

N1000A DCA-X

Wide Bandwidth Oscilloscope Mainframe and Modules

The N1000A DCA-X performs precision measurements on high speed digital designs from 50 MBd to more than 80 Gbd on up to 16 channels simultaneously. Applications include optical transceiver design and production test, electrical ASIC/FPGA/IC design and characterization, serial bus characterization, and measurements and trouble-shooting via TDR/TDT and S-parameter measurements of channels, cables and PCBs.



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Introduction

Keysight offers complete Digital Communication Analyzer solutions that can be combined with or used alongside the DCA-X, including clock recovery, stand-alone Digital Communication Analyzers (DCA-M) and software. For complete information on Keysight's entire DCA family, please refer to these other helpful documents:

- Keysight DCA Wide Bandwidth Oscilloscope Family Brochure (5992-3301EN)
- Keysight DCA Family FlexDCA Sampling Oscilloscope Software Technical Overview (5992-3319EN)
- Keysight N1000A DCA Wide Bandwidth Oscilloscope Family Configuration Guide (5992-3372EN)
- Keysight DCA Family Clock Data Recovery Solutions Data Sheet (5991-1620EN)
- Keysight N1090A (5992-3655EN), N1092A/B/C/D/E (5992-3886EN), and N1094A/B (5992-3700EN) DCA-M Optical and Electrical Sampling Oscilloscope Data Sheets.



User Interface

The N1000A user interface and operating system is identical to the FlexDCA interface of the DCA-M modules (over a simple USB 2.0 or 3.0 connection) and N1010A FlexDCA on a PC.



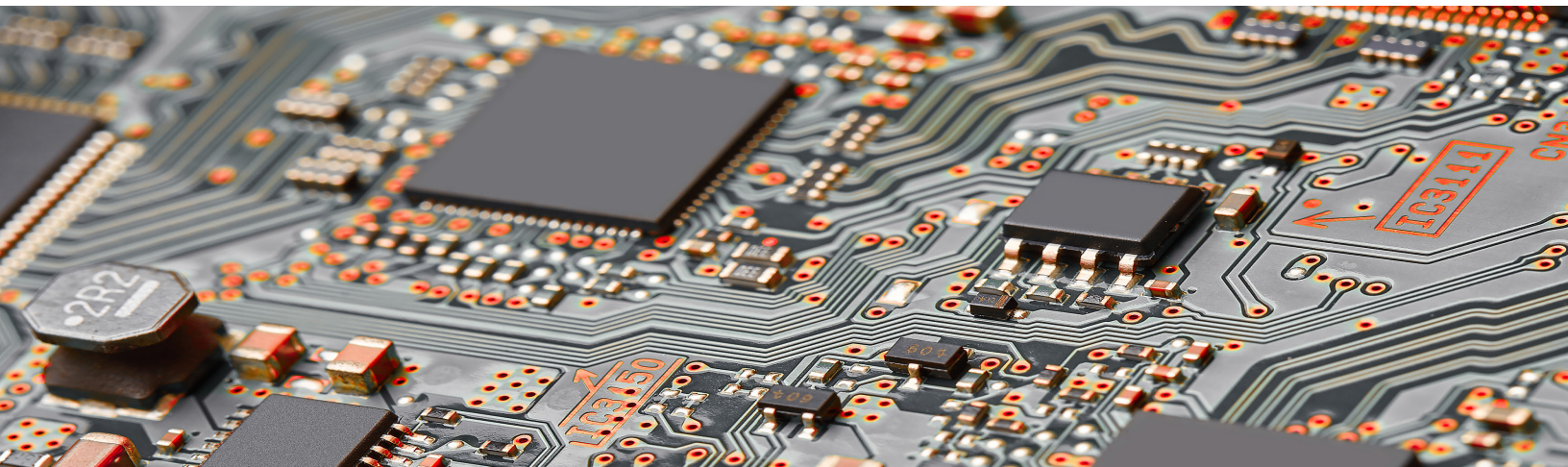
Optical + Electrical and Electrical Clock Recovery



Optical + Electrical DCA-M



FlexDCA Software



N1000A DCA-X Specifications

General notes

NOTE: All specifications describe warranted performance over the temperature range +10°C to + 40°C (unless otherwise noted). The specifications are applicable after the temperature is stabilized, which occurs after 1 hour of continuous operation in final setup configuration and while self calibration is valid. Many performance parameters are enhanced through frequent, simple user calibrations.



NOTE: Specifications describe warranted performance. Characteristics provide useful, nonwarranted information about the functions and performance of the instrument. Characteristics are printed in *green italics*.

NOTE: Factory Calibration Cycle. For optimum performance, the instrument should have a complete verification of specifications once every 12 months.

NOTE: Nominal Value indicates the expected, but not warranted, value of the parameter.

N1000A computer system and storage specifications

| Item | Description |
|------------------|-------------------------------|
| CPU | Intel I5 Quad Core |
| RAM | 8 GB |
| Operating System | Windows 10, 64 bit |
| Mass Storage | 240 GB internal SSD hard disk |

N1000A display specifications

| Item | Description |
|---------------------------|--|
| Display Area | 210.4 mm x 157.8 mm 10.4 inch diagonal color active matrix LCD module incorporating amorphous silicon TFTs. |
| Entire Display Resolution | 1024 pixels horizontally x 768 pixels vertically |
| Waveform Colors | Select from over 16 colors. User may change color assignment of all traces (channels, waveform memory, and signal processing functions). |
| Persistence Modes | Gray scale, color grade, infinite, variable |
| Connect-the-dots | On/Off selectable |
| Persistence | Minimum, variable (100 ms to 40s), infinite |
| Graticule | On/Off |
| Grid Intensity | 0 to 100% |
| Dialog Boxes | Opaque or transparent |
| Supports External Display | Supports multiple display configurations via Windows display utility. |

N1000A environmental specifications

| Item | Description |
|--|---|
| Use | indoor |
| Temperature | |
| Operating | 10°C to +40°C (50°F to +104°F) |
| Non-operating | −40°C to +70°C (−40°F to +158°F) |
| Altitude (Operating) | Up to 4,600 meters (15,000 ft) |
| Humidity ¹ | Type tested at 95%, +40°C (non-condensing) |
| Weight | |
| Mainframe without modules (characteristic) | 20.5 kg (43 lb) |
| Module (characteristic) | 1.2 kg (2.6 lb) |
| Dimensions (excluding handle) | |
| Without front connectors and rear feet | 221 mm H x 426 mm W x 530 mm D (8.7 inch x 16.76 inch x 20.9 inch) |
| With front connectors and rear feet | 234 mm H x 426 mm W x 601 mm D (9.23 inch x 16.76 inch x 23.67 inch) |
| With front cover and rear feet | 234 mm H x 426 mm W x 612 mm D (9.23 inch x 16.76 inch x 24.1 inch) |

1. Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual 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 to MIL-PRF-28800F Class 3.

N1000A LINE power specifications

| Item | Description |
|--|--------------------------|
| Line Power | 100/120Vac, 50/60/400 Hz |
| | 220/240Vac, 50/60 Hz |
| Power in Watts | 700 Watts Maximum |
| The products can operate with mains supply voltage fluctuations up to ±10% of the nominal voltage. | |

N1000A horizontal (timebase) specifications

| Item | Description |
|--|--|
| Scale Factor | Full scale is ten divisions. |
| Minimum | 100 fs/div |
| Maximum | 50 ms/div |
| Delay | Time offset relative to the front panel trigger input on the instrument mainframe. |
| Minimum | 16 ns |
| Maximum | 1s |
| Time Interval Accuracy | 1 ps + 1% of Δ time interval for intervals from minimum delay to minimum delay + 1 ns ¹ , or 6 ps + 1% of Δ time interval ¹ <i>500 fs + 0.25% of Δ time interval (characteristic)²</i> |
| Time Interval Accuracy (Pattern Lock Mode) | 1 GHz to 32 GHz: 500 fs + 0.5% of 1 / (clock input frequency), or 5 ps (whichever is smaller) ¹ 50 MHz to 1 GHz: 500 fs + 0.5% of 1 / (clock input frequency), or 30 ps (whichever is smaller) ¹ <i>250 fs + 0.25% of 1 / (clock input frequency) (characteristic)²</i> |
| Jitter Mode Operation | <i>Time interval accuracy – jitter mode operation 500 fs (characteristic)</i> . Test configuration: PRBS of length 2^7-1 bits, Data and Clock 10 Gb/s. |
| Time Interval Resolution ³ | <i>(screen diameter)/(record length) or 60 fs, whichever is larger</i> |
| Display Units | Unit Interval or Time |
| Record length | |
| Without Pattern Lock | 2 to 128k samples/waveform in increments of 1. |
| With Pattern Lock | 2 to 256M samples/waveform in increments of 1. ⁴ |

1. Dual marker measurement performed at a temperature within $\pm 5^\circ$ C of horizontal calibration temperature.

2. Dual marker measurement performed at a temperature within $\pm 1.5^\circ$ C of horizontal calibration temperature.

3. The time interval resolution is the smallest time you can characterize between two points.

4. Maximum number of samples depends on pattern, number of active channels, available memory, pattern lock enabled, and *Acquire Entire Pattern* enabled.

N1000A front-panel inputs and outputs specifications

| Item | Description |
|---|---|
| Trigger Input, Connector | 2.92 mm (male) Mainframe ships with 2.92 mm female-female connector saver (P/N 1250-4105) |
| Trigger Input, Impedance (Normalized) | 50 Ω |
| Trigger Input, Maximum | 2 Vpp maximum |
| Precision Timebase Input, Connector (Option N1000A-PTB only) | 2.92 mm (male) Mainframe ships with 2.92 mm female-female connector saver (P/N 1250-4105). |
| Precision Timebase Input, Impedance (Normalized) (Option N1000A-PTB only) | 50 Ω |
| Precision Timebase Input, Maximum (Option N1000A-PTB only) | 1.3 Vpp maximum |
| DC Cal Output | BNC (female) Range: -2.0V to +2.0V |
| USB | Three USB 2.0 ports |
| Ground Connection | Banana plug |

N1000A rear-panel inputs and outputs specifications

| Item | Description |
|-----------------|--|
| GPIB | Fully programmable, complies with IEEE 488.2 |
| Display Port | For connecting external displays |
| VGA Port | Analog, full color, 15 pin D-sub (female) |
| LAN | Two Gigabit Ethernet ports |
| USB | Two USB 3.0 ports Two USB 2.0 ports |
| USB Device Port | Instrument control over USB |

N1000A internal precision timebase specifications (Option PTB)

The *N1000A Internal Precision Timebase Specifications* are for Option PTB, which is the N1000A internal precision timebase. These specifications refer to the signal input to the front-panel **Precision Timebase Input** connector.

NOTE: If **Freerun** trigger mode is *not* used, a trigger input *must* also be supplied. This is in addition to the reference clock input to the front-panel **Precision Timebase** connector. The trigger input must be synchronous to the reference clock but may be a sub-rate of the clock based on the required frequency range for the trigger input.

| Item | Description |
|--|---|
| Maximum Input Signal | 1.3 Vpp |
| Input DC Offset Range | ± 200 mV |
| Input Signal Type The internal precision timebase works with typical digital clock signals, such as a BERT output, as well as sine waves. If the rise time or fall time of the clock signal is less than 15% of the period of the clock (for example, less than 15 ps for a 10 GHz clock), reduce the edge speed by using an external low-pass filter or length of cable. For the lowest jitter, use a signal that is as close as possible to the maximum signal amplitude (1.3 Vpp) and minimize any sub-harmonics. | |
| Jitter (Input ≥ 750 mVpp, sinusoidal) (Characteristic) | |
| 2.4 GHz to <4.0 GHz trigger (tested at 2.4 GHz, 750 mVpp) | ≤ 200 fs rms < 400 fs rms, with 54XXX, 8348X, or N1045A (<i>non Option LOJ</i>) module |
| 4 GHz to 9.0 GHz trigger (tested at 5 GHz, 750 mVpp) | ≤ 120 fs rms < 400 fs rms, with 54XXX, 8348X, or N1045A (<i>non Option LOJ</i>) module |
| >9.0 GHz to 44.0 GHz trigger (tested at 10, 20, and 40 GHz, 500 mVpp) | ≤ 90 fs rms < 200 fs rms, with 54XXX, 8348X, or N1045A (<i>non Option LOJ</i>) module |
| Precision Timebase Input | |
| Nominal Impedance | 50Ω |
| Connector Type | 2.92 mm (male) |

N1000A general trigger specifications

| Item | Description |
|------------------------|--------------------------|
| Maximum Trigger Signal | 2V peak-to-peak |
| Trigger Input | |
| Nominal Impedance | 50Ω |
| Reflection | 10% for 100 ps rise time |
| Connector Type | 2.92 mm (male) |

N1000A internal trigger mode specifications

| Item | Description |
|---------|---|
| Freerun | Freerun trigger mode internally generates an asynchronous trigger that allows viewing the sampled signal amplitude without an external trigger signal but provides no timing information. Freerun is useful in troubleshooting external trigger problems. |

N1000A clock trigger / pattern lock mode specifications

| Item | Description ¹ |
|--|--|
| Clock Trigger | 50 MHz to 32 GHz, effective divide-by-one, AC coupled |
| Pattern Lock (Option PLK) | 50 MHz to 32 GHz, AC coupled |
| Pattern Lock Length (Option PLK) | 1 to 2 ²³ (8,388,608) symbols |
| Jitter | |
| 50 MHz to < 500 MHz | 1.0 ps rms + 10 PPM of horizontal position (maximum) <800 fs rms + 5 PPM of horizontal position (typical) |
| 500 MHz to 32 GHz ^{2,3} (Option STB) | 450 fs rms (maximum) 400 fs rms (typical) |
| 500 MHz to 32 GHz ^{2,3} (Option LOJ) | 250 fs rms (maximum) 200 fs rms (typical) |
| Trigger Sensitivity | 200 mV p-p |
| Trigger Slew rate | ≥ 2V/ns |

1. These specifications refer to the signal input to the front-panel **Trigger Input** connector. The sampled input signal timing is recreated by using an externally supplied trigger signal that is synchronous with the sampled signal input.
2. Verified at 10 GHz with a clock and signal slew rate ≥ 15V/ns.
3. Verified at 28 GHz with a clock and signal slew rate ≥ 20V/ns.

N1000A edge trigger mode specifications

| Item | Description ¹ |
|-----------------------------|---|
| Input | DC to 2.5 GHz |
| Jitter ² | 1.0 ps rms + 10 PPM horizontal position (maximum) <800 fs rms + 5 PPM horizontal position (characteristic) |
| Trigger Sensitivity | 200 mV p-p (sinusoidal input or 200 ps minimum pulse width) |
| Triggering Level Adjustment | -1V to +1V |
| Edge Select | Positive or negative |

1. These specifications refer to the signal input to the front-panel **Trigger Input** connector. The sampled input signal timing is recreated by using an externally supplied trigger signal that is synchronous with the sampled signal input.

2. Verified at 2.5 GHz with a clock and signal slew rate $\geq 2V/ns$.

N1000A vertical (channel) specifications

| Item | Description |
|--------------------------------|--|
| Sample Rate | Up to 250 kHz |
| Number of Channels | Up to 16 channels |
| Vertical Resolution | 16 bit hardware A/D converter for N10xx-series modules. 14 bit hardware A/D converter for 861xx, 54xxx, and 8348x-series modules. |
| Full Resolution Channel Scales | Adjusts in a 1-2-5-10 sequence for coarse adjustment or fine adjustment resolution from the front panel knob. |
| Adjustments | Scale, offset, activate filter, sampler bandwidth, attenuation factor, transducer conversion factors |

Module Selection Guides

Optical / electrical modules

| Module | Option | No. of electrical channels | Highest electrical bandwidth (GHz) | No. of optical channels | Wavelength range (nm) | Unfiltered optical bandwidth (GHz) | Fiber input (μm) |
|--------|--------|----------------------------|------------------------------------|-------------------------|-----------------------|------------------------------------|------------------|
| N1030A | | 0 | | 1 | 1250 - 1600 | 65 | 9/125 |
| | EC1 | 1 | 95 | 1 | 1250 - 1600 | 65 | 9/125 |
| N1030B | | 0 | | 2 | 1250 - 1600 | 65 | 9/125 |

Available optical reference filter rates for optical modules

| Module | Option | NRZ < 10 Gb/s | NRZ 10 Gb/s - 14 Gb/s | NRZ 20 Gb/s - 28 Gb/s | NRZ 39 Gb/s - 43 Gb/s | PAM4 26 Gb/s (with option IRC) | PAM4 53 Gb/s (with option IRC) |
|--------|--------|---------------|-----------------------|-----------------------|-----------------------|--------------------------------|--------------------------------|
| N1030A | | | | • | | • | • |
| N1030B | | | | • | | • | • |

Electrical modules

| Module | Option | No. of electrical channels | Highest Electrical bandwidth (GHz) | Step Generator (TDR) |
|--------|--------|----------------------------|------------------------------------|----------------------|
| N1040A | 033 | 2 | 33 | |
| | 060 | 2 | 60 | |
| N1045B | 02x | 2 | 60 | |
| | 04x | 4 | 60 | |
| N1046A | 71F | 1 | 75 | |
| | 72F | 2 | 75 | |
| | 74F | 4 | 75 | |
| | 81F | 1 | 85 | |
| | 82F | 2 | 85 | |
| | 84F | 4 | 85 | |
| | 11F | 1 | 100 | |
| | 12F | 2 | 100 | |
| | 14F | 4 | 100 | |
| N1055A | 32x | 2 | 35 | 2 |
| | 34x | 4 | 35 | 4 |
| | 52x | 2 | 50 | 2 |
| | 54x | 4 | 50 | 4 |
| N1060A | 050 | 2 | 50 | |
| | 085 | 2 | 85 | |

Module SIRC Filters

System Impulse Response Correction (SIRC) filters provide channel SIRC measurement and data files to give an ideal channel response. SIRC data can be applied in FlexDCA's System Impulse Response Correction dialog. The SIRC correction data feature is a digital filter that is used to:

- Improve the response of module reference filters to more closely match an ideal receiver.
- Enable non-standard reference receiver rates or bandwidths.
- Increase the bandwidth of the channel by up to 50%.
- Ensures that an eye diagram will look identical between different modules.

SIRC correction data is unique to a specific 86116C's serial number. The data can be purchased with new modules or purchased separately for your existing modules. Purchasing data for an existing module requires that the module be returned to Keysight Technologies. SIRC data is downloaded from Keysight.com. To order SIRC data, contact your Keysight representative or visit <http://www.keysight.com/Find/FlexDCA>.

NOTE: The SIRC filter ranges shown in the following tables are only available with option IRC and compliance is not guaranteed.

N1030A/B SIRC filter ranges

| Module/Option | Channel | Range ¹ | |
|-----------------------------------|-------------|----------------------|-----------------|
| | | Min SIRC Freq. | Max SIRC Freq. |
| N1030A Option 560 | All Optical | 21.5 GBd (16.13 GHz) | 80 GBd (60 GHz) |
| N1030A Options 280 <i>and</i> 560 | All Optical | 15.6 GBd (11.7 GHz) | 80 GBd (60 GHz) |
| N1030A Option EC1 | Electrical | 20 GHz | 127 GHz |

¹ Only available with option IRC and compliance not gaurented.

N1040A SIRC filter ranges

| Module/Option | Channel | Range ¹ | |
|-------------------|---------|--------------------|----------------|
| | | Min SIRC Freq. | Max SIRC Freq. |
| N1040A Option 033 | All | 10 GHz | 38 GHz |
| N1040A Option 060 | All | 10 GHz | 70 GHz |

¹ Only available with option IRC and compliance not gaurented.

N1045B SIRC filter ranges

| Module/Option | Channel | Range ¹ | |
|---------------|---------|--------------------|----------------|
| | | Min SIRC Freq. | Max SIRC Freq. |
| N1045B | All | 10 GHz | 70 GHz |

¹ Only available with option IRC and compliance not guaranteed.

N1046A SIRC filter ranges

| Module/Option | Channel | Range ¹ | |
|-------------------|---------|--------------------|----------------|
| | | Min SIRC Freq. | Max SIRC Freq. |
| N1046A Option 1xF | All | 22.5 GHz | 130 GHz |
| N1046A Option 7xF | All | 22.5 GHz | 80 GHz |
| N1046A Option 8xF | All | 22.5 GHz | 90 GHz |

¹ Only available with option IRC and compliance not guaranteed.

N1060A SIRC filter ranges

| Module/Option | Channel | Range ¹ | |
|------------------------|---------|--------------------|----------------|
| | | Min SIRC Freq. | Max SIRC Freq. |
| N1060A Option 050 | All | 25 GHz | 60 GHz |
| N1060A Option 085 | All | 25 GHz | 100 GHz |
| N1060A Option E33, 050 | All | 16.5 GHz | 60 GHz |
| N1060A Option E33, 085 | All | 16.5 GHz | 100 GHz |

¹ Only available with option IRC and compliance not guaranteed.

Module Specifications

NOTE: All specifications describe warranted performance over the temperature range +10°C to +40°C (unless otherwise noted). The specifications are applicable after the temperature is stabilized, which occurs after 1 hour of continuous operation in final setup configuration and while self calibration is valid. Many performance parameters are enhanced through frequent, simple user calibrations.

NOTE: Specifications describe warranted performance. Characteristics provide useful, nonwarranted information about the functions and performance of the instrument. Characteristics are printed in *green italics*.

NOTE: Factory Calibration Cycle. For optimum performance, the instrument should have a complete verification of specifications once every 12 months.

NOTE: Nominal Value indicates the expected, but not warranted, value of the parameter.



N1030A/B module specifications



N1030A/B optical channel specifications

| Item | Description | |
|--|---|------------|
| Optical Channel Count | 1 (N1030A) 2 (N1030B) | |
| Optical Channel Bandwidth, -3 dB | 65 GHz (<i>characteristic</i>) ¹ 60 GHz ² | |
| Nominal Wavelength Range | 1250 nm to 1600 nm | |
| Factory calibrated wavelengths ³ | 1310 nm (± 20 nm) 1550 nm (± 20 nm) | |
| User calibration wavelength range | 1250 nm to 1600 nm | |
| Reference receiver filters ⁴ | | |
| | 25 Gb/s Ethernet (25.78125 Gb/s) 400GBASE-SR16 (26.5625 Gb/s) Ethernet OTU4 FEC/ITU-T G.959.1 (27.952493 Gb/s) 32G Fibre Channel (28.05 Gb/s) 53.125 GBaud PAM4 TDECQ (26.6 GHz) 53.125 GBaud NRZ (39.8 GHz) | |
| RMS Noise (<i>Characteristic</i>) | 1310 nm | 1550 nm |
| 25 Gb/s Ethernet (25.78125 Gb/s) | 16 μW | 18 μW |
| 400GBASE-SR16 (26.5625 Gb/s) | 16 μW | 18 μW |
| Ethernet OTU4 FEC/ITU-T G.959.1 (27.952493 Gb/s) | 16 μW | 18 μW |
| 32G Fibre Channel (28.05 Gb/s) | 16 μW | 18 μW |
| 53.125 GBaud PAM4 TDECQ (26.6 GHz) | 18 μW | 22 μW |
| 53.125 GBaud NRZ (39.8 GHz) | 30 μW | 35 μW |
| Unfiltered (60 GHz) | 35 μW | 45 μW |
| Unfiltered (65 GHz) | 80 μW | 95 μW |

| | | |
|---|--|-------------|
| RMS Noise (Maximum) | 1310 nm | 1550 nm |
| 25 Gb/s Ethernet (25.78125 Gb/s) | 20 μ W | 25 μ W |
| 400GBASE-SR16 (26.5625 Gb/s) | 20 μ W | 25 μ W |
| Ethernet OTU4 FEC/ITU-T G.959.1 (27.952493 Gb/s) | 20 μ W | 25 μ W |
| 32G Fibre Channel (28.05 Gb/s) | 20 μ W | 25 μ W |
| 53.125 GBaud PAM4 TDECQ (26.6 GHz) | 30 μ W | 35 μ W |
| 53.125 GBaud NRZ (39.8 GHz) | 40 μ W | 55 μ W |
| Unfiltered (60 GHz) | 50 μ W | 65 μ W |
| Unfiltered (65 GHz) | 105 μ W | 110 μ W |
| Optical Sensitivity (<i>Characteristic</i>) ⁵ | 1310 nm | 1550 nm |
| 25 Gb/s Ethernet (25.78125 Gb/s) | -6.5 dBm | -6.0 dBm |
| 400GBASE-SR16 (26.5625 Gb/s) | -6.5 dBm | -6.0 dBm |
| Ethernet OTU4 FEC/ITU-T G.959.1 (27.952493 Gb/s) | -6.5 dBm | -6.0 dBm |
| 32G Fibre Channel (28.05 Gb/s) | -6.5 dBm | -6.0 dBm |
| Scale Factor Specifications (per division, 8 divisions) | | |
| Minimum | 5 μ W | |
| Maximum | 500 μ W | |
| CW Offset Range ⁶ | +1.0 mW to -3 mW | |
| CW Accuracy (single mode) ⁷ | $\pm 15 \mu\text{W} \pm 1.5\%$ of reading \pm connector uncertainty (<i>Characteristic</i>) $\pm 30 \mu\text{W} \pm 3\%$ of reading \pm connector uncertainty | |
| Maximum Measureable Input Power | 4 mW at 500 μ W/division scale factor | |
| Average Power Monitor Range | -30 dBm to +6 dBm (1310 nm) -30 dBm to +6 dBm (1550 nm) | |
| Average Power Monitor Accuracy ⁸ | | |
| For $1 \mu\text{W} \leq P_{\text{input}} \leq 2 \text{ mW}$ | 200 nW \pm 5% of reading \pm connector uncertainty | |
| For $2 \text{ mW} \leq P_{\text{input}} \leq 4 \text{ mW}$ | 200 nW \pm 10% of reading - 100 μ W \pm connector uncertainty | |
| Maximum Non-destruct Peak Power | 5 mW (+7 dBm) | |

| | |
|-----------------------|---------------------|
| Fiber Input | 9/125 μm |
| Fiber Input Connector | FC |
| Channel ADC | 16 bits |

¹ With the unfiltered setting selected, -3 dBo is calculated from the -6 dBe point.

² Tuned to -3 dBo (\pm measurement uncertainty) at stated bandwidth(s).

³ For the average power monitor and the channel vertical path.

⁴ The frequency response is verified using an optical impulse (< 1 ps FWHM).

⁵ Generally represents the power level where an ideal eye diagram will approach 0% mask margin due to the noise of the oscilloscope.

Provides a *non-specified* figure of merit to compare sensitivities of various optical channels. These values are calculated from the characteristic noise values.

⁶ Referenced two divisions from screen bottom.

⁷ Single marker, referenced to power sensor.

⁸ Average power monitor accuracy is tied to the calibration accuracy of the power sensor.

N1030A (Option EC1) electrical channel specifications

| Item | Description |
|--|---|
| Electrical Channel Count | 1 |
| Electrical Input Connectors | 1 mm (m) bulkhead |
| Bandwidth, -3 dB (user selectable) | 33, 40, 50, 70, 85, and 95 GHz ¹ |
| Transition Time (10% to 90% calculated from $TR = 0.35/BW$) | |
| 33 GHz BW | 10.6 ps (Calculated) |
| 40 GHz BW | 8.8 ps (Calculated) |
| 50 GHz BW | 7.0 ps (Calculated) |
| 70 GHz BW | 5 ps (Calculated) |
| 85 GHz BW | 4.2 ps (Calculated) |
| 95 GHz BW | 3.7 ps (Calculated) |
| RMS Noise (Characteristic) | |
| 33 GHz BW | 350 μ V (Characteristic) |
| 40 GHz BW | 350 μ V (Characteristic) |
| 50 GHz BW | 450 μ V (Characteristic) |
| 70 GHz BW | 650 μ V (Characteristic) |
| 85 GHz BW | 950 μ V (Characteristic) |
| 95 GHz BW | 1150 μ V (Characteristic) |
| RMS Noise (Maximum) | |
| 33 GHz BW | 450 μ V |
| 40 GHz BW | 500 μ V |
| 50 GHz BW | 600 μ V |
| 70 GHz BW | 800 μ V |
| 85 GHz BW | 1200 μ V |
| 95 GHz BW | 1400 μ V |
| Scale Factor (per division) | |

| | |
|---|---|
| Minimum | 1 mV/division |
| Maximum | 100 mV/division |
| DC Accuracy (V_{AVG} Measurement) (at 33, 40, 50, 70, 85, 95 GHz BWs) ² | |
| Specification | ± 2 mV $\pm 4\%$ (reading – offset) |
| Characteristic | ± 2 mV |
| DC Offset Range (referenced to center of screen) | ± 500 mV |
| Input Dynamic Range (relative to channel offset) | ± 400 mV |
| Maximum Input Signal | ± 2 V (+16 dBm) |
| Maximum Sample Rate | |
| When used in an 86100D mainframe | 40 kSa/s (<i>Characteristic</i>) |
| When used in an N1000A mainframe | 250 kSa/s (<i>Characteristic</i>) |
| Nominal Input Impedance | 50 Ω |

¹ Tuned to be –3 dB (\pm measurement uncertainty) at stated bandwidth(s).

² Specified at calibration temperature ± 0.5 °C. Perform a new module calibration if hardware skew has been applied.

N1040A module specifications



N1040A specifications

| Item | Description | |
|--|-------------------------|--------------------------------------|
| Electrical Channel Count | 2 | |
| Electrical Input Connectors | Option 033 | Option 060 |
| | 2.92 mm | 1.85 mm |
| Bandwidth, 3 dB (user selectable) ¹ | Option 033 | Option 060 |
| | 20 GHz 33 GHz | 20 GHz 33 GHz 40 GHz 60 GHz |
| Transition Time (10% to 90% calculated from TR = 0.35/BW) | Option 033 | Option 060 |
| 20 GHz BW | 17.5 ps (Calculated) | 17.5 ps (Calculated) |
| 33 GHz BW | 10.6 ps (Calculated) | 10.6 ps (Calculated) |
| 40 GHz BW | — | 8.8 ps (Calculated) |
| 60 GHz BW | — | 5.8 ps (Calculated) |
| Channel-to-Channel Skew Range | ±100 ps | |
| RMS Noise | Option 033 | Option 060 |
| 20 GHz BW | 275 μV (Characteristic) | 275 μV (Characteristic) |
| 33 GHz BW | 350 μV (Characteristic) | 350 μV (Characteristic) |
| 40 GHz BW | — | 450 μV (Characteristic) |
| 60 GHz BW | — | 550 μV (Characteristic) |
| RMS Noise (Maximum) | 500 μV | 800 μV |
| Scale Factor (per division) | | |

| | |
|---|--|
| Minimum | 1 mV/division |
| Maximum | 100 mV/division |
| DC Accuracy (V_{AVG} Measurement) (at 20, 33, 40, 60 GHz BWs) ² | |
| Specification | $\pm 2 \text{ mV} \pm 4\%$ of (reading – channel offset) |
| Characteristic | $\pm 1.15 \text{ mV}$ |
| DC Offset Range (referenced to center of screen) | $\pm 500 \text{ mV}$ |
| Input Dynamic Range (relative to channel offset) | $\pm 400 \text{ mV}$ |
| Maximum Input Signal | $\pm 2 \text{ V}$ (+16 dBm) |
| Maximum Sample Rate | |
| When used in an 86100D mainframe | 40 kSa/s (<i>Characteristic</i>) |
| When used in an N1000A mainframe | 250 kSa/s (<i>Characteristic</i>) |
| Nominal Input Impedance | 50 Ω |
| Reflections (for 30 ps rise time) | 20% (<i>Characteristic</i>) |

¹ Tuned to be –3 dB (\pm measurement uncertainty) at stated bandwidths.

² Specified at calibration temperature $\pm 0.5 \text{ }^\circ\text{C}$. Perform a new module calibration if hardware skew has been applied.

N1045B module specifications

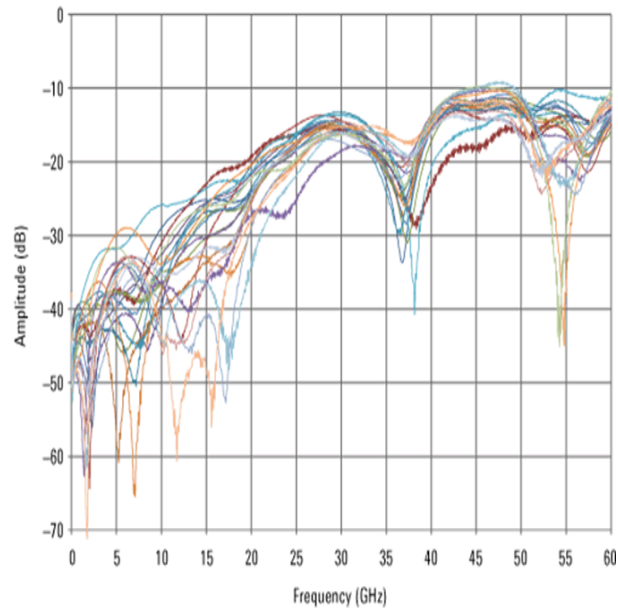


N1045B specifications

| Item | Description |
|--|--|
| Electrical Input Channels (per option) | |
| 02F | 2 Channel Remote Head with 1.85 mm (f) connectors. |
| 02M | 2 Channel Remote Head with 1.85 mm (m) connectors. |
| 04F | 4 Channel Remote Head with 1.85 mm (f) connectors. |
| 04M | 4 Channel Remote Head with 1.85 mm (m) connectors. |
| Remote Head Cable Length | The nominal length of the remote head cables is 1270 mm as measured from the module's front panel to the remote head's casing. |
| Bandwidth, 3 dB (user selectable) | 20 GHz (Characteristic) 35 GHz (Characteristic) 45 GHz (Characteristic) 60 GHz |
| Transition Time (10% to 90% calculated from $TR = 0.35/BW$) | |
| 20 GHz BW | 17.5 ps (Calculated) |
| 35 GHz BW | 10 ps (Calculated) |
| 45 GHz BW | 7.8 ps (Calculated) |
| 60 GHz BW | 5.8 ps (Calculated) |
| Channel-to-Channel Skew Range | ± 100 ps |
| RMS Noise | |
| 20 GHz BW | 310 μV (Characteristic) |
| 35 GHz BW | 450 μV (Characteristic) |
| 45 GHz BW | 530 μV (Characteristic) |

| | |
|--|---|
| 60 GHz BW | 875 μ V (<i>Characteristic</i>) |
| RMS Noise (<i>Maximum</i>) | 975 μ V (60 GHz BW setting) |
| Scale Factor (per division) | |
| Minimum | 1 mV/division |
| Maximum | 100 mV/division |
| DC Accuracy (V_{AVG} Measurement). Specified at calibration temperature ± 0.5 °C. (Perform a new module calibration if hardware skew has been applied.) | |
| 20, 35, 45, 60 GHz | ± 1.15 mV (<i>Characteristic</i>) |
| DC Accuracy (V_{AVG} Measurement). Specified at calibration temperature ± 5 °C. | |
| 20, 35, 45, 60 GHz | ± 2 mV $\pm 4\%$ of (reading – channel offset) |
| DC Offset Range (referenced to center of screen) | ± 500 mV |
| Input Dynamic Range (relative to channel offset) | ± 400 mV |
| Maximum Input Signal | ± 2 V (+16 dBm) |
| Maximum Sample Rate | 250 kSa/s (<i>when used in N1000A Mainframe, Characteristic</i>) 40 kSa/s (<i>when used in 86100D Mainframe, Characteristic</i>) |
| Nominal Input Impedance | 50 Ω (<i>Characteristic</i>) |
| Reflections (for 30 ps rise time) | 20% (<i>Characteristic</i>) |

Input Impedance (Graph of S11) , *Characteristic*



N1046A module specifications



N1046A maximum BW per option specifications

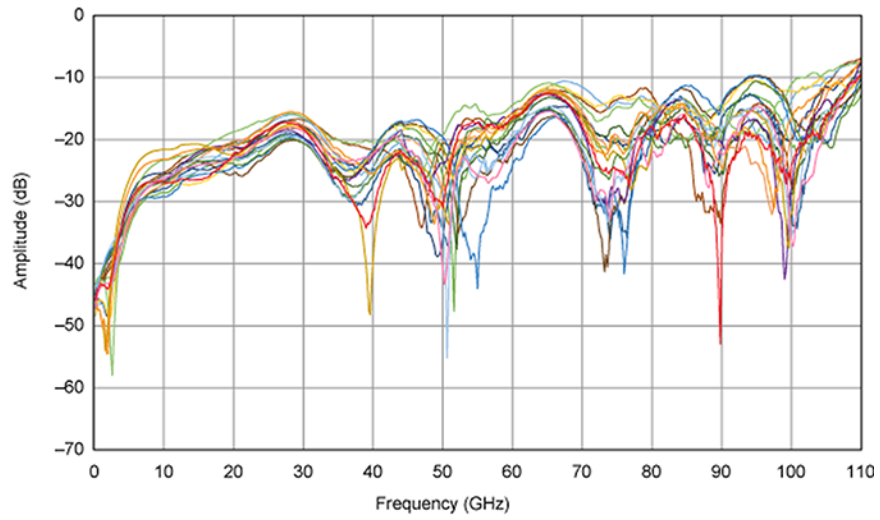
| Option | Maximum BW | | | | | | | | |
|--------|------------|--------|---------|-----------|--------|---------|-----------|--------|---------|
| | 1 Channel | | | 2 Channel | | | 4 Channel | | |
| | 75 GHz | 85 GHz | 100 GHz | 75 GHz | 85 GHz | 100 GHz | 75 GHz | 85 GHz | 100 GHz |
| 71F | ◆ | | | | | | | | |
| 81F | | ◆ | | | | | | | |
| 11F | | | ◆ | | | | | | |
| 72F | | | | ◆ | | | | | |
| 82F | | | | | ◆ | | | | |
| 12F | | | | | | ◆ | | | |
| 74F | | | | | | | ◆ | | |
| 84F | | | | | | | | ◆ | |
| 14F | | | | | | | | | ◆ |

N1046A specifications

| Item | Description | | |
|--|---|--|--|
| Bandwidth ^a , 3 dB (user selectable) | Options | | |
| | 71F, 72F, and 74F | 81F, 82F, and 84F | 11F, 12F, and 14F |
| 45 GHz | ◆ | ◆ | ◆ |
| 60 GHz | ◆ | ◆ | ◆ |
| 75 GHz | ◆ | ◆ | ◆ |
| 85 GHz | | ◆ | ◆ |
| 100 GHz | | | ◆ |
| 122 GHz (Characteristic) | | | ◆ |
| Transition Time (10% to 90% calculated from $t_r = 0.35/BW$) | Options | | |
| | 71F, 72F, and 74F | 81F, 82F, and 84F | 11F, 12F, and 14F |
| 45 GHz | 7.8 ps | 7.8 ps | 7.8 ps |
| 60 GHz | 5.9 ps | 5.9 ps | 5.9 ps |
| 75 GHz | 4.7 ps | 4.7 ps | 4.7 ps |
| 85 GHz | — | 4.2 ps | 4.2 ps |
| 100 GHz | — | — | 3.5 ps |
| 122 GHz (Characteristic) | — | — | < 3.2 ps |
| Channel-to-Channel Skew Range | ±100 ps | | |
| RMS Noise | Options | | |
| | 71F, 72F, and 74F | 81F, 82F, and 84F | 11F, 12F, and 14F |
| 45 GHz | 600 μ V 440 μ V (Characteristic) | 600 μ V 440 μ V (Characteristic) | 600 μ V 440 μ V (Characteristic) |
| 60 GHz | 750 μ V 580 μ V (Characteristic) | 750 μ V 580 μ V (Characteristic) | 750 μ V 580 μ V (Characteristic) |
| 75 GHz | 1 mV 780 μ V (Characteristic) | 1 mV 780 μ V (Characteristic) | 1 mV 780 μ V (Characteristic) |
| 85 GHz | — | 1200 μ V 900 μ V (Characteristic) | 1200 μ V 900 μ V (Characteristic) |

| | | | |
|--|--|---|--|
| 100 GHz | — | — | 1400 μ V 1050 μ V (Characteristic) |
| 122 GHz (Characteristic) | — | — | 2000 μ V (Characteristic) |
| Scale Factor (per division) | | | |
| Minimum | 1 mV/division | | |
| Maximum | 100 mV/division | | |
| DC Accuracy (V_{AVG} Measurement) | | | |
| Specified at calibration temperature ± 0.5 °C. (Perform a new module calibration if hardware skew has been applied.) | ± 2 mV (Characteristic) | | |
| Specified at calibration temperature ± 5 °C. | ± 2 mV \pm 4% of (reading – channel offset) | | |
| DC Offset Range (referenced to center of screen) | ± 500 mV | | |
| Input Dynamic Range (relative to channel offset) | ± 400 mV | | |
| Maximum Input Signal | ± 2 V (+16 dBm) | | |
| Maximum Sample Rate | When used in an 86100D mainframe: 40 kSa/s (Characteristic). When used in an N1000A mainframe: 250 kSa/s (Characteristic) | | |
| Nominal Input Impedance | 50 Ω (Characteristic) | | |
| Remote Head Cable Length | The nominal length of the remote head cables is 1270 mm as measured from the module's front panel to the remote head's casing. | | |
| Input Impedance | | | |

Graph of S11 (*Characteristic*)



- a. Tuned to be -3 dB (\pm measurement uncertainty) at stated bandwidth(s), except for 122 GHz which is tuned for highest bandwidth while keeping channel noise ≤ 2.5 mV RMS.

N1055A module specifications



N1055A general specifications

| Item | Module Options (Connectors: F = female, M = male) | | | |
|--|--|--------------------------|---|--------------------------|
| | N1055A-32F N1055A-32M | N1055A-34F N1055A-34M | N1055A-52F N1055A-52M | N1055A-54F N1055A-54M |
| Number of Channels | 2 ^a | 4 | 2 ^a | 4 |
| Remote Head Cable Length | The nominal length of the remote head cables is 1270 mm as measured from the module's front panel to the remote head's casing. | | | |
| Electrical Input^b | 2.92 mm (female or male) | | 1.85 mm (female or male) | |
| Electrical Channel Bandwidth | 35 GHz ^{c, d} | | 35 GHz or 50 GHz ^d | |
| Receiver Transition Time (10% to 90% calculated from $T_R = 0.35/BW$) | 10 ps, characteristic | | 10 ps (35 GHz BW setting), characteristic 7 ps (50 GHz BW setting), characteristic | |
| Channel-to-Channel Skew Range | ±150 ps | | | |
| Vertical Resolution | 16 bit A/D converter | | | |
| RMS Noise | 600 μV, characteristic 730 μV, maximum | | 600 μV (35 GHz BW setting), characteristic 750 μV (50 GHz BW setting), characteristic 950 μV (50 GHz BW setting), maximum | |
| Scale Factor (Per Division) | | | | |
| Minimum | 1 mV / division | | | |
| Maximum | 100 mV / division | | | |

| | |
|--|---|
| DC Accuracy (V_{AVG} Measurement) | $\pm 800 \mu V$, <i>characteristic</i> Specified at calibration temperature $\pm 0.5^\circ C$. (Perform a new module calibration if hardware skew has been applied.) |
| | $\pm 2 mV \pm 4\%$ of (reading–channel offset) Specified at calibration temperature $\pm 10^\circ C$ |
| DC Offset Range (referenced from center of screen) | $\pm 500 mV$ |
| Input Dynamic Range (relative to channel offset) | $\pm 400 mV$ |
| Maximum Input Signal | +2V / –1V |
| Nominal Impedance | 50 ohm |
| Maximum Sample Rate, module timebase ^e | |
| Option-FS1 | 250 kSa/s, <i>characteristic</i> |
| standard | 80 kSa/s, <i>characteristic</i> |
| TDR Step Repetition Rate ^e | |
| Mainframe Timebase | 1 kHz to 250 kHz, <i>characteristic</i> |
| Module timebase (standard) | 1 kHz to 80 kHz, <i>characteristic</i> |
| Module timebase (Option FS1) | 1 kHz to 250 kHz, <i>characteristic</i> |

- a. Upgradable from 2 channel to 4 channel after purchase (return to Keysight).
- b. Connector style is the same on all channels and is selected at time of order.
- c. Upgradable from 35 GHz to 50 GHz after purchase (return to Keysight).
- d. Tuned to be –3 dB (\pm measurement uncertainty) at stated bandwidth(s) using NIST traceable swept-sine test system.
- e. FlexDCA software auto-selects the mainframe or module timebase dependent on the DUT setup. In cases where the mainframe timebase is used, the maximum sample rate will be:
86100D Mainframe: 40 kSa/s for standard modules and modules with option-FS1, (*characteristic*).
N1000A Mainframe: 80 kSa/s for standard modules and 250 kSa/s for modules with option-FS1, (*characteristic*).

TDR system specifications

| Item | Module Options (Connectors: F = female, M = male) | |
|---|--|--|
| | N1055A-32F N1055A-32M N1055A-34F N1055A-34M | N1055A-52F N1055A-52M N1055A-54F N1055A-54M |
| Incident ^{a, b} TDR Step Transition Time (10 % to 90 %) | | |
| Without TDR Calibration | < 18 ps | < 7 ps |
| With TDR Calibration | <i>Adjustable from 15 ps, characteristic</i> | <i>Adjustable from 6 ps, characteristic</i> |
| Reflected ^b TDR Step Transition Time (10% to 90%) | | |
| Without TDR Calibration | < 20 ps | < 11 ps |
| With TDR Calibration | < 18 ps | <i>9.5 ps, characteristic</i> |
| TDR Step Amplitude (Combined Oscilloscope and TDR Performance) | 100 mV Setting: 0 mV to ±100 mV 200 mV Setting: 0 mV to ±200 mV | 100 mV Setting: 0 mV to ±100 mV 200 mV Setting: 0 mV to ±200 mV |

a. Incident TDR edge speed is defined as the transition time at the output of the remote head. It is calculated by de-convolving the receiver transition time from the measured transition time when the remote head is terminated with a short.

b. Measured on a negative TDR step, terminated in a short.

Step flatness (graphs of combined oscilloscope and TDR performance)

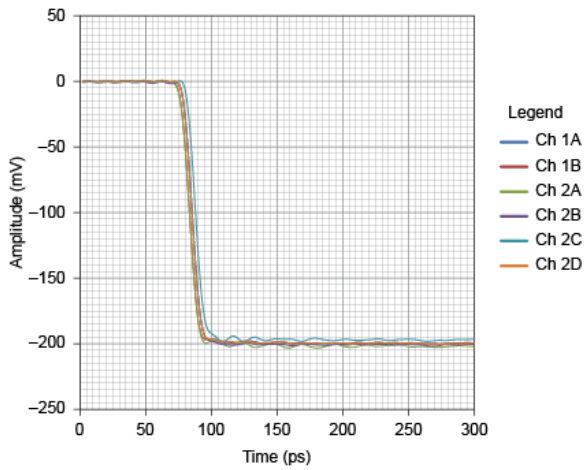


Figure 1. Options 52F, 52M, 54F, and 54M with TDR Calibration (Characteristic)

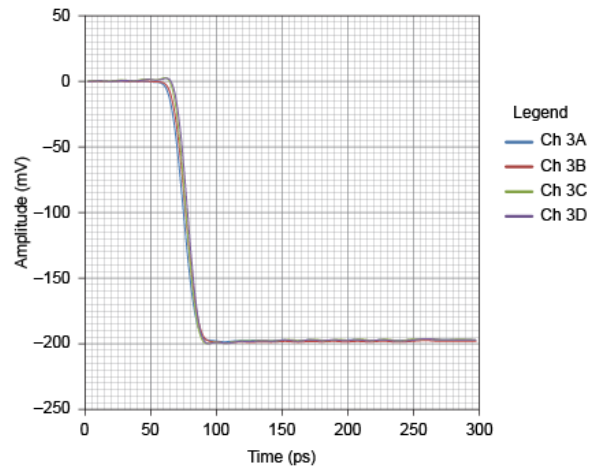


Figure 2. Options 32F, 32M, 34F, and 34M with TDR Calibration (Characteristic)

In the following two graphs, the blue trace shows Channel A, the red trace shows Channel B, The green trace shows Channel C, and the yellow trace shows Channel D.

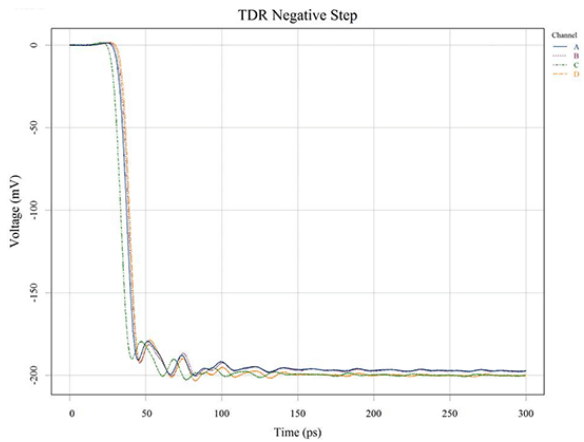


Figure 3. Options 52F, 52M, 54F, and 54M without TDR Calibration (Characteristic)

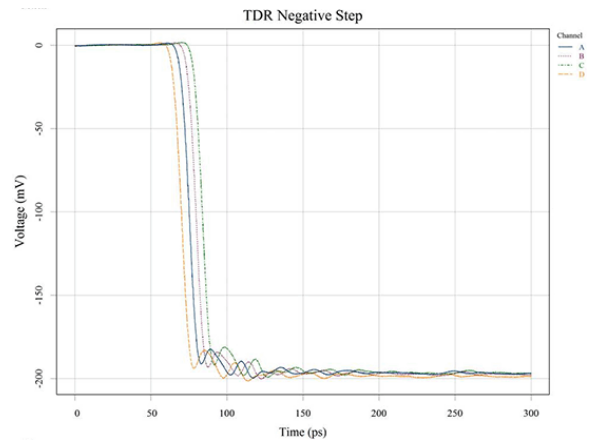


Figure 4. Options 32F, 32M, 34F, and 34M without TDR Calibration (Characteristic)

N1055A performance characteristics

Apply when N1055A used with N1010300A Signal Integrity Package for FlexDCA Sampling Oscilloscope Software. Test conditions:

- Mainframe and module have been turned on for at least one hour and have been calibrated
- TDR calibration has been performed using appropriate electronic or mechanical calibration units
- Derived from measurements made on 1.85 mm verification devices that were calibrated by Keysight metrology lab
- Averages of 512 except as noted in dynamic range

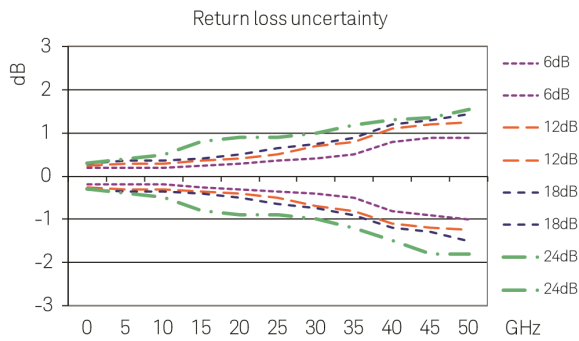


Figure 5. Return Loss Uncertainty (Characteristic)

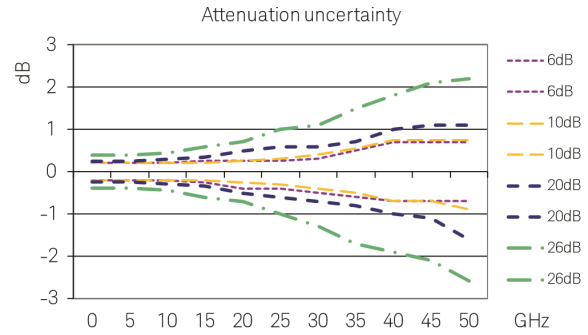


Figure 6. Attenuation Uncertainty (Characteristic)

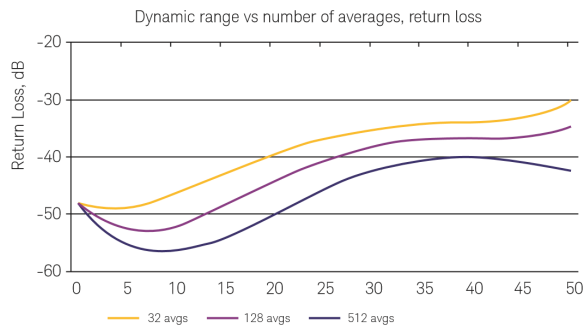


Figure 7. Dynamic Range vs Number of Averages, Return Loss (Characteristic)

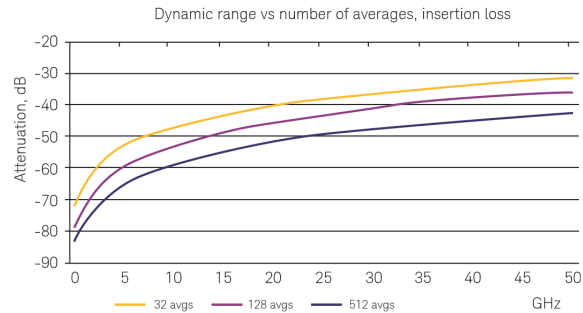


Figure 8. Dynamic Range vs Number of Averages, Insertion Loss (Characteristic)

N1060A module specifications



N1060A general specifications

| Item | Option 050 | Option 085 |
|---|--|--|
| Bandwidth ^a , 3 dB (user selectable) | 50 GHz | 50 GHz, 70 GHz, 85 GHz, and 95 GHz <i>(characteristic)</i> |
| Risetime (10% to 90%, calculated from TR = 0.35/BW) | 7 ps <i>(characteristic)</i> | 4 ps <i>(characteristic)</i> |
| RMS noise | | |
| Characteristic | 0.7 mV (50 GHz) | 0.7 mV (50 GHz) 1.1 mV (75 GHz) 1.2 mV (85 GHz) 1.6 mV (95 GHz) |
| Maximum | 1 mV (50 GHz) | 1 mV (50 GHz) 1.3 mV (75 GHz) 1.6 mV (85 GHz) 2.0 mV (95 GHz) |
| Scale Factor (per division) | | |
| Minimum | 1 mV/division | |
| Maximum | 140 mV/division | |
| DC Accuracy (V_{AVG} Measurement) | | |
| Specified at calibration temperature $\pm 0.5^{\circ}\text{C}$. (Perform a new module calibration if hardware skew has been applied.) | ± 2 mV <i>(Characteristic)</i> | |
| Specified at calibration temperature $\pm 5^{\circ}\text{C}$. | ± 2 mV $\pm 4\%$ of (reading - channel offset) | |
| DC offset range (referenced from center of screen) | ± 560 mV | |
| Input dynamic range (relative to channel offset) | ± 560 mV | |
| Maximum input signal | $\pm 1\text{V}$ (+10 dBm) | |

| | |
|---|---|
| Random Jitter (clock recovery without precision timebase active) | |
| N1000A-LOJ | < 200 fs (<i>characteristic</i>) at 10.3 GHz, 26.56 GHz. |
| N1000A-STD | < 400 fs (<i>characteristic</i>) at 10.3 GHz, 26.56 GHz. |
| Random jitter (clock recovery and precision timebase configuration) ^b | < 80 fs (≥ 10 GHz) 45 fs (<i>characteristic</i>) at 26.56 GHz 60 fs (<i>characteristic</i>) at 10.3 GHz |
| Random jitter (external trigger signal applied to precision timebase input) ^c | < 80 fs (≥ 10 GHz) 45 fs (<i>characteristic</i>) at 26.56 GHz 60 fs (<i>characteristic</i>) at 10.3 GHz |
| Precision timebase reference input frequency range | 2.4 to 32 GHz |
| Precision timebase reference input amplitude (recommended for optimal jitter performance) | 1.0 to 1.6 Vpp (<i>characteristic</i>) |
| Precision timebase input signal type (The precision timebase performs optimally with a sinusoidal input. Non-sinusoidal signals will operate with some degradation in timebase linearity.) | Sinusoid |
| Precision timebase maximum input level | ± 2 V (16 dBm) |
| Precision timebase nominal input impedance | 50 ohm |
| Precision timebase connector type | 2.92 mm male |
| Channel nominal impedance | 50 ohm |
| Electrical Input | 1 mm (male) ^d |
| Channel-to-channel skew range | ± 100 ps |
| Effective trigger-to-sample delay (clock recovery and precision timebase configuration) | < 350 ps (<i>characteristic</i>) |

a. Tuned to be -3 dB (\pm measurement uncertainty) at stated bandwidths, except for 95 GHz which is tuned for highest bandwidth while keeping channel noise ≤ 2 mV RMS.

b. Verified with input signal 1 Vpp @ 10 GHz and 26.56 GHz with 50 GHz channel BW.

c. Verified with input signal 1 Vpp @ 10 GHz, 0.8 Vpp @ 26.56 GHz with 50 GHz channel BW, ~ 1 Vpp to PTB input.

d. Ships with ruggedized 1.0 mm (f) to 1.85 mm (f) adaptors.

Input impedance specifications

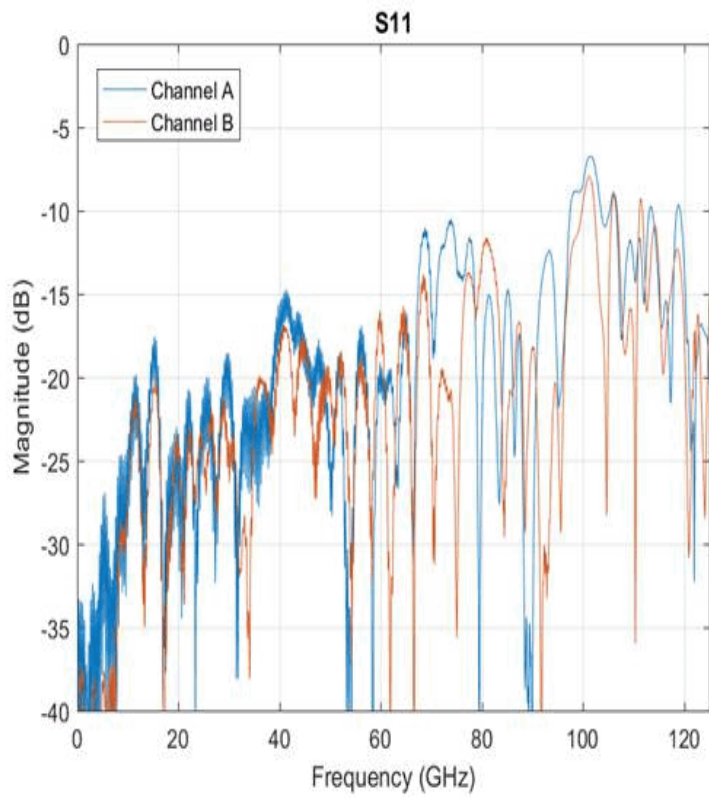


Figure 9. Graph of S11 (*characteristic*)

N1060A clock recovery specifications

| Item | Option 216 | Option 232 | Option 264 |
|--|--|---|---|
| Data rates input range | 125 MBd to 16 GBd <i>125 MBd to 16.4 GBd (characteristic)</i> | 125 MBd to 32 GBd <i>125 MBd to 32.8 GBd (characteristic)</i> | 125 MBd to 64 GBd <i>125 MBd to 65.8 GBd (characteristic)</i> |
| Clock frequency input range | 62.5 MHz to 8 GHz <i>62.5 MHz to 8.2 GHz (characteristic)</i> | 62.5 MHz to 16 GHz <i>62.5 MHz to 16.4 GHz (characteristic)</i> | 62.5 MHz to 32 GHz <i>62.5 MHz to 32.8 GHz (characteristic)</i> |
| Minimum input level to acquire lock (NRZ and PAM4, single-ended, open eye) | 100 mVpp <i>30 mVpp at 10.3125 GBd (characteristic)</i> | 100 mVpp <i>30 mVpp at 10.3125 GBd (characteristic)</i> <i>30 mVpp at 26.56 GBd (characteristic)</i> | 100 mVpp (rate ≤ 53.125 GBd) 200 mVpp (rate > 53.125 GBd) <i>30 mVpp at 10.3125 GBd (characteristic)</i> <i>30 mVpp at 26.56 GBd (characteristic)</i> <i>60 mVpp at 53.125 GBd (characteristic)</i> <i>60 mVpp at 56 GBd (characteristic)</i> <i>100 mVpp at 64 GBd (characteristic)</i> |
| Minimum input level to acquire lock (PAM4, single-ended, closed eye) | N/A | <i>200 mVpp at 26.56 GBd with 20 dB channel loss at 13.28 GHz (characteristic)</i> | <i>200 mVpp at 26.56 GBd with 20 dB channel loss at 13.28 GHz (characteristic)</i> <i>200 mVpp at 53.125 GBd with 16 dB channel loss at 26.56 GHz (characteristic)</i> |
| Recovered clock random jitter ^a | 300 fs maximum ≥ 2.5 GHz <i>120 fs at 10.3 GHz (characteristic)</i> | 300 fs maximum ≥ 2.5 GHz <i>80 fs at 26.56 GHz (characteristic)</i> <i>120 fs at 10.3 GHz (characteristic)</i> | |
| Clock recovery adjustable loop bandwidth range (user selectable) | 0.015 to 20 MHz (depends on Baud Rate) | | |
| Clock recovery loop peaking range | Up to 4 settings (dependent on loop BW) | | |
| Loop bandwidth accuracy ^{b, c} | $\pm 30\%$, (characteristic, NRZ) | | |

| | | | |
|---|--|---|---|
| Tracking range (includes spread-spectrum tracking) | $\pm 2500 \text{ ppm } (\pm 0.25\%), (\text{characteristic, NRZ})$ | | |
| Acquisition range | | | |
| Standard signals: | $\pm 300 \text{ ppm}, (\text{characteristic})$ | | |
| Spread spectrum signals: | $\pm 5000 \text{ ppm}, (\text{characteristic, NRZ})$ | | |
| Maximum consecutive identical digits to lock | 150 (characteristic) | | |
| Auto relocking | Yes (user enabled) | | |
| Jitter Spectrum Analysis (Option JSA) | | | |
| Phase noise accuracy | $\pm 30\% (\text{characteristic, NRZ})$ | | |
| Clock Recovery Emulation (CRE) Operating Range (Valid for open-eye signals) | 1 — 58 GBd (NRZ) (characteristic) | | |
| | 1 — 31 GBd (PAM4) (characteristic) | | |
| Front panel recovered clock amplitude | $\geq 200 \text{ mVpp}$ 450 mV at 5 GHz (characteristic) | $\geq 200 \text{ mVpp}$ 450 mV at 5 GHz (characteristic) 275 mV at 26.56 GHz (characteristic) | $\geq 200 \text{ mVpp}$ 450 mV at 5 GHz (characteristic) 275 mV at 26.56 GHz (characteristic) |
| Front panel recovered clock divide ratio (user selectable) | 1, 2, 4, 8, 16, 32 | | |
| Recovered clock front panel connector type | 2.92 mm (m) | | |
| Internal frequency counter accuracy | $\pm 10 \text{ ppm}$ 4 ppm (characteristic) | | |

- a. Verified by connecting a sinewave to N1060A Channel A, then measuring Recovered Clock signal connected to Channel B (PTB enabled).
- b. PLL bandwidth is calibrated and verified using a clean NRZ, PRBS13 signal.
- c. Actual PLL bandwidth may vary due to several factors, including pattern characteristics (low/high transition density), signaling format (PAM4), and signal quality (closed eyes).

Modules no longer available but supported by the N1000A DCA-X Mainframe

- N1045A 60 GHz Electrical
- 54752A 50 GHz Dual Channel Electrical
- 54754A Differential TDR/TDT
- 83484A Dual Channel 50 GHz Electrical
- 83496A Optical/Electrical Clock Recovery, 50 Mb/s-7.1 Gb/s
- 83496B Optical/Electrical Clock Recovery with Phase Noise Analysis
- 86112A Dual Channel 20 GHz Electrical
- 86105C Optical/Electrical Channel
- 86105D Optical/Electrical Channel
- 86107A Precision Timebase Reference
- 86108A Precision Waveform Analyzer
- 86108B Precision Waveform Analyzer
- 86115D Dual Channel Optical
- 86116C Optical/Electrical Channel
- 86117A 50 GHz Dual Channel Electrical
- 86118A Dual 70 GHz remote sampling head

Ordering Information

The following tables offer helpful information about the DCA-X software, mainframe and plug-in modules and their options but are not intended to serve as a configuration guide.

When configuring a solution, please also refer to the following helpful documents:

- Keysight DCA Wide-Bandwidth Oscilloscope Family Configuration Guide (5992-3372EN)
- Keysight DCA Family FlexDCA Sampling Oscilloscope Software Technical Overview (5992-3319EN)
- Keysight DCA Family Clock Data Recovery Solutions Data Sheet (5992-1620EN)

N1000A DCA-X

N1000A DCA-X hardware options

| | |
|------------|--|
| N1000A | Infiniium DCA-X mainframe |
| N1000A-PLK | Pattern Lock |
| N1000A-STB | Standard timebase |
| N1000A-LOJ | Low jitter timebase |
| N1000A-PTB | Precision timebase integrated in the mainframe |
| N1000A-GPI | GPIB card installed (mandatory option) |

N1000A miscellaneous options

| | |
|------------|---|
| N1000A-AFP | Module slot filler panel |
| N1000A-AX4 | Rack mount flange kit |
| N1000A-AXE | Rack mount flange kit with handles |
| N1000A-UK6 | Commercial calibration certificate with test data |

N1000A DCA-X hardware upgrade options (if you already own an N1000A)

| | |
|-------------|--|
| N1000AU-PLK | Add Pattern Lock |
| N1000AU-LOJ | Add low jitter timebase |
| N1000AU-PTB | Add precision timebase integrated in the mainframe |

FlexDCA software packages

| | |
|-----------|--|
| N1010100A | Research and Development Package for FlexDCA |
| N1010200A | Manufacturing Package for FlexDCA |
| N1010300A | Signal Integrity Package for FlexDCA |

Application software

| SW Application Model | SW Application Description <i>See the application software datasheet to confirm hardware requirements.</i> |
|----------------------|---|
| N109228CA | Electrical TX Test SW for OIF-CEI-3.1 |
| N109310CA | Electrical TX Test SW for SFF-8431 (SFP+) |
| D9010UDAA | User Defined Application Software (for DCA-X and RT Scopes) |
| N1091APCA | Electrical TX Test SW for IEEE 802.3ap/bj (10G/40G) |
| N1091BMCA | Electrical TX Test SW for IEEE 802.3bm |
| N1091BACA | Electrical TX Test SW for IEEE 802.3ba (40G/100G) |
| N1091BJCA | Electrical TX Test SW for IEEE 802.3bj (100G) |
| N1091BSCB | Electrical TX Test SW for IEEE 802.3bs/cd |
| N1091CKCA | Electrical TX Test SW for IEEE 802.3ck |
| N109212CA | Electrical TX Test SW for OIF-CEI-112G |
| N109256CB | Electrical TX Test SW for OIF-CEI-4.0 |
| N1095BSCA | Optical TX Test SW for IEEE 802.3bs/cd |
| N1094BS1A | PAM4 Measurement Software Development Kit. |

Optical/electrical modules

| | |
|------------|---|
| N1030A | Single 65 GHz optical channel, 9/125 μ m fiber input |
| N1030A-280 | Hardware filters for 25-28 NRZ Gbaud rates |
| N1030A-560 | Hardware filters for 53-56 Gbaud rates |
| N1030A-65U | 65 GHz unamplified optical channel |
| N1030A-EC1 | Add 95 GHz single electrical channel |
| N1030A-IRC | Impulse response correction (optical and electrical channels) |
| N1030B | Two 65 GHz optical channels, 9/125 μ m fiber input |
| N1030B-280 | Hardware filters for 25-28 NRZ Gbaud rates |
| N1030B-560 | Hardware filters for 53-56 Gbaud rates |
| N1030B-65U | 65 GHz unamplified optical channel |
| N1030B-IRC | Impulse response correction |

Dual/quad electrical channel modules

| | |
|------------|---|
| N1040A-033 | Two 33 GHz electrical channels |
| N1040A-060 | Two 60 GHz electrical channels |
| N1045B | 2/4 port 60 GHz electrical remote head |
| N1045B-02F | 2 channel remote head, 1.85 mm, female |
| N1045B-02M | 2 channel remote head, 1.85 mm, male |
| N1045B-04F | 4 channel remote head, 1.85 mm, female |
| N1045B-04M | 4 channel remote head, 1.85 mm, male |
| N1046A | 100 GHz, 1/2/4 port electrical remote sampling head |
| N1046A-71F | 1 channel, 75 GHz remote head, 1 mm, female |
| N1046A-81F | 1 channel, 85 GHz remote head, 1 mm, female |
| N1046A-11F | 1 channel, 100 GHz remote head, 1 mm, female |
| N1046A-72F | 2 channel, 75 GHz remote head, 1 mm, female |
| N1046A-82F | 2 channel, 85 GHz remote head, 1 mm, female |
| N1046A-12F | 2 channel, 100 GHz remote head, 1 mm, female |
| N1046A-74F | 4 channel, 75 GHz remote head, 1 mm, female |
| N1046A-84F | 4 channel, 85 GHz remote head, 1 mm, female |
| N1046A-14F | 4 channel, 100 GHz remote head, 1 mm, female |

TDR/TDT modules

| | |
|---------------------|--|
| N1055A ^a | 35/50 GHz, 2/4 port, TDR/TDT remote head |
| N1055A-FS1 | Fast sampling, mandatory option |
| N1055A-32F | 35 GHz, 2 channel remote head, 2.92 mm, female |
| N1055A-32M | 35 GHz, 2 channel remote head, 2.92 mm, male |
| N1055A-34F | 35 GHz, 4 channel remote head, 2.92 mm, female |
| N1055A-34M | 35 GHz, 4 channel remote head, 2.92 mm, male |
| N1055A-52F | 50 GHz, 2 channel remote head, 1.85 mm, female |
| N1055A-52M | 50 GHz, 2 channel remote head, 1.85 mm, male |
| N1055A-54F | 50 GHz, 4 channel remote head, 1.85 mm, female |
| N1055A-54M | 50 GHz, 4 channel remote head, 1.85 mm, male |

a. When used in an 86100D, 86100D option ETR is recommended if more than one TDR module is connected to the same DUT

Precision waveform analyzer modules

| | |
|-------------------------|---|
| N1060A-050 ^a | Dual 50 GHz electrical channels |
| N1060A-085 ^a | Dual 85 GHz electrical channels |
| N1060A-216 | Clock recovery 125 MBd to 16 GBd |
| N1060A-232 | Clock recovery 125 MBd to 32 GBd |
| N1060A-264 | Clock recovery 125 MBd to 64 GBd |
| N1060A-PTB | Integrated precision timebase (mandatory option ^b) |
| N1060A-E33 | Integrated hardware filters for 33 GHz, 40 GHz, and 43 GHz |
| N1060A-EVA | Integrated variable equalizers in clock path (mandatory option ^b) |
| N1060A-JSA | Jitter Spectrum Analysis (mandatory option ^b) |
| N1060A-A1F | Two 1mm (f) to 1mm (f) adapters |
| N1060A-A1M | Two 1mm (m) to 1mm (m) adapters |
| N1060A-A1X | Two 1mm (m) to 1mm (f) adapters |
| N1060A-CA1 | Cable pair, 1 mm(m) to 1 mm (f), 160 mm length |
| N1060A-CA2 | Matched cable pair, 2.4 mm(m) to 2.4 mm (m), 24 inch length |
| N1060A-DC2 | Two DC blocks, 2.4mm connectors, 16V, 50 kHz to 50 GHz |
| N1060AU-085 | Upgrade to Option 085 Performance |
| N1060AU-264 | Upgrade to Option 264 |
| N1060AU-232 | Upgrade to Option 232 |

a. 86100D option ETR recommended when used in an 86100D mainframe, N1000A option PLK recommended when used in an N1000A mainframe

b. Mandatory options are automatically provided with the product and cannot be unselected.

External clock recovery solutions

N1076B electrical clock recovery

| | |
|------------|---|
| N1076B-216 | Clock recovery range: 125 MBd to 16 GBd |
| N1076B-232 | Clock recovery range: 125 MBd to 32 GBd |
| N1076B-264 | Clock recovery range: 125 MBd to 64 GBd (56 GBd for PAM4 signals) |
| N1076B-EVA | Integrated variable equalizers (mandatory option ^a) |
| N1076B-JSA | Jitter Spectrum Analysis |

a. Mandatory options are automatically provided with the product and cannot be unselected.

N1077A optical/electrical clock recovery

| | |
|------------|---|
| N1077A-216 | Clock recovery range: 50 MBd to 16 GBd |
| N1077A-232 | Clock recovery range: 50 MBd to 32 GBd |
| N1077A-SMS | Internal SM and MM splitters |
| N1077A-SXT | No supplied splitter (standard option). External splitter must be supplied by user. |
| N1077A-JSA | Jitter spectrum analysis |

N1078A optical/electrical clock recovery

| | |
|------------|--|
| N1078A-216 | Clock recovery range: 125 MBd to 16 GBd |
| N1078A-225 | Clock recovery range: 25 to 29 GBd |
| N1078A-232 | Clock recovery range: 125 MBd to 32 GBd |
| N1078A-253 | Clock recovery range: 53 to 58 GBd |
| N1078A-264 | Clock recovery range: 125 MBd to 64 GBd |
| N1078A-S50 | Internal 50-50 SM optical splitter |
| N1078A-SXT | No supplied splitter (standard option). External splitter must be supplied by user. |
| N1078A-JSA | Jitter spectrum analysis |
| N1078A-EVA | Integrated variable equalizers in electrical input path (mandatory option ^a) |

a. Mandatory options are automatically provided with the product and cannot be unselected.

Warranty Options (for All Products)

| | |
|--------|-------------------------------------|
| R1280A | Customer return repair service |
| R1282A | Customer return calibration service |

Accessories

See the *DCA Accessories Guide* for available accessories (5991-2340EN).