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Agilent 83433A
10 Gb/s Lightwave Transmitter
Agilent 83434A
10 Gb/s Lightwave Receiver
Product Overview



83433A

- Excellent 10 Gb/s and 2.5 Gb/s optical waveforms
- Modulate at data rates from 2.4 to 10.7 Gb/s
- Generates STM-64/OC-192 and STM-16/OC-48 compliant eye patterns with appropriate data input
- 1550 nm ITU-T grid wavelength internal DFB laser with Mach-Zehnder modulator
- Compatible with external polarization controlled TLS at wavelengths from 1530 to 1565 nm

83434A

- Choice of clock recovery at 9953.28 MHz or 10.664228 GHz (FEC) with option 83434A-106, or 10.3125 (10 GigE) with option 83434A-H31
- PIN diode-based receiver, wavelength range 1300 to 1600 nm
- Linear, non-retimed data output
- –16 dBm sensitivity (BER of 1 x 10^{-10} for 2^{31}-1 PRBS)

Agilent Technologies

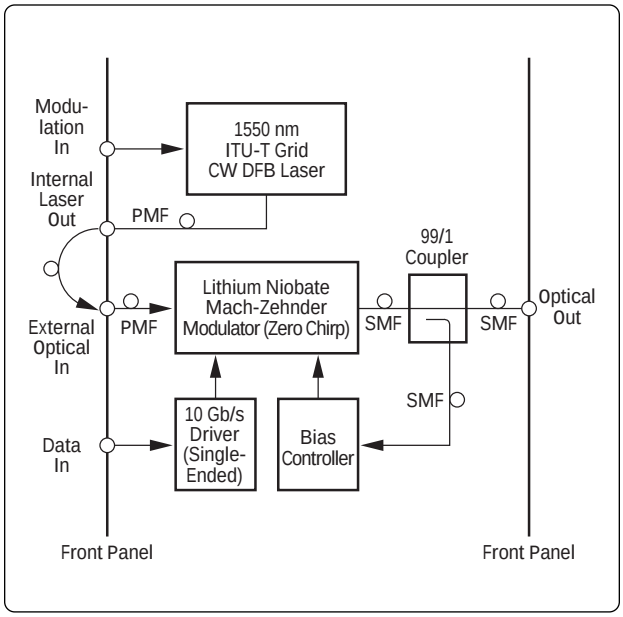
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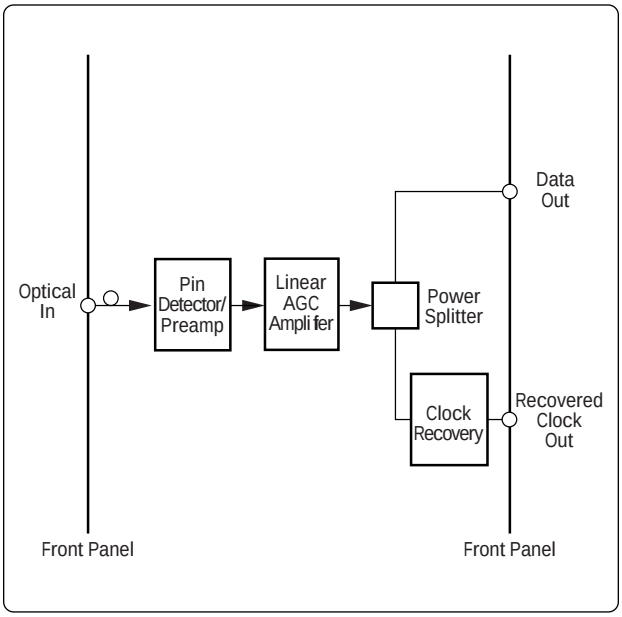
Agilent 83433A transmitter



Agilent 83434A receiver



83433A block diagram



83434A block diagram

10 Gb/s Optical Interfaces for Bit Error Ratio Testing

The Agilent 83433A transmitter and the Agilent 83434A receiver provide the optical interfaces necessary to allow bit error ratio testing of 10 Gb/s optical transmitters and receivers used in 10 Gb/s SONET/SDH, 10 GigE, and IP optical net-works as well as systems employing forward error correction (FEC). The 83433A and 83434A may be combined to create a complete optical link for system or fiber testing.

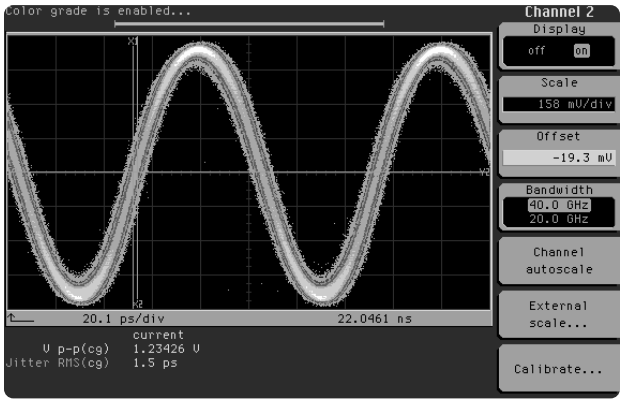
The 83434A receiver's non-retimed output is designed for use with the Agilent 71612C 12.5 Gb/s Error Performance Analyzer. The 71612C can optimize the receiver output decision threshold and timing to optimize BER. Because of this, Q-factor and eye contour analysis for optical signal degradation testing can be accomplished using the 83434A, 71612C and the E4543A Q-factor and eye-contour analysis software.

The 83434A receiver recovers clock and data from digitally modulated SONET/SDH OC-192/STM-64 optical signals. Option 83434A-106 substitutes clock recovery for FEC signals at 10.664 GHz, and option 83434A-H31 recovers the clock for 10 GigE. The amplified PIN-diode produces a linear output with AGC stabilization. The receiver is designed to provide –16 dBm sensitivity for a 2^{31}-1 PRBS with a BER performance of at least 1 x 10^{-10}.

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10 Gb/s Clock Recovery for Oscilloscope Triggering

The 83434A receiver can also be used for optical eye diagram analysis with a sampling oscilloscope, such as the 86100B Infiniium DCA, when no separate clock signal is available or when an optical channel is not available. The clock output of the 83434A can be used to trigger an oscilloscope at 9.953 Gb/s (or 10.664 Gb/s with option 83434A-106, or 10.3125 Gb/s with option 83434A-H31) ensuring that the eye diagram is an accurate representation of all possible bit combinations on the incoming data stream. The non-retimed linear data output allows for diagnostic analysis of the incoming waveform.



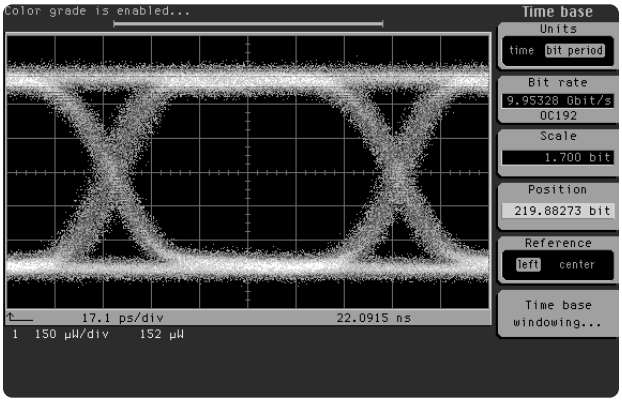
*Agilent 83434A recovered clock output at 9953.28 MHz**

10 Gb/s DWDM Testing

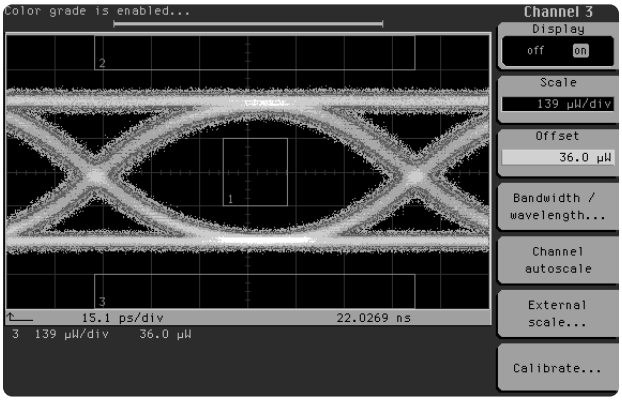
The 83433A transmitter was designed with DWDM testing in mind. The internal laser standard wavelength is one of the ITU-T grid wavelengths between 1548.41 nm and 1556.65 nm. The 83433A allows low frequency modulation of the internal laser to facilitate channel identification applications. An external tunable laser source with polarization maintaining fiber, such as the Agilent 8164B with option 81680A-071, can be used with the front panel input to the lithium niobate Mach-Zehnder modulator to test channel crosstalk, or the internal laser and modulator can be connected externally with the supplied semi-rigid PMF fiber.

Excellent Waveform Generation for General Purpose Testing

The 83433A transmitter with the 71612C Error Performance Analyzer can produce high fidelity, low jitter waveforms for 2.488 Gb/s STM-16/OC-48, 9.953 Gb/s STM-64/OC-192, and other transmission rates from 2.4 Gb/s through 10.7 Gb/s. The Mach-Zehnder modulator is adjusted for a fixed zero chirp. Its output waveform produces a nominal extinction ratio of 12 dB. The internal DFB laser may be modulated at frequencies from 15 kHz to 10 MHz to increase line-width for SBS suppression. The laser's center wavelength can be manually adjusted ±1 nm around the specified ITU-T grid center wavelength.



*Agilent 83433A unfiltered optical waveform at 9953.28 Mb/s**



*Agilent 83433A filtered optical waveform at 9953.28 Mb/s with time-scaled OC-48 mask**

* Driven with Agilent 71612B Error Performance Analyzer

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Performance Specifications and Characteristics

Specifications describe the warranted performance of the instrument over the operating temperature range except where noted. **Characteristics** (italicized) provide information about non-warranted instrument performance in the form of nominal values.

Agilent 83433A Lightwave Transmitter

Digital Data Input

	Min	Nominal	Max	Units
Data rate compatibility[23]	2.4		10.7	Gb/s
Amplitude[1]	0.5		1.5	V pk-pk
Return loss				
0.1 to 5000 MHz	12			dB
5000 to 10,700 MHz	9			dB
Impedance		*50*		Ohms
Mark density	45		55	%
Max run of consecutive "ones" or "zeros"		*100*		bits
Polarity		Non-inverting		

Maximum Safe Input Level

	Max Level	Units
Digital data input	2.0	V pk-pk
	+2.0, –2.0	V dc
Low-frequency modulation input	2.0	V pk-pk
External optical modulator input[2]	+14	dBm

Low-Frequency Modulation Input

	Min	Nominal	Max	Units
Frequency range 3 dB points	0.015		10	MHz
Amplitude for 5% mod index[1]	0.5	*1*	1.5	V pk-pk
Impedance		*50*		Ohms
Polarity		Inverting		

Internal Laser Output

	Min	Nominal	Max	Units
CW Power[3]	+8.5	*+10*	+11.5	dBm
Wavelength[4,24]	1548.41		1556.65	nm
Wavelength adjustment range	–1		+1	nm
Spectral width at –20 dBc FWHM			10	MHz
Side-mode suppression ratio	30			dB

Optical Modulator Input

	Min	Nominal	Max	Units
Wavelength	1530		1565	nm
Optical power input[2]	+2		+12	dBm
Input return loss	27			dB

Modulated Optical Output

	Min	Nominal	Max	Units
Modulator insertion loss	3	*5*	7	dB
Optical power output[5]	0		+5.5	dBm
Output return loss	27			dB
Extinction ratio[6]	12			dB
Jitter generation[7]				
OC-192 data rate[6]			0.15	UI pk-pk
Eye mask				
OC-192 data rate	Meets GR-253-CORE (scaled to data rate)			
OC-48 data rate	Meets GR-253-CORE			

General

Digital data input connector
APC-3.5 male
Low-frequency modulation input connector
BNC female
Internal laser output connector
FC/PC[8]
Optical modulator input connector
FC/PC[8]
Modulated optical output connector
Diamond HMS-10/HP[9]
Optical jumper cable
Includes semi-rigid, polarization maintaining fiber to connect internal laser output and optical modulator input
Laser safety
21 CFR 1040 Class IIIb, IEC 60825-1 Class 3B
General safety
Meets or exceeds CAN/CSA-C22.2 NO.1010 and EN 61010/IEC 61010-1 and all amendments
EMI
Radiated and conducted emissions are in compliance with the requirements of CISPR Publication 11, Class A and immunity in compliance with IEC 61326-1
Power
100, 120, 220, 240 VAC (±10%), 47 to 63 Hz
Operating temperature
0 to +45°C
Storage temperature
–40 to +70°C
Weight
3.5 kg (7.8 lbs)
Dimensions
102 mm (4 in) height, 216 mm (8.5 in) width, 444 mm (17.5 in) depth (Agilent System II, half-width case)

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Agilent 83434A Lightwave Receiver

Optical Input

	Min	Nominal	Max	Units
Wavelength	1300		1600	nm
Optical input power[10,11,12,13]	–16		0	dBm
Return loss	28			dB
"Loss of optical input" Alarm Threshold	*–25*		*–20*	dBm

Maximum Safe Input Level

	Max Level	Units
Optical input power[14]	+7	dBm

Data Output

	Min	Nominal	Max	Units
Amplitude[15,16]	0.5		1.5	V pk-pk
Lower 3 dB frequency[1]			0.10	MHz
Upper 3 dB frequency[1,18]	6.5			GHz
Return loss[17]	9.5			dB
Impedance		*50*		ohms

Recovered Clock Output

	Min	Nominal	Max	Units
Amplitude[1]	0.5		1.5	V pk-pk
Frequency[19,23]	9953.26	*9953.28*	9953.30	MHz
Option 83434-106	10664.028	*10664.228*	10664.428	MHz
Option 83434-H31	10310.44	*10312.50*	10314.56	MHz
Duty cycle		*50/50*	45/55	%
Clock to data alignment[20]			±25.12	ps
Jitter transfer bandwidth[19]	4	*5*	6	MHz
Jitter generation[16,21]			2	ps rms
Return loss[22]	12			dB
Impedance		*50*		ohms

General

Optical input connector
Diamond HMS-10[9]
Data output connector
APC-3.5 male
Recovered clock output connector
APC-3.5 male
General safety
Meets or exceeds CAN/CSA-C22.2 NO.1010 and EN 61010/IEC 61010-1 and all amendments
EMI
Radiated and conducted emissions are in compliance with the requirements of CISPR Publication 11, Class A and immunity in compliance with IEC 61326-1
Power
100, 120, 220, 240 VAC (±10%), 47 to 63 Hz
Operating temperature
0 to +45°C
Storage temperature
–40 to +70°C
Weight
3.4 kg (7.6 lbs)
Dimensions
102 mm (4 in) height, 216 mm (8.5 in) width, 444 mm (17.5 in) depth (Agilent System II, half-width case)

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1 AC coupled
2 Input power greater than +10 dBm may cause modulated optical output power to exceed Class I level.
3 Class IIIb laser output
4 Wavelength adjustment disabled
5 Average power with internal laser modulated with 2^{31}-1 PRBS
6 Measured with 1 V pk-pk data input signal and 2^{31}-1 PRBS on an 83480A, 83485B with OC-192 filter.
7 Applies over the temperature range 0 to 30°C
8 Panda polarization-maintaining fiber with slow axis aligned to key
9 Standard instrument has FC/PC adapters. Other adapters available as options.
10 Better than 1 x 10^{-10} BER when tested with Agilent 71612C using either of two patterns:
a) 2^{31}-1 PRBS, or b) 100 consecutive "ones" or "zeros" on a 2^{31}-1 PRBS
11 Source extinction ratio ≥8.2 dB measured within ±10% of eye center
12 Applies over the temperature range 25°C ±10°C.
13 Tested with FC/PC adapter.
14 1310 or 1550 nm
15 Non-inverting, non-retimed linear output with AGC stabilization
16 For PRBS up to and including 2^{31}-1
17 0.01 to 10,700 MHz
18 Measured with swept network analyzer at –8 dBm optical input with fixed AGC control in Tx and Rx.
19 Type A resonator based clock recovery
20 Falling clock edge to data transition measured with 2^{31}-1 PRBS.
21 Integrated phase noise measurement method.
22 10,300 to 10,320 MHz standard, 10,624 to 10,684 MHz option 83434A-106
23 For NRZ data format
24 Actual wavelength will be one of the ITU-T grid wavelengths between 1548.41 nm and 1556.65 nm ±0.1 nm. Wavelength adjustment range is ±1 nm.

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Ordering Information

General

- ❑ **Agilent 83433A** 10 Gb/s Lightwave Transmitter
  Includes FC/PC connector interface on modulated optical output. Includes semi-rigid Panda polarization-maintaining fiber for connection between internal laser output and external optical modulator input. Standard instrument has a center wavelength at one of the ITU-T grid wavelengths between 1548.41 nm and 1556.65 nm.

  Options to replace standard laser with other ITU-grid wavelength laser available upon request.

- ❑ **Agilent 83434A** 10 Gb/s Lightwave Receiver
  Includes FC/PC connector interface on optical input. Standard instrument has clock recovery at 9953.28 MHz.

- ❑ **Option 83434A-106** Replaces clock recovery at SDH/SONET STM-64/OC-192 with FEC 10.664228 GHz

- ❑ **Option 83434A-H31** to replace clock recovery at 9953.28 MHz with 10.3125 GHz available upon request.

Optical Connectors

For additional connector interfaces order the Agilent 81000XI series.

- ❑ **81000 FI** FC/PC connector (default)
- ❑ **81000 AI** HMS-10 connector
- ❑ **81000 SI** DIN 47256 connector
- ❑ **81000 VI** ST connector
- ❑ **81000 KI** SC/PC/APC connector

Related Products

- ❑ **Agilent 83430A** 2.5 Gb/s Lightwave Digital Source
- ❑ **Agilent 83446A** 2.5 Gb/s Lightwave Clock/Data Receiver
- ❑ **Agilent 86130A** BitAlyzer® Error Performance Analyzer
- ❑ **Agilent 71612C** 12.5 Gb/s Error Performance Analyzer
- ❑ **Agilent E4543A** Q-factor and Eye-contour Analysis Software
- ❑ **Agilent 86100B** Infiniium DCA
- ❑ **Agilent 8164B with option 81680A-071** Tunable Laser Source

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