)/16.5 Gb/s (Option 216) into two data streams
- Tolerates small input signals with input sensitivity of 25 mVpp differential for clock data recovery and 70 mVpp differential for demultiplexing
- Provides aux clock with intrinsic random jitter as low as 100 fs RMS for accurate measurements
- Upgrades path for existing BERTs
- Enables easy operation and remote control through USB 2.0 and LAN connections, and standalone graphical user interface

### Characterize next-generation receivers and transmitters

The N4877A clock data recovery and demultiplexer 1:2 operates from 50 Mb/s to 32 Gb/s. The wide data-rate range allows testing of emerging standards like 100 GbE and 32GFC, while covering existing lower speed standards. A lower rate option operating up to 16.5 Gb/s, is ideal for 16GFC as well as computer standards like USB 3.0, SATA, SAS, SD UHS-II and PCIe including the emerging 16 GT/s generation.

### Recover clocks or clean-up clocks

The N4877A provides clock signals for BERTs or oscilloscopes when access to appropriate clock signals from the device under test (DUT) is not possible. But it can also act as a clean-up PLL for existing clocks with excessive intrinsic jitter to allow accurate measurements.

### Measure the real performance of clockless devices

Accurate transmitter measurements are possible because of low intrinsic jitter, paired with tunable loop bandwidth, selectable peaking and good sensitivity.

The N4877A's auxiliary clock output provides ultra-low intrinsic random jitter of less than 100 fs RMS, making it the ideal companion for sampling scopes equipped with a precision time base.

### Simplify receiver testing of high-speed devices

Receiver testing is easier because of software-controlled swappable demultiplexer outputs and a jitter tolerance test mode.

The N4877A clock data recovery and demultiplexer 1:2 is the counterpart to the N4876A multiplexer 2:1 and complements Agilent's J-BERT- and ParBERT-based receiver test solutions for data rates between 12.5 Gb/s and 28.4 Gb/s.

Cable kits specifically designed to maintain phase relationship between recovered clock and data are available for J-BERT N4903B.

## Easily control all settings

The N4877A's settings can be controlled through its rear-panel USB connection and a standalone user interface that runs on a Microsoft Windows® PC. The software can be installed on instruments running Windows XP® or Windows 7®.

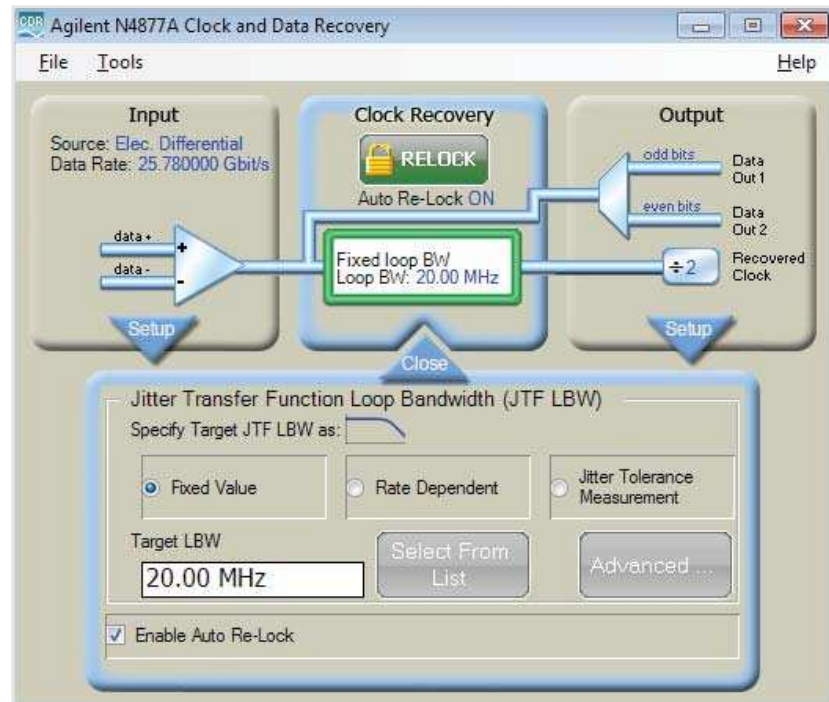


Figure 4. The intuitive graphical user interface is used to set expected data rate, change loop behavior, select output clock dividers and swap the demultiplexer outputs of the N4877A.

Support multiple applications with the N4877A

Application example: receiver testing with J-BERT N4903B high-performance serial BERT for 25 Gb/s

The N4877A clock data recovery and demultiplexer 1:2 can be used in a variety of applications. The following examples present typical use cases for clock data recovery in receiver and transmitter testing.

100 GbE, 32GFC, CEI and InfiniBand reach data rates beyond 25 Gb/s. The N4877A clock data recovery and demultiplexer is used in combination with the J-BERT N4903B and N4876A multiplexer for receiver testing of high-speed devices up to 28.4 Gb/s. In the example below, the N4877A recovers required sub-rate clocks and demultiplexes the 25 Gb/s data stream, enabling the J-BERT error detector to measure the bit-error-ratio during receiver sensitivity or jitter tolerance testing.

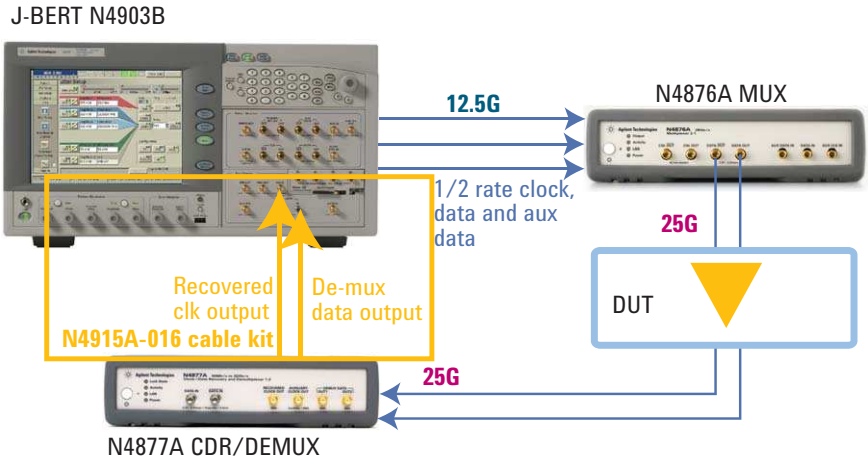


Figure 5. Setup for jitter tolerance characterization of a 28 Gb/s receiver. Cable kit N4915A-016 ensures the phase relationship between recovered clock and demultiplexed data.

Application example: clock recovery for sampling scope with high-bandwidth sampling heads and precision time base

Sampling scopes are the ideal choice for transmitter characterization when high-bandwidth, low noise floor and low intrinsic jitter are required. The N4877A, with its ultra-low jitter auxiliary clock output, provides a clean sine wave for a precision time-base module enabling the most accurate measurements. The main recovered clock output, with its divide stages, triggers the front panel trigger input.

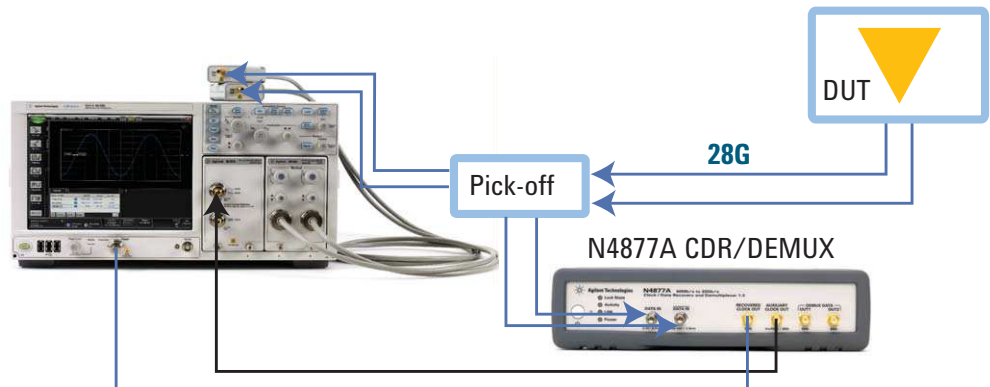


Figure 6. The setup for characterization of a 28 Gb/s high-bandwidth, low intrinsic jitter transmitter. For maximum performance the N4915A-015 pick-off kit is recommended.

Application example:  
28G data source with very low  
random jitter

The N4877A can be used as a cleanup PLL whenever a clean clock is required, such as for a 28 Gb/s data source with very low intrinsic random jitter (RJ). In the setup shown below, the N4877A cleans up the clock derived from the J-BERT N4903B to around 250 fs RJ RMS. This clock is used by the N4876A multiplexer to generate a data signal with very low RJ. The precision time base gets a very clean clock signal from the auxiliary clock out of the N4877A. The front panel trigger for the scope is provided by the J-BERT N4903B.

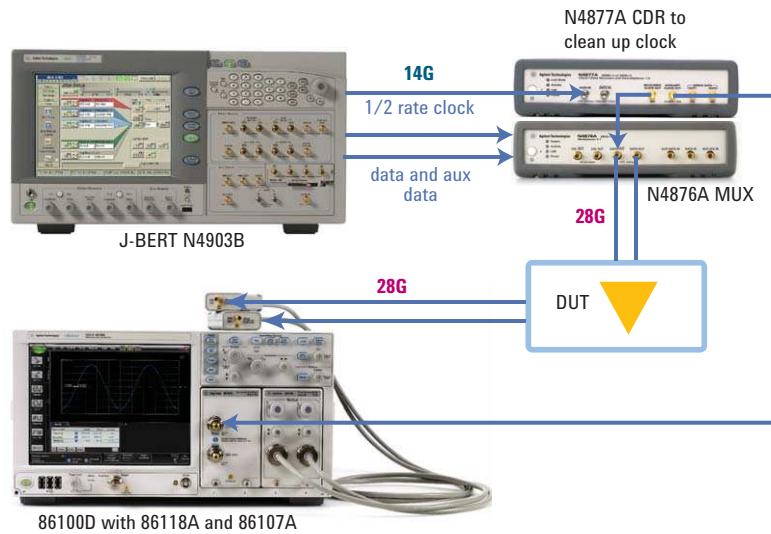


Figure 7. The N4877A is used to reduce random jitter for precision clocking.

Application example:  
27G testing with ParBERT

In combination with a multi-channel BERT system like the 81250 ParBERT, the N4877A clock data recovery and demultiplexer enables full-rate sampling up to 27 Gb/s. The CDR follows jitter within the range of its loop settings, while demultiplexing the incoming data stream into an even and odd bit stream. A ParBERT error detector (ED) clock group with two 13.5 Gb/s error detector modules analyzes every bit up to data rates of 27 Gb/s. The clocking for ParBERT's ED clock group is provided by the recovered clock of the N4877A.

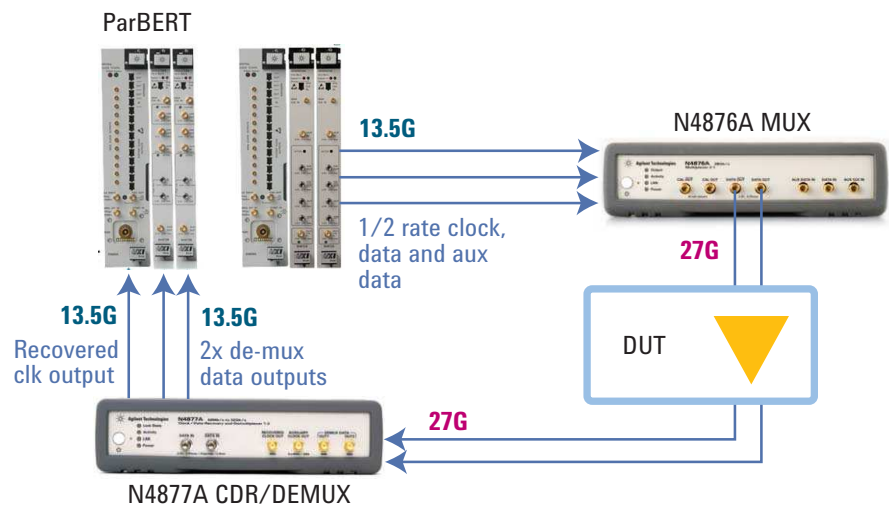


Figure 8. The ParBERT-based 27G test setup can be scaled for multi-lane testing by adding generators, analyzers, N4876As and N4877As.

## Specifications for N4877A



Figure 9. 2.4 mm (f) data signal inputs and SMA clock/data outputs on the front panel of the N4877A clock data recovery and demultiplexer 1:2.

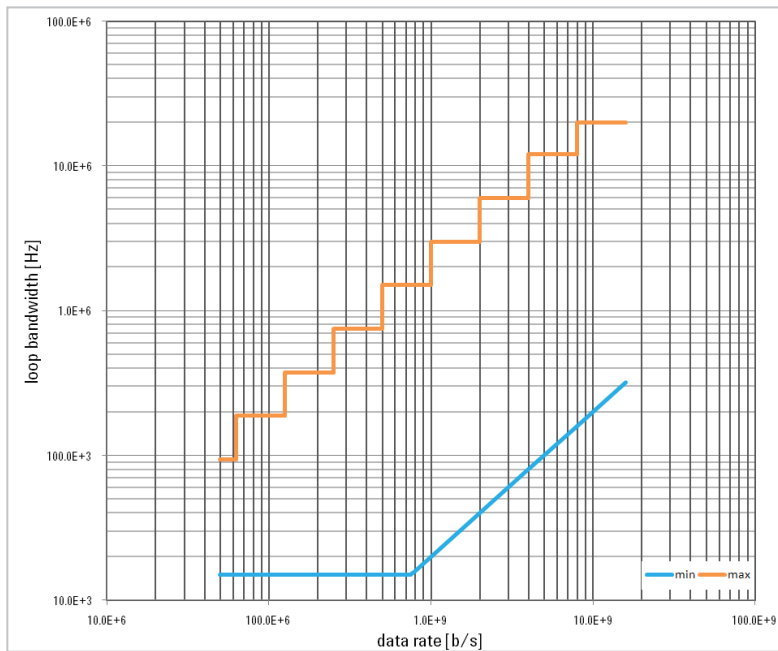
### N4877A specifications

#### Data inputs

|  |   |
|--|---|
| Input range                            | <p><b>Option 232:</b><br/>Specified range: 380 Mb/s to 28.4 Gb/s<br/>Over programming range: 50 Mb/s to &lt; 380 Mb/s and &gt; 28.4 Gb/s to 32 Gb/s<sup>4</sup></p> <p><b>Option 216:</b><br/>Specified range: 380 Mb/s to 16.5 Gb/s<br/>Over programming range: 50 Mb/s to &lt; 380 Mb/s</p> |
| Connector                              | 2.4 mm (f)  |
| Interface                              | Differential or single-ended, AC coupled, 50 $\Omega$ ; unused input must be terminated with 50 $\Omega$  |
| Input voltage window/<br>max amplitude | -2.2 V to 3.2 V/2 V <sub>pp</sub> , max   |
| Input sensitivity                      | 25 mV single ended or differential to gain lock <sup>2</sup> , typical<br>70 mV single ended or differential for Demultiplexer @ BER 10 <sup>-12</sup> <sup>3</sup> , typical   |
| Min. transition density                | 20% <sup>1</sup>  |

#### Recovered clock output

|                  |   |
|------------------|---|
| Connector        | SMA (f)   |
| Interface        | Single-ended, AC coupled, 50 $\Omega$   |
| Output voltage   | 350 mV <sub>pp</sub> , typical  |
| Output frequency | 16 GHz, max   |
| Output dividers  | User definable, available dividers are:<br>1 up to 16 Gb/s<br>2, 4, 8, 16 over full data-rate range |



#### Loop bandwidth range

##### Data rate

|                      |                         |                        |                        |                        |                        |                        |                        |                       |
|----------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|
| 50 Mb/s to 62.5 Mb/s | > 62.5 Mb/s to 125 Mb/s | > 125 Mb/s to 250 Mb/s | > 250 Mb/s to 500 Mb/s | > 500 Mb/s to 1.0 Gb/s | > 1.0 Gb/s to 2.0 Gb/s | > 2.0 Gb/s to 4.0 Gb/s | > 4.0 Gb/s to 8.0 Gb/s | > 8.0 Gb/s to 32 Gb/s |
|----------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|

##### Max loop bandwidth

|          |           |           |           |         |         |         |          |          |
|----------|-----------|-----------|-----------|---------|---------|---------|----------|----------|
| 93.8 kHz | 187.5 kHz | 375.0 kHz | 750.0 kHz | 1.5 MHz | 3.0 MHz | 6.0 MHz | 12.0 MHz | 20.0 MHz |
|----------|-----------|-----------|-----------|---------|---------|---------|----------|----------|

##### Data rate

|                     |                       |
|---------------------|-----------------------|
| 50 Mb/s to 750 Mb/s | > 750 Mb/s to 32 Gb/s |
|---------------------|-----------------------|

##### Min loop bandwidth

|        |                      |
|--------|----------------------|
| 15 kHz | (data rate)/(5000 b) |
|--------|----------------------|

|                               |  |
|-------------------------------|--|
| Peaking                       | Up to 4 peaking settings   |
| Tracking range, including SSC | 0.5% deviation, typical  |
| Clock output jitter           | 400 fs RMS for data rates < 2.5 Gb/s, typical<br>250 fs RMS for data rates ≥ 2.5 Gb/s, typical |

#### Auxiliary clock output

|                  |                                |
|------------------|--------------------------------|
| Connector        | SMA (f)                        |
| Interface        | Single-ended, AC coupled, 50 Ω |
| Output voltage   | 800 mV <sub>pp</sub> , typical |
| Output frequency | 4 GHz to 8 GHz                 |
| Output jitter    | < 100 fs RMS, typical          |

#### Data out 1 & 2

|   |   |
|---|---|
| Connector                               | SMA (f)   |
| Interface                               | Single-ended, AC coupled, 50 Ω                                |
| Data output voltage                     | 350 mV <sub>pp</sub> , typical                                |
| Demultiplexing ratio                    | 1:2   |
| Data output jitter                      | 5 ps pp, typical<br>measured @ 14.2 Gb/s using a 1100 pattern |
| Skew: recovered clock to demux data out | 644 ps, typical   |



Figure 11. USB and LAN connection are located at the back of the Agilent N4877A clock data recovery and demultiplexer 1:2.

#### Rear panel

Connectors rear panel      USB; LAN; IEC power connector

#### General characteristics for N4877A

|                                    |  |
|------------------------------------|--|
| Power consumption                  | 100–240 V, ~50/60 Hz, 90 VA, max                                       |
| Operating temperature              | 10 °C to 40 °C   |
| Storage temperature                | –40 °C to 70 °C  |
| Operating humidity                 | 95% relative humidity, non-condensing                                  |
| Storage humidity                   | 50% relative humidity  |
| Physical dimensions<br>(W x H x D) | Bench top with bumper:<br>228 x 59 x 360 mm (9.0 x 2.3 x 14.2 in)      |
| Rack mount without bumper          | ½ x 19" width, 1U height:<br>213 x 44.5 x 360 mm (8.4 x 1.8 x 14.2 in) |
| Weight net                         | 2.9 kg (6.4 lb)  |
| Weight shipping                    | 5.5 kg (12.1 lb)   |

#### Regulatory standards

|                    |   |
|--------------------|---|
| Safety             | IEC61010-1:2010, EN61010-1:2010, CAN/CSA-C22<br>No. 61010-04, UL 61010-1:2004 |
| EMC                | IEC61326-1:2005, EN61326-1:2006   |
| Quality management | ISO 9004, ISO 14001   |

#### Remote control interface

|                           |   |
|---------------------------|---|
| Connectivity              | USB 2.0, LAN, rear panel  |
| Programming language      | Command line programming interface, SCPI  |
| Standalone user interface | Color, graphical user interface   |
| System requirements       | Operating system: Microsoft Windows XP, SP3 (32 bit),<br>or Vista SP2 (32 and 64 bit), or<br>Windows 7 SP1 (32 and 64 bit) Microsoft .NET 2.0 SP2 |

1. The longest run of consecutive bits is dependent on data rate and loop bandwidth. Characteristic consecutive identical bits (CID): 150.
2. If the N4915A-015 pick-off kit is used on N4877A inputs, the 14 dB loss needs to be taken into account. Sensitivity with the N4915A-015 pick-off kit for CDR is 175 mV differential, typical.
3. If the N4915A-015 pick-off kit is used on N4877A inputs, the 14 dB loss needs to be taken into account. Sensitivity with the N4915A-015 pick-off kit for the demultiplexer is 350 mV differential, typical.
4. Sensitivity might be decreased for data rates above 28.4 Gb/s

## Agilent N1075A Optical Pick-Off/Converters



Figure 12. N1075A optical/pick-off converter for multimode and single-mode Option M14 to > 16 Gb/s (top) and single-mode up to 32 Gb/s Option S32 (bottom)

### Accurate, Convenient Solution for Recovering Clock Signals from High-Speed Optical Communication Signals

- Provides an easy method for using the N4877A clock recovery solution with optical signals
- Extracts a portion of the optical test signal using a built-in coupler. Main optical signal returned to the front panel
- Converts the tapped optical signal to an electrical signal compatible with the N4877A
- Operates with both multimode and single-mode optical signals

Verify the compliance of next-generation transmitters

Many communications standards specify the use of a timing reference recovered from the DUT for transmitter compliance test. Clock recovery with an adjustable loop bandwidth provides an important jitter filtering response that emulates system response and can provide an important margin in eye-mask tests. The N1075A extends the clock recovery performance of the N4877A to provide this capability for optical test.

Test system-level optical waveforms and BER

When an optical transmitter is deployed in a communication system, a timing reference for oscilloscope triggering may not be available and must be derived from the signal-under-test. BERT systems typically only accept electrical signals. The N1075A can be used to derive an electrical signal from an optical input, while passing the main optical signal to the 86100 DCA. The N4877A generates a clock trigger for oscilloscope synchronization. For BER test, the N1075A/N4877A can provide electrical clock and data to the BERT-error-detector derived from an optical signal.

Analyze live traffic of optical communications networks

The N1075A is placed in an active communications link. The coupled signal is converted by the N1075A into an electrical signal that can be monitored with a real-time oscilloscope for protocol and pattern analysis.



Figure 13. A front panel view of the Agilent N1075A M14 optical pick-off/converter.

## Specifications for N1075A

### N1075A-M14 Specifications

|  |  |
|--|--|
| Internal split ratio<br>(to OE / to front panel)                                 | 30/70 multimode path<br>50/50 single-mode path   |
| Data rate range  | DC coupled, to > 16 Gb/s<br>(optical-to-electrical conversion is purely analog and rolls off but continues to operate above 16 Gb/s) |
| Insertion loss   | 4.5 dB 850 nm multimode path<br>4.5 dB 1550 nm single-mode path  |
| Input return loss  | 16 dB multimode path<br>25 dB single-mode path   |
| Wavelength range   | 830 nm to 1360 nm multimode path<br>1250 nm to 1650 nm single-mode path  |
| Noise equivalent power   | 10 $\mu$ W (13 dB SNR or 200 $\mu$ W required to achieve lock with N4877A. Higher powers required above 16 Gb/s)                     |
| Data input/output connectors   | FC/PC 62.5/125 $\mu$ m multimode optical<br>FC/PC 9/125 $\mu$ m single-mode optical<br>3.5 mm electrical (output only)               |
| Optical-to-electrical conversion gain<br>(responsivity is reduced above 16 Gb/s) | 60 V/W minimum multimode path<br>95 V/W minimum single-mode path   |



Figure 14. A front panel view of the Agilent N1075A M14 optical pick-off/converter.

### N1075A-S32 Specifications

|  |   |
|--|---|
| Internal split ratio<br>(to OE / to front panel)                                 | 50/50 single-mode   |
| Data rate range  | DC coupled to 32 Gb/s   |
| Insertion loss   | 4.5 dB 1550 nm single-mode  |
| Input return loss  | 25 dB single-mode   |
| Wavelength range   | 1300 nm to 1620 nm single-mode  |
| Noise equivalent power   | 7.5 $\mu$ W typical (13 dB SNR or 150 $\mu$ W assures lock with N4877A. Higher powers required above 16 Gb/s) |
| Data input/output connectors   | FC/PC 9/125 $\mu$ m single-mode optical<br>2.4 mm electrical (output only)                                    |
| Optical-to-electrical conversion gain<br>(Responsivity is reduced above 16 Gb/s) | 110 V/W minimum   |



Figure 14. A rear panel view of the Agilent N1075A optical pick-off/converter.

### General characteristics for N1075A M14 and S32

|                                 |   |
|---------------------------------|---|
| Power consumption               | 100–240 V, ~47 Hz to 63 Hz, 80 VA max   |
| Operating temperature           | 10 °C to 40 °C  |
| Maximum relative humidity       | 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C Samples of this product have been type tested in accordance with the <i>Agilent Environmental Test Manual</i> and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test methods are aligned with IEC 60068-2 and levels are similar |
| Storage temperature             | –40 °C to 70 °C   |
| Max. altitude                   | Up to 2000 m  |
| Physical dimensions (W x H x D) | Bench top with bumper:<br>228 x 59 x 360 mm (9.0 x 2.3 x 14.2 in)   |
| Rack mount without bumper       | ½ x 19" width, 1U height:<br>213 x 44.5 x 360 mm (8.4 x 1.8 x 14.2 in)  |
| Weight net                      | –M14: 3.06 kg (6.75 lb)<br>–S32: 2.72 kg (6 lb)   |
| Weight shipping                 | 5.7 kg (12.5 lb)  |

### Regulatory standards

|                    |  |
|--------------------|--|
| Safety             | IEC61010-1:2001, EN61010-1:2001, CAN/CSA-C22 No. 61010-04, UL 61010-1:2004 |
| EMC                | IEC61326-5-1:2005, EN61326-2-1:2006  |
| Quality management | ISO 9004, ISO 14000  |

## Agilent N1070A Optical Clock Recovery Solution



Figure 16. N1070A optical clock recovery solution M14/216 for multimode and single-mode to > 16 Gb/s



Figure 17. N1070A optical clock recovery solution S32/232 for single-mode up to 32 Gb/s

A High-Performance,  
Convenient Solution  
for Deriving Clock  
and Synchronization  
from Optical Digital  
Communication Signals

- Bundles the N4877A clock data recovery instrument with the N1075A optical pick-off/converter
- Optional N1027A cabling accessories maintain correct phase relationships between trigger and samples in 86100 oscilloscope applications
- Provides a simple 86100 DCA configuration when both a precision time base and clock data recovery are required

## Achieve accurate waveform jitter analysis

When signals are measured with an oscilloscope that is triggered with a recovered clock, accurate jitter measurements become dependent on maintaining the correct phase relationship between trigger events and sampling. A common example is when there are large jitter components at discrete frequencies common with receiver stress test signals. For example, if a large sinusoidal jitter component is present and the oscilloscope is triggered at one extreme of the jitter deviation, but the sample is acquired at the opposite extreme, the apparent displayed jitter will be double the actual value. Correct phase relationships are maintained through specific cabling between the N1075A, N4877A, and 86100. These cables are provided with the N1070A bundle by ordering the appropriate N1027A accessory cable kit. The N1027A-M14 and N1027A-S32 configurations each have a unique set of cables that provide balance between the trigger and sampling paths.

## Configure an 86100 waveform test system for the highest optical waveform accuracy

The 86100 digital communications analyzer is the industry standard for optical waveform analysis. When analyzing very high data-rate low jitter signals, the 86100 is typically configured with the 86107A precision time base module. When triggering the 86100 with a recovered clock, the ultra-low jitter output from the N1070A/N4877A auxiliary output provides an ideal signal for any version of the 86107A. As an added benefit, the N1070A does not require space in the 86100 mainframe.

## Expected performance of the N1070A

The N1070A optical clock recovery solution is based on the N4877A clock data recovery instrument and the N1075A optical coupler/converter. Specifications are based on the performance of these two individual instruments. Performance of the combined instruments is not warranted, as the solution is not tested as a combined system.

In general, the signal quality and strength required to achieve a phase-locked condition and generate a clock is much less than what would be considered appropriate for an eye-mask test or for parametric analysis of an eye diagram. The N1075A-M14 system is rolling off above 16 Gb/s. However, if the signal power is large, phase lock can be achieved at 25 and 28 Gb/s. The following information provides useful parameters to help determine appropriate signal-level performance for proper operation.

## Operating conditions

### Minimum optical modulation power to achieve lock (at the input of the N1075A)

#### N1070A with N1075 M14

|                       |                  |
|-----------------------|------------------|
| 850 nm multimode path | -9 dBm @ 10 Gb/s |
|                       | -9 dBm @ 14 Gb/s |
|                       | -3 dBm @ 25 Gb/s |
|                       | -1 dBm @ 28 Gb/s |

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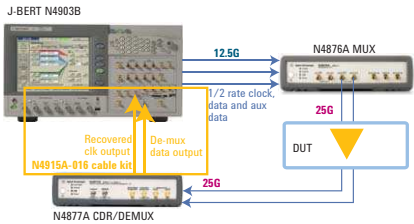
|                          |                   |
|--------------------------|-------------------|
| 1550 nm single-mode path | -10 dBm @ 10 Gb/s |
|                          | -9 dBm @ 14 Gb/s  |
|                          | -5 dBm @ 25 Gb/s  |
|                          | -1 dBm @ 28 Gb/s  |

#### N1070A with N1075 S32

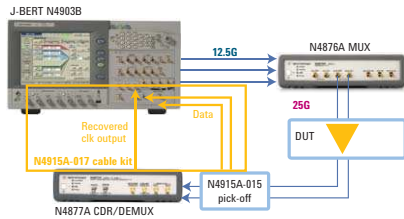
|                          |                   |
|--------------------------|-------------------|
| 1550 nm single-mode path | -15 dBm @ 10 Gb/s |
|                          | -14 dBm @ 14 Gb/s |
|                          | -12 dBm @ 28 Gb/s |
|                          | -10 dBm @ 32 Gb/s |

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## Ordering information N4877A clock data recovery and demultiplexer 1:2



*N491A-016 cable kit is orange in above diagram*



*N491A-017 cable kit is orange in above diagram*

Includes: 2x adapters 2.4 mm (m) to 3.5 mm (f), 4 x 50 Ω termination SMA (m), USB cable, ROHS addendum, commercial calibration report and certificate, CD with software, user guides, and a hard copy Getting Started Guide.

| Description  | Model number |
|--|--------------|
| Clock data recovery and demultiplexer 1:2  | N4877A       |
| Data rate range 50 Mb/s to 32 Gb/s   | N4877A-232   |
| Data rate range 50 Mb/s to 16.5 Gb/s   | N4877A-216   |
| High bandwidth pick-off kit for N4877A   | N4915A-015   |
| <b>Includes:</b>   |              |
| A matched pair of high-bandwidth 14 dB pick-offs 2.4 mm (m) – 3.5 mm (f) – 2.4 mm (f) 14 dB / 20% output to N4877A inputs  |              |
| 2 x 2.4 mm (f) to 2.4 mm (f) adapters  |              |
| 2 x 3.5 mm (m) to 2.4 mm (m) adapters direct mount to N4877A inputs  |              |
| Cable kit for N4877A CDR and demux to N4900 series BERT error detector   | N4915A-016   |
| <b>Remark:</b>   |              |
| This cable kit is recommended if the N4877A CDR and demultiplexer functions are used in combination with a N4900 Series BERT. The cable kit ensures correct data clock delay.  |              |
| <b>The cable kit contains:</b>   |              |
| 1x SMA (m) to SMA (m) cable for clock connection   |              |
| 1x SMA (m) to 2.4 mm (m) cable for demultiplexer out to N4900 series BERT error detector connection  |              |
| Cable kit for N4877A CDR and demux to N4900 series BERT error detector   | N4915A-017   |
| <b>Remark:</b>   |              |
| This cable kit is recommended when the N4877A CDR function but not the demultiplexer function is used in combination with a N4900 Series BERT. The cable kit ensures correct data clock delay when used with the N4915A-015 high bandwidth pick-off set. |              |
| <b>The cable kit contains:</b>   |              |
| 1x SMA (m) to SMA (m) cable for clock connection   |              |
| 1x matched pair 2.4 mm (m) to 2.4 mm (m) cable for pick-off (N4915A-015) out to N4900 Series BERT error detector connection  |              |
| Cable kit: 2.4 mm matched cable pair   | N4910A       |
| Adapter 3.5 mm (f) to 2.4 mm (m)   | N4911A-002   |
| Termination SMA (m) 50 Ω   | N4911A-004   |
| Termination 2.4 mm (m) 50 Ω  | N4912A       |
| Power divider, DC to 26.5 GHz, 3.5 mm (f) – 3.5 mm (f) – 3.5 mm (f)  | 11636B       |
| Power divider, DC to 50 GHz, 2.4 mm (f) – 2.4 mm (f) – 2.4 mm (f)  | 11636C       |
| Adapter 2.4 mm (m) to 3.5 mm (m), DC to 26.5 GHz   | 11901A       |
| Adapter 2.4 mm (m) to 2.4 mm (m), DC to 50 GHz   | 11900A       |
| Rack-mount kit   | N7744A-100   |
| Warranty and calibration service   | R1280        |

Ordering information  
N1075A optical  
pick-off/converter

Included accessories: functional test report; ROHS addendum, FC/PC optical connector adapters.

| Description                         | Model number |
|-------------------------------------|--------------|
| Optical pick-off/converter          | N1075A       |
| Single-mode and multimode > 16 Gb/s | N1075A-M14   |
| Single-mode up to 32 Gb/s           | N1075A-S32   |
| Rack-mount kit                      | E5810A-100   |
| Warranty and calibration service    | R1280        |

Ordering information  
N1070A optical clock  
recovery solution

Included accessories: : All standard accessories included with the N4877A and N1075A and the electrical cable and adapters to connect the N1075A electrical output to the N4877A data input

| Description  | Model number       |
|--|--------------------|
| Optical clock recovery solution  | N1070A             |
| Customer selects N4877A-216 or N4877A-232  | See N4877A details |
| Customer selects N1075A-M14 or N1075A-S32  | See N1075A details |
| Includes phase matching cable kit for N1075A-M14 + N4877A  | N1027A-M14         |
| Includes phase matching cable kit for N1070A-S32 + N4877A  | N1027A-S32         |
| Rackmount kit for one or two instruments   | N7744A-100         |
| Warranty and calibration service (for individual N4877A and N1075A instruments and not as a combined system) | R1280              |

Next to the N4877A clock data recovery and demultiplexer 1:2, Agilent offers a selection of other electrical clock data recovery products

Other clock data recovery  
products

| Description  | Model number |
|--|--------------|
| 13 Gb/s clock data recovery unit 622 Mb/s to 13.5 Gb/s   | N4982A-R13   |
| 26 Gb/s clock recovery module                            | N4982A-R19   |
| 25.8 Gb/s / 28 Gb/s / 31 Gb/s clock data recovery module | N4982A-R25   |
| 28 Gb/s clock data recovery module                       | N4982A-R28   |
| 40 Gb/s clock data recovery module                       | N4982A-R40   |

| Related literature   |                    |
|--|--------------------|
| Title  | Publication number |
| <i>Instrumentation-Grade Clock Recovery Solutions to 32 Gb/s, Brochure</i>   | 5990-9933EN        |
| <i>Agilent 86100D Wide-Bandwidth Oscilloscope, Brochure</i>  | 5990-5822EN        |
| <i>Infiniium 90000 X-Series Oscilloscopes 16-32 GHz True Analog Bandwidth, Data Sheet</i>  | 5990-5271EN        |
| <i>Infiniium DSO90000 Series High-Performance Oscilloscopes, Data Sheet</i>  | 5989-7819EN        |
| <i>J-BERT N4903B High-Performance Serial BERT, Data Sheet</i>  | 5990-3217EN        |
| <i>N4876A 28 Gb/s Multiplexer 2:1, Data Sheet</i>  | 5990-5247EN        |
| <i>ParBERT 81250 System, Technical Overview</i>  | 5968-9188E         |
| <i>Tips and Techniques for Accurate Characterization of 28 Gb/s Designs, Application Note</i>  | 5990-9784EN        |
| <i>Error Detection Up to 28.4 Gb/s During Receiver Test with Agilent J-BERT N4903B Using Under-Sampling Techniques, Application Note</i> | 5990-6239EN        |
| <i>N4960A Serial BERT 32 and 17 GB/s, Data Sheet</i>   | 5991-0712EN        |

## Specification assumptions

Non-warranted values are described as typical.

All specifications are valid in the range from 5 °C to 40 °C except if otherwise stated ambient temperature 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, are valid using the recommended cable set N4910A (2.4 mm, 24" matched pair).



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*For other unlisted countries:*

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