SpectraIBER

The expandable test solution – to 10 Gb/s

Specifications

VXI bus

Agilent Technologies

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Overview

This specifications document covers the SpectraIBER family of test solutions. SpectraIBER provides the test and measurement capability to rigorously BER test a wide range of SONET and SDH network elements including optical add/drop multiplexers, optical translators, transponders and multi-channel systems.

Specifications are arranged in two groups:

- SpectraIBER test solutions at 10 Gb/s
- SpectraIBER test solutions at 2.5Gb/s and below

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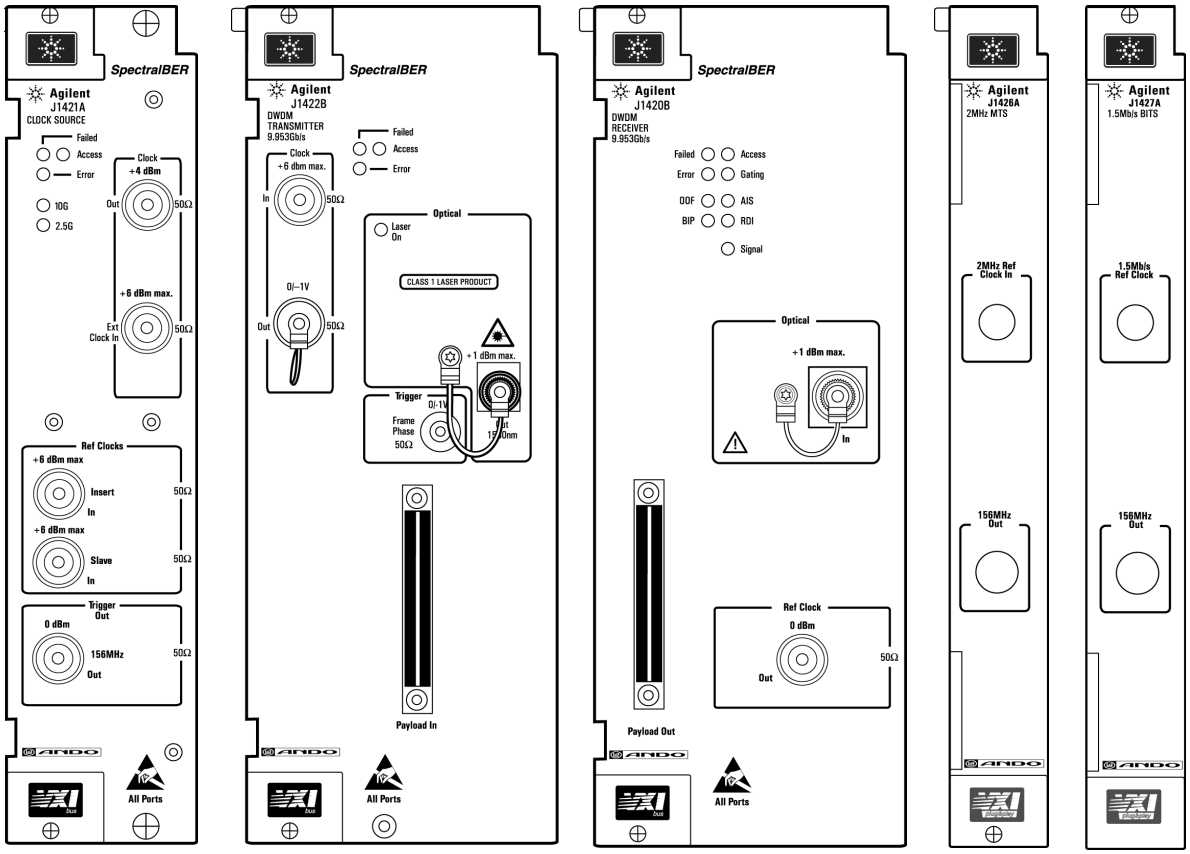
SpectralBER 10 Gb/s Modules



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SpectraIBER test solutions at 10 Gb/s and below

Except where otherwise stated, the following parameters are warranted performance specifications. Parameters described as 'typical' or 'nominal' are supplemental characteristics that provide a useful indication of typical but non-warranted performance. All specifications are for +5°C to +35°C after 30 minutes warm-up unless otherwise stated.

Transmitter Module (J1422B)

Optical Output	1 per module
Laser Type	MQW-DFB, externally modulated
Connector	FC/PC ***(standard)*** ST ***(option 100)*** Customer exchangeable
Wavelength	1528 nm to 1563 nm; 1557 nm typical
Spectral width (–3 dB) (–20 dB)	 0.3 nm max 1 nm max
Fiber output power	0 ± 1 dBm; 0 dBm typical *(standard)* 2.5 ± 0.5 dBm *(option 001)*
Side mode suppression ratio	> 30 dB
Extinction ratio	10 dB min
Pulse shape	Conforms to ITU-T G.957 & Bellcore GR-253
Safety Classification	Class 1 EN 60825-1:1994 / IEC 825-1 (1993) Class I FDA 21 CFR Ch.1 1040.10
Fiber Type	Single mode
Laser Control	On, Off

Operating Modes	
Interface Rate	The module operates at two line rates, selectable as:
SONET SDH	OC-192 or OC-48 STM-64 or STM-16

Tx Clock Input	Accepts timing for the transmitter output from a clock module or the previous Tx clock output in a daisy chain arrangement.
Frequency (OC-192/STM-64) (OC-48/STM-16)	 9.95328 GHz ± 20 ppm (nominal) 2.48832 GHz ± 20 ppm (nominal)
Level	> 0.6 V pk-pk (nominal) dc coupled 50 ohm to GND +6 dBm max
Connector	APC-3.5

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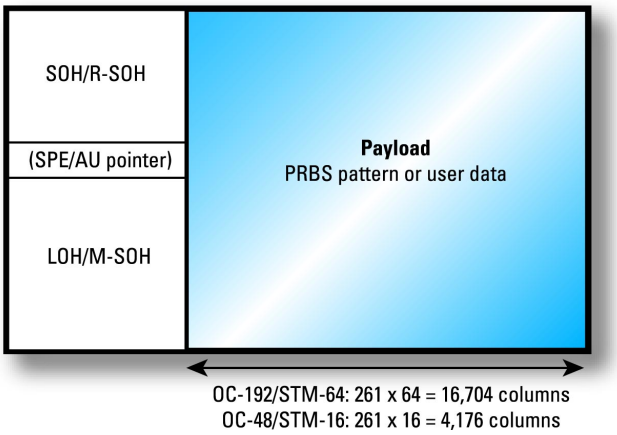
Transmitter Module (J1422B) (continued)

Tx Clock Output	Enables clocks to be daisy chained from Tx clock output to Tx clock input. This allows a number of transmitter modules to be clocked by a single clock module.
Frequency (OC-192/STM-64) (OC-48/STM-16)	 9.95328 GHz (nominal) 2.48832 GHz (nominal)
Duty Cycle	50% (nominal)
Level	0.7 V pk-pk (nominal) dc coupled 50 ohm to GND
Connector	APC-3.5

Payload Modes

***J1422A* Payload Mode**	Concatenated payload that fills entire payload area (including POH) with the payload mode test pattern. Compatible with initial release of SpectraIBER 10G (J1422A).



Payload test patterns	PRBS 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{10}-1, 2^{9}-1 (inverted or non-inverted) all ones all zeros 512 bit user programmable pattern at OC-192/STM-64 128 bit user programmable pattern at OC-48/STM-16

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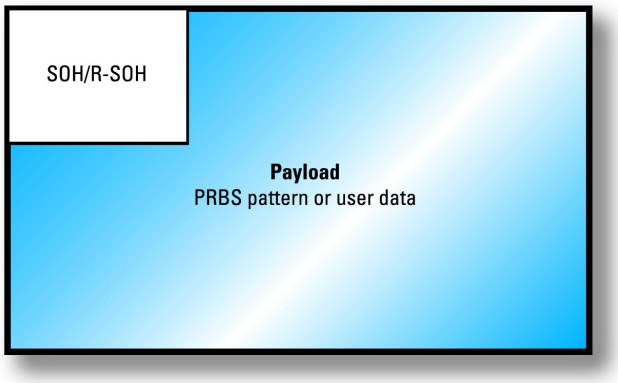
Transmitter Module (J1422B) (continued)

_AP9940_ Payload Mode

Concatenated payload that fills entire payload area (including POH), pointer and LOH/M-SOH with the payload test pattern. Compatible with Ando AP9940.



Payload test patterns

PRBS 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1 (inverted or non-inverted)
all ones
all zeros
512 bit user programmable pattern at OC-192/STM-64
128 bit user programmable pattern at OC-48/STM-16

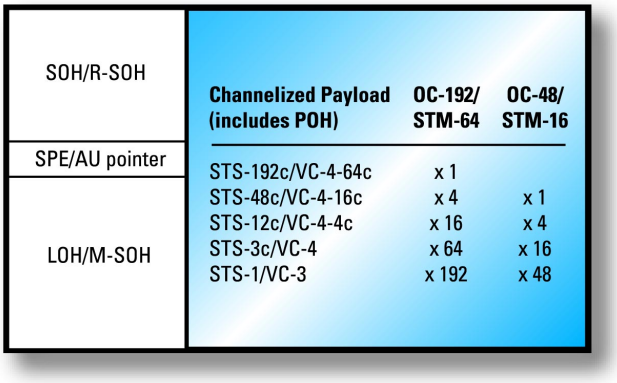
Payload Payload Mode

Bulk filled payloads with a channelized multiplexing structure, including POH, consistent with ITU-T and Bellcore (Telecordia) standards.

The foreground STS-n/VC-4/VC-3 test signal can be mapped into any one, or all, channels. The background channels can be identical to the foreground or filled with a different pattern. There are no background channels for an STS-192c/VC-4-64c payload mapping (or an OC-48/STM-16 output signal with an STS-48c/VC-4-16c payload mapping).

SONET
SDH

STS-192c, STS-48c, STS-12c, STS-3c or STS-1 SPE
VC-4-64c, VC-4-16c, VC-4-4c, VC-4 or VC-3



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Transmitter Module (J1422B) (continued)

Foreground payload test patterns	PRBS 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{10}-1, 2^{9}-1 (inverted or non-inverted) all ones all zeros 512 bit user programmable pattern at STS-192c/VC-4-64c 128 bit user programmable pattern at STS-48c/VC-4-16c 32 bit user programmable pattern at STS-12c/VC-4-4c 8 bit user programmable pattern at STS-3c/VC-4 8 bit user programmable pattern at STS-1/VC-3
Background payload fill patterns	All background channels carry the same payload fill pattern PRBS 2^{23}-1, 2^{15}-1 (inverted or non-inverted) all ones all zeros 128 bit user programmable pattern at STS-48c/VC-4-16c 32 bit user programmable pattern at STS-12c/VC-4-4c 8 bit user programmable pattern at STS-3c/VC-4 8 bit user programmable pattern at STS-1/VC-3 Alternatively, all background channels can carry a copy of the foreground channel.

Overhead Control

TOH/SOH Byte Access	Allows a user-defined value in the range 00h to FFh to be programmed into any TOH/SOH byte (except the B1, B2, H1, H2 and H3 bytes). Values change in real time without errors in the data stream.
J0 Message	A 16 byte repeating sequence (message + CRC bytes) or 64 byte repeating sequence (message + CR/LF framing) can be enabled. The 15/62 message bytes are user programmable. When the sequence is inactive, the static C1 value is transmitted.
POH Byte Access	*Only available with* **Payload** *payload mode.* Allows a user-defined value in the range 00h to FFh to be programmed into any POH byte (except the B3 byte). Values change in real time without errors in the data stream.
J1 Message	*Only available with* **Payload** *payload mode.* A 16 byte repeating sequence (message + CRC bytes) or 64 byte repeating sequence (message + CR/LF framing) can be enabled. The 15/62 message bytes are user programmable. When the sequence is inactive, the static J1 value is transmitted.

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Transmitter Module (J1422B) (continued)

SPE/AU Pointer Control	*Only available with* **Payload** *payload mode.*
Modes	POS, NEG, New Pointer
POS	Increment pointer value by 1
NEG	Decrement pointer value by 1
New Pointer	Set new pointer value (0 to 782) with or without NDF

APS Sequencer	*Only available with* **Payload** *payload mode.*
	Automatic Protection Switching Sequencer (K1/K2 bytes).
Modes	Off, Step, Single, Repeat
Off	The static K1/K2 values are transmitted.
Step	K1/K2 sequence is transmitted step-by-step under user control.
Single	K1/K2 sequence is transmitted once only.
Repeat	K1/K2 sequence is transmitted repeatedly.

Alarm Generation	
Alarms	LOS, OOF, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI
	AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI *only available with* **Payload** *payload mode*
Modes	Off, On, Repeat, Single
Repeat	Alarm condition is generated for a duration of p frames in an interval of q frames (where p = 1 to 480,000 frames, q = 2 to 16,000,000 frames).
Single	A single instance of the alarm is generated.

Error Add	
Errors	B1, B2, REI-L/MS-REI, Bit
	B3, REI-P/HP-REI *only available with* **Payload** *payload mode*
	Bit error add is only available with a PRBS test pattern.
Modes	Single, Rate, Error All
Rate	$m \times 10^{-n}$ (where m = 1 to 9, n = 3 to 12).
	1×10^{-12} min, max depends on error type selected.

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Transmitter Module (J1422B) (continued)

Frame Scrambler Control

On	Scrambler enabled
Off	Scrambler disabled

CID Stressing Consecutive 1's digit test to ITU-T G.958 Appendix 1.

Frame pulse output An 8 kHz pulse coincident with the first A1 byte of the frame. High during transmission of the first A1 byte.

Level 0 / -1 V (nominal) dc coupled 50 ohm to GND

Connector SMA

External Input Parallel connector reserved for future use.

Status Indicators

Front Panel

Failed	Indicates detection of failure during module self test. Illuminated during self test, switched off on successful completion
Error	Indicates presence of module error message. Switched off when error message is read via VXI control bus.
Access	Indicates module is being addressed via VXI control bus.
Laser On	Indicates that the transmitter optical output is active.

VXIbus Characteristics

Device Type Message based module.

Power Requirements

Current Maximum current drawn from VXIbus dc voltage rails:

dc Volts	dc Current	Dynamic Current
+24 V	0.7 A	0.08 A
+12 V	0.2 A	0.04 A
+5 V	11.0 A	0.45 A
–2 V	1.0 A	0.02 A
–5.2 V	4.5 A	0.05 A
–12 V	0.2 A	0.08 A
–24 V	0.1 A	0.05 A

Power Dissipation 105 W max

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Transmitter Module (J1422B) (continued)

Cooling Requirements

Airflow	6 litres/second/slot for 10 °C rise
Back Pressure	0.2 mm H_2O

Size	3-slot, C-size VXI module
Weight	4.5 kg (10 lb) (nominal)
Dimensions	262 mm (H) × 90 mm (W) × 355 mm (D) (nominal)

Options

Option 001	High power output.
Option 100	Replaces standard FC/PC optical connector with ST type.

Accessories

15826A	Cable to connect Transmitter Clock Out to Transmitter Clock In of a second transmitter module, allowing both transmitters to be clocked by a single clock module in a daisy chain arrangement.

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Receiver Module (J1420B)

Optical Input	1 per module
Wavelength	1500 nm to 1600 nm (nominal)
Sensitivity	–12 dBm for BER = 1×10^{-12}
Max Input Power Without Damage	+1 dBm
Max Input Power	–3 dBm for BER = 1×10^{-12}
Fiber Type	Single mode
Connector	FC/PC *(standard)* ST *(option 100)* Customer exchangeable

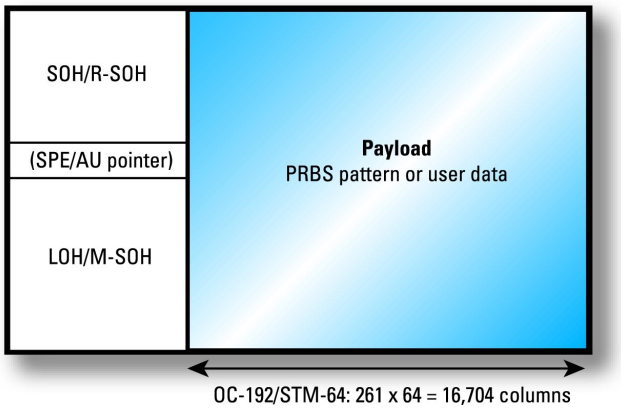
Operating Modes

Interface Rate	The module operates at 9.95328 Gb/s, selectable as:
SONET SDH	OC-192 STM-64
Data Rate Tolerance	± 20 ppm

Payload Modes

***J1420A* Payload Mode**

Concatenated payload that fills entire payload area (including POH) with the payload test pattern. Compatible with initial release of SpectralBER 10G (J1420A).



Payload Test Patterns	PRBS 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{10}-1, 2^{9}-1 (inverted or non-inverted) all ones all zeros 512 bit user programmable pattern

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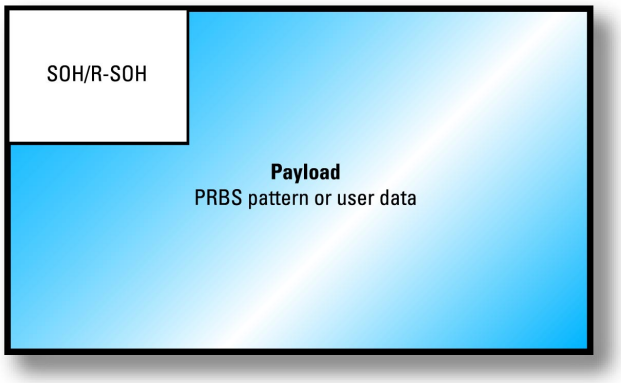
Receiver Module (J1420B) (continued)

_AP9940_ Payload Mode

Concatenated payload that fills entire payload area (including POH), pointer and LOH/M-SOH with the payload test pattern. Compatible with Ando AP9940.



Payload Test Patterns

PRBS 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1 (inverted or non-inverted)
all ones
all zeros
512 bit user programmable pattern

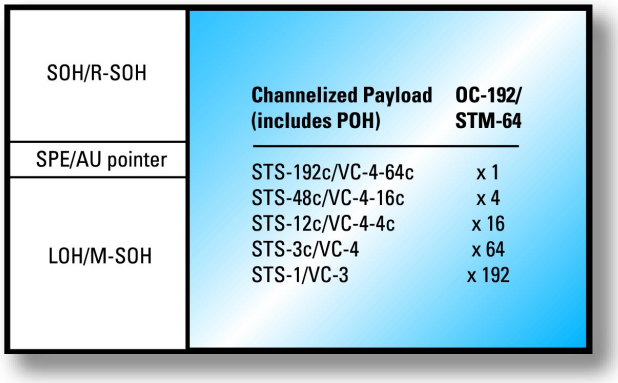
Payload Payload Mode

Bulk filled payloads with a channelized multiplexing structure, including POH, consistent with ITU-T and Bellcore (Telecordia) standards.

Any one STS-n/VC-4/VC-3 channel can be selected as the test channel.

SONET
SDH

STS-192c, STS-48c, STS-12c, STS-3c or STS-1 SPE
VC-4-64c, VC-4-16c, VC-4-4c, VC-4 or VC-3



Payload Test Patterns

PRBS 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{10}-1, 2^{9}-1 (inverted or non-inverted)
all ones
all zeros
512 bit user programmable pattern at STS-192c/VC-4-64c
128 bit user programmable pattern at STS-48c/VC-4-16c
32 bit user programmable pattern at STS-12c/VC-4-4c
8 bit user programmable pattern at STS-3c/VC-4
8 bit user programmable pattern at STS-1/VC-3

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Receiver Module (J1420B) (continued)

J0 Message Capture	A 16 byte sequence (message + CRC bytes) or 64 byte sequence (message + CR/LF framing) can be captured and displayed.
J1 Message Capture	*Only available with* **Payload** *payload mode.* A 16 byte sequence (message + CRC bytes) or 64 byte sequence (message + CR/LF framing) can be captured and displayed.
TOH/SOH Byte Capture	*Only available with* **Payload** *payload mode.* Allows the values of the 9 columns of TOH/SOH associated with a user-selected STS-3/STM-1 channel to be captured and displayed.
POH Byte Monitor	*Only available with* **Payload** *payload mode.* Allows the values of the POH of the selected test channel to be monitored and displayed.
SPE/AU Pointer Analysis	*Only available with* **Payload** *payload mode.* Pointer value, positive count, positive seconds, negative count, negative seconds, NDF seconds, missing NDF seconds, implied SPE/AU offset
APS Capture	*Only available with* **Payload** *payload mode.* Real time capture of Automatic Protection Switching message sequence (K1/K2 bytes).
Capture Sequence	Up to 64 conditions. A condition is a unique K1/K2 value. Each condition is displayed along with the number of frames for which the condition has persisted.
Capture Modes	Manual, Trigger
Manual	Capture on user request.
Trigger	Capture when a user defined trigger condition is detected.
Trigger Mode	Change, Equal, Not Equal Change: First change detected in received K1/K2 condition. Equal: Received K1/K2 condition is equal to trigger condition. Not Equal: Received K1/K2 condition is not equal to trigger condition.
Trigger Position	Trigger point can be specified at top, center or bottom of capture sequence (always at top for Change trigger mode).
Trigger Condition	User defined trigger condition for Equal and Not Equal trigger modes. Trigger Data: 0000h to FFFFh Trigger Mask: 0000h to FFFFh

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Receiver Module (J1420B) (continued)

Service Disruption Test	*Only available with* **Payload** *payload mode.*
	Service disruption test measures error burst length for measurement of protection switching times.
Results	Longest burst length, shortest burst length, last burst length
Accuracy	± 0.01% ± 30 μs
Resolution	1 μs
Range	2 s max

Alarm Detection	LOS, OOF, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, Pattern Sync Loss
	AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI *only available with* **Payload** *payload mode*

Errors Detected	B1, B2, REI-L/MS-REI, Bit
	B3, REI-P/HP-REI *only available with* **Payload** *payload mode*

Measurements	
Basic	B1, B2, B3, REI-L/MS-REI, REI-P/HP-REI, Bit: error count, error ratio, error seconds
	LOS, OOF, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, Pattern Sync Loss: alarm seconds
	Elapsed time
G.826 and G.828 Performance Analysis	B1, B2, B3, REI-L/MS-REI, REI-P/HP-REI: errored blocks (EB), severely errored seconds (SES), unavailable seconds (UAS), background block errors (BBE), error second ratio (ESR), severely errored second ratio (SESR), background block error ratio (BBER), severely errored period (SEP), severely errored period intensity (SEPI)

Measurement Period	
Mode	Manual, Single, Repeat
Manual	Start / Stop
Single/Repeat	User-defined timed gating period from 1 to 999 seconds, 1 to 999 minutes or 1 to 999 hours. Single or repetitive gating with no dead time between measurement periods.

Frame Descrambler Control	
On	Descrambler enabled
Off	Descrambler disabled

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Receiver Module (J1420B) (continued)

Reference Clock Output	Recovered clock providing loop timed clock capability when connected to the clock module.
Frequency	155.52 MHz
Duty Cycle	50% (nominal)
Level	0 dBm
	0.7 V pk-pk (nominal) dc coupled 50 ohm to GND
Connector	SMA

External Output	Parallel connector reserved for future use.

Status Indicators

Front Panel

Failed	Indicates detection of failure during module self test. Illuminated during self test, switched off on successful completion
Error	Indicates presence of module error message. Switched off when error message is read via VXI control bus.
Access	Indicates module is being addressed via VXI control bus.
Gating	Indicates that measurement is in progress.
OOF	Out of Frame detected.
BIP	Flashes on every time a BIP (B1, B2 or B3) error is detected.
AIS	Remains lit whilst AIS-L/MS-AIS, or AIS-P/AU-AIS present.
RDI	Remains lit whilst RDI-L/MS-RDI or RDI-P/HP-RDI present.
Signal	Indicates when the receiver has an input.

VXIbus Characteristics

Device Type	Message based module.

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Receiver Module (J1420B) (continued)

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

dc Volts	dc Current	Dynamic Current
+24 V	0.8 A	0.08 A
+12 V	0.3 A	0.04 A
+5 V	13.0 A	0.83 A
–2 V	0.8 A	0.03 A
–5.2 V	4.5 A	0.06 A
–12 V	0.3 A	0.07 A
–24 V	0.1 A	0.06 A

Power Dissipation — 120 W max

Cooling Requirements

Airflow — 6 litres/second/slot for 10 °C rise

Back Presure — 0.2 mm H_2O

Physical

Size — 3-slot, C-size VXI module

Weight — 4.8 kg (10.6 lb) (nominal)

Dimensions — 262 mm (H) × 90 mm (W) × 355 mm (D) (nominal)

Options

Option 100 — Replaces standard FC/PC optical connector with ST type.

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Clock Source Module (J1421A)

Clock Output	9.95328 GHz, 2.48832 GHz
Accuracy	± 4.6 ppm with internal reference only
Duty Cycle	50% ± 5% (typical) (except for external clock)
Level	4 dBm (nominal) ac coupled 50 ohm to GND (except for external clock)
Connector	APC-3.5
Timing Sources	Timing for the clock output is derived from one of four sources:
Internal Clock	
Accuracy	± 4.6 ppm
Frequency Offset	–20 to +20 ppm, 1 ppm/step
Insert Clock	
Frequency	155.52 MHz ± 20 ppm, 622.08 MHz ± 20 ppm, 2488.32 MHz ± 20 ppm
Duty Cycle	50% (nominal)
Level	> 0.6 V pk-pk (nominal) dc coupled 50 ohm to GND
	+6 dBm max
Connector	SMA
Slave Clock	For loop timing and input from reference clock module.
Frequency	155.52 MHz ± 20 ppm
Duty Cycle	50% (nominal)
Level	> 0.6 V pk-pk (nominal) dc coupled 50 ohm to GND
	+6 dBm max
Connector	SMA
External Clock	
Frequency	9.5328 GHz ± 20 ppm or 2.48832 GHz ± 20 ppm
Duty Cycle	50% (nominal)
Level	4 dBm ± 2 dBm (typical) dc coupled 50 ohm to GND
Connector	APC-3.5
Trigger Output	156 MHz Square Wave
Frequency	155.52 MHz (nominal)
Duty Cycle	50% ± 5% (typical)
Level	0 dBm
	0.7 V pk-pk (nominal) ac coupled 50 ohm to GND
Connector	SMA

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Clock Source Module (continued)

Status Indicators

Front Panel

Failed	Indicates detection of failure during module self test. Illuminated during self test, switched off on successful completion
Error	Indicates presence of module error message. Switched off when error message is read via VXI control bus.
Access	Indicates module is being addressed via VXI control bus.
10G	Indicates operating at 9.95328 GHz. No indication with external clock.
2.5G	Indicates operating at 2.48832 GHz. No indication with external clock.

VXIbus Characteristics

Device Type	Message based module.

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

dc Volts	dc Current	Dynamic Current
+24 V	0.5 A	0.01 A
+12 V	0.4 A	0.01 A
+5 V	2.0 A	0.03 A
-2 V	0.1 A	0.01 A
-5.2 V	3.4 A	0.01 A
-12 V	0.6 A	0.01 A
-24 V	0.2 A	0.05 A

Power Dissipation: 57 W max

Cooling Requirements

Airflow	5.2 litres/second/slot for 6 °C rise
Back Presure	0.2 mm H_2O

Physical

Size	2-slot, C-size VXI module
Weight	3.5 kg (7.7 lb) (nominal)
Dimensions	262 mm (H) × 60 mm (W) × 355 mm (D) (nominal)

Accessories

Supplied	Semi-rigid cable to connect Clock Out to Clock In of adjacent transmitter module. Semi-rigid cable which may be used to connect Ref Clock Out of a receiver module to Slave In, allowing loop timing of transmitter data out. The cable is suitable for use when the receiver is located to the right of the clock source, with three slots in between (enough space for a transmitter module).

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2 MHz (MTS) Reference Clock Module (J1426A)

Clock Output	155.52 MHz
Accuracy	Determined by reference clock input
Duty Cycle	50% (nominal)
Level	0.7 V pk-pk (nominal) dc coupled 50 ohm to GND
Connector	SMA

Clock Input

Rate	2.048 MHz ± 20 ppm clock
Level	0.75 to 1.5 V pk-pk
Connector	BNC 75 ohm

VXIbus Characteristics

Device Type	No control needed. Only power is supplied from backplane of VXI bus.

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

dc Volts	dc Current	Dynamic Current
+24 V	0.1 A	0.08 A
+12 V	0.2 A	0.07 A
+5 V	0.1 A	0.03 A
–2 V	0.3 A	0.05 A
–5.2 V		
–12 V	0.9 A	0.12 A
–24 V	0.2 A	0.02 A

Power Dissipation: 22 W max

Cooling Requirements

Airflow	5.4 litres/second/slot for 4 °C rise
Back Pressure	0.2 mm H_2O

Physical

Size	1-slot, C-size VXI module
Weight	1.4 kg (3.1 lb) (nominal)
Dimensions	262 mm (H) × 30 mm (W) × 355 mm (D) (nominal)

Accessories

Supplied	Semi-rigid cable to connect Clock Out to Slave Clock In of adjacent clock source module.

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1.5 Mb/s (BITS) Reference Clock Module (J1427A)

Clock Output	155.52 MHz
Accuracy	Determined by reference clock input
Duty Cycle	50% (nominal)
Level	0.7 V pk-pk (nominal) dc coupled 50 ohm to GND
Connector	SMA

Clock Input

Rate	1.544 Mb/s ± 20 ppm data
Line Code	B8ZS
Level	2.7 to 3.3 V pk-pk
Connector	Bantam 100 ohm balanced

VXI bus Characteristics

Device Type	No control needed. Only power is supplied from backplane of VXI bus.

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

dc Volts	dc Current	Dynamic Current
+24 V	0.1 A	0.08 A
+12 V	0.2 A	0.07 A
+5 V	0.1 A	0.03 A
–2 V	0.3 A	0.05 A
–5.2 V		
–12 V	0.9 A	0.12 A
–24 V	0.2 A	0.02 A

Power Dissipation: 22 W max

Cooling Requirements

Airflow	5.4 litres/second/slot for 4 °C rise
Back Pressure	0.2 mm H_2O

Physical

Size	1-slot, C-size VXI module
Weight	1.4 kg (3.1 lb) (nominal)
Dimensions	262 mm (H) × 30 mm (W) × 355 mm (D) (nominal)

Accessories

Supplied	Semi-rigid cable to connect Clock Out to Slave Clock In of adjacent clock source module.

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Mainframe (J1425A)

J1425A is the recommended mainframe for use with SpectraIBER 10G. It comprises an E8404A VXI mainframe, an E1406A slot 0 command module, a J1423A manual set and other accessories (for example a GPIB cable and EMC filler panels for unused VXI slots).

The E8404A VXI mainframe provides 13 C-size VXI slots. The E1406A module supplied with the mainframe requires one slot. The remaining 12 slots can be used by any combination of the SpectraIBER 10G modules, or any other C-size VXI product (assuming dc power capacity is not exceeded).

Detailed specifications of the E8404A VXI mainframe can be found on the Internet at:
http://www.tm.agilent.com

Remote Control

Control of the measurement hardware is via a GPIB interface provided on the E1406A slot 0 command module. SpectraIBER provides a GPIB command set based on the industry standard SCPI format. SpectraIBER is also supplied with Universal Instrument Driver (UID) software.

Graphical User Interface

SpectraIBER 10G is supplied with Graphical User Interface (GUI) software. This is a standalone virtual front panel application providing access to all instrument functions. The GUI software provides additional functionality as described below.

A PC or workstation controller equipped with a GPIB interface (not supplied) is required to use SpectraIBER.

For PC hardware requirements, please see Configuration Guide.

Operating Systems Supported	Windows 95/98/2000/NT Solaris
Save/Recall Settings	Instrument settings can be saved to and recalled from a directory on the controller's disk drive.
Couple Receiver to Transmitter	A receiver module can be coupled to a transmitter module in the same system. When coupled, the receiver's settings follow the specified transmitter's settings.
Logging	Measurement data can be logged while a measurement period is active (***ie*** while the receiver is gating). There is a separate log for each receiver in a system.
Log Format	Each log consists of separate Periodic Log and Event Log files. Each file contains: Filename field Receiver module address field User supplied comments field Receiver setup field Start of logging date & time field Logged data

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Data Logged	The user can select which data to log from a list of all alarms, error counts and error ratios. Each data entry in the log is time-stamped with date & time (from the PC/workstation controller), and elapsed time since the start of gating (from the receiver module).
Periodic Log	For selected alarms and errors, logs the current alarm seconds count, error count and/or error ratio at predefined intervals. Logging intervals can be set in the range from 2 minutes to 24 hours with a resolution of 1 minute. The user can select G.826 or G.828 analysis results to be appended to the log at the end of gating.
Event Log	Logs the binary state of all selected alarms and errors each time any state changes.

General

Environmental

Operating Temperature	+5°C to +35°C
Storage Temperature	–20°C to +60°C
Humidity	30% to 85% RH
EMC	Meets test specifications EN 55011:1991 (Group 1, Class A) / CISPR 11 (1990) (Group 1, Class A) EN 50082-1:1992

Product Safety	Meets EN 61010-1:1993 / IEC 61010-1 (1990) +A1(1992) +A2(1995) EN 60825-1:1994 / IEC 825-1 (1993) FDA 21 CFR Ch.1 1040.10 See Transmitter Module specifications for safety classification.

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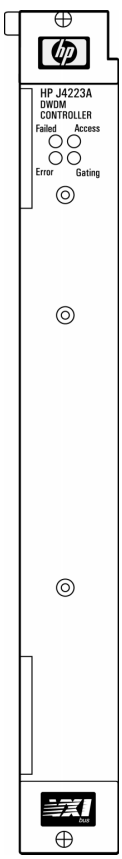
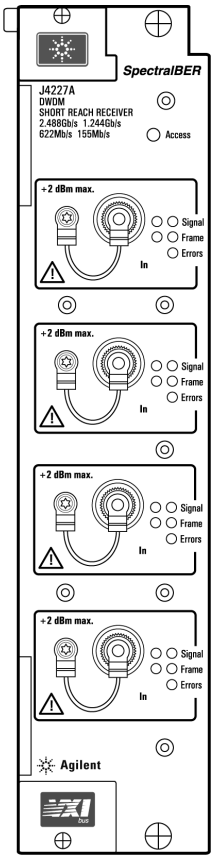
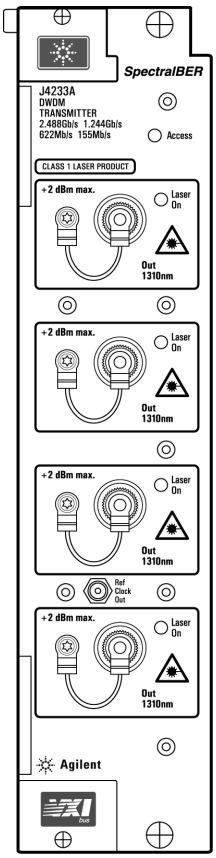
SpectralBER Multi-rate Modules





Also J4226A



Also J4234A, J4235A

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SpectraIBER test solutions at 2.5 Gb/s and below

Except where otherwise stated, the following parameters are warranted performance specifications. Parameters described as 'typical' or 'nominal' are supplemental characteristics that provide a useful indication of typical but non-warranted performance. All specifications are for +5°C to +40°C after 30 minutes warm-up unless otherwise stated.

Transmitter Modules (J4233A, J4234A, J4235A)

Optical Outputs 4 per module

	J4233A	**J4234A**	**J4235A**
Laser Type	Fabry-Perot	DFB	DFB
Connector	FC/PC *(standard)* ST *(option 100)* Customer exchangeable	FC/PC *(standard)* ST *(option 100)* Customer exchangeable	FC/PC *(standard)* ST *(option 100)* Customer exchangeable
Wavelength	1310 nm ± 20 nm	1550 nm ± 5 nm	ITU-T ± 0.07 nm
Spectral Width	3 nm max	1 nm max (–20 dB)	1 nm max (–20 dB)
Wavelength Temperature Coefficient	≤ 0.4 nm / °C	≤ 0.008 nm / °C	≤ ± 0.009 nm over 10 years
Fiber Output Power	–1 dBm min +2 dBm max +1 dBm typ	–1 dBm min +2 dBm max +1 dBm typ *(standard)*	–1 dBm min +2 dBm max +1 dBm typ
Side Mode Suppression Ratio	N/A	> 30 dB	> 30 dB
Extinction Ratio	10 dB min		
Pulse Shape	Conforms to ITU-T G.957 and Bellcore GR-253		
Safety Classification	Class 1 EN 60825-1:1994 / IEC 825-1 (1993) Class I FDA 21 CFR Ch.1 1040.10		
Fiber Type	Single mode		
Laser Control	On, Off (each port independently)		

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Transmitter Modules (continued)

Operating Modes

Interface Rate	Each of the four ports operates independently, at up to four line rates, selectable as:
SONET SDH	OC-48, OC-12 or OC-3 STM-16, STM-4 or STM-1
	1.244 Gb/s unframed PRBS only *(option 200)*
Framing	On, Off (each port independently)
	With framing off, the output signal is an unframed PRBS as defined in Payload Test Patterns below.

Tx Clock Sync	All four ports are synchronized to the same clock source, but with a random bit correlation between ports.
Data Rate	2.48832 Gb/s 622.08 Mb/ s 155.52 Mb/ s 1.24416 Gb/ s *(option 200)*
Stability	± 3.5 ppm
Aging	± 1 ppm/year

Tx Ref Clock Output	Provided for trigger purposes and synchronized to the transmitter clock source.
Frequency	77.76 MHz (nominal)
Level	ecl (nominal) ac coupled 50 ohm to GND
Connector	SMA

Payload	Concatenated payload at the selected line rate.
SONET SDH	OC-48c SPE, OC-12c SPE, OC-3c SPE VC-4-16c, VC-4-4c, VC-4
Payload Test Patterns	PRBS 2^{23}-1, 2^{15}-1, 2^{11}-1, 2^{9}-1

Overhead Control

TOH/SOH	All set to default values with the exception of the calculated B1 and B2 bytes, and the programmable J0 byte.
J0 Message	A 16 byte repeating sequence (15 message bytes + 1 byte CRC) is transmitted. The 15 message bytes are user programmable.
POH	All set to default values with the exception of the calculated B3 byte.

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Transmitter Modules (continued)

Error Add

Errors	B1, B2, Bit Only Bit error add is available with an unframed PRBS test pattern.
Modes	Single, Rate
Rate	1.0×10^{-n} (where $n = 7$ to 9).

Status Indicators

Front Panel

Access	Indicates module is being addressed via VXI control bus.
Laser On (1 per port)	Indicates that the transmitter optical output is active.

VXIbus Characteristics

Device Type	Register based module.

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

J4233A, J4234A, J4235A

dc Volts	dc Current	Dynamic Current
+24 V	1.2 A	930 mA
+12 V	860 mA	100 mA
+5 V	9.2 A	1.63 A
–2 V	2.1 A	50 mA
–5.2 V	2.6 A	290 mA
–12 V	1.5 A	60 mA
–24 V		

Power Dissipation: 106 W max

Cooling Requirements

Airflow	6 litres/second/slot for 10 °C rise
Back Pressure	0.2 mm H_2O

Physical

Size	2-slot, C-size VXI module
Weight	3.1 kg (6.8 lb) (nominal)
Dimensions (H × W × D)	262 mm (H) × 60 mm (W) × 355 mm (D) (nominal)

Options

Option 100 (J4233A, J4234A, J4235A)	Replaces standard FC/PC optical connectors with ST type.
Option 200 (J4233A, J4234A, J4235A)	Adds 1.244 Gb/s unframed PRBS operation.

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Receiver Modules (J4226A, J4227A)

Optical Inputs	4 per module	
	J4226A	**J4227A**
Wavelength	1200 nm to 1600 nm	1200 nm to 1600 nm
Connector	FC/PC	FC/PC *(standard)* ST *(option 100)* Customer exchangeable
Sensitivity	–28 dBm for BER = 1×10^{-10}	–19 dBm for BER = 1×10^{-10}
Max Input Power Without Damage	+2 dBm	+2 dBm
Max Input Power	–8 dBm for BER = 1×10^{-10}	–3 dBm for BER = 1×10^{-10}
Fiber Type	Multi mode	Multi mode

Operating Modes	**J4226A**	**J4227A**
Interface Rate	Each of the four ports operates independently, at one line rate, selectable as:	Each of the four ports operates independently, at up to four line rates, selectable as:
SONET SDH	OC-48 STM-16	OC-48, OC-12 or OC-3 STM-16, STM-4 or STM-1 1.244 Gb/s unframed PRBS only *(option 200)*
Framing	On, Off (each port independently)	On, Off (each port independently)
	With framing off, the input signal is an unframed PRBS as defined in Payload Test Patterns below.	With framing off, the input signal is an unframed PRBS as defined in Payload Test Patterns below.
Data Rate Tolerance	2.48832 Gb/s ± 20 ppm	2.48832 Gb/s ± 20 ppm 622.08 Mb/ s ± 20 ppm 155.52 Mb/ s ± 20 ppm 1.24416 Gb/ s ± 20 ppm *(option 200)*

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Receiver Modules (continued)

Payload	Concatenated payload at the selected line rate.
SONET SDH	OC-48c SPE, OC-12c SPE, OC-3c SPE VC-4-16c, VC-4-4c, VC-4
Payload Test Patterns	PRBS 2^{23}-1, 2^{15}-1, 2^{11}-1, 2^{9}-1
J0 Message Capture	A 16 byte sequence (15 message bytes + 1 byte CRC) can be captured and displayed
Alarm Detection	LOS, OOF, LOF, AIS-L/MS-AIS, Pattern Sync Loss
Errors Detected	B1, B2, Bit
Measurements	B1, B2, Bit: error count, error ratio
	Elapsed time
Measurement Period	
	All ports in receiver modules associated with the same DWDM Controller can be gated together synchronously, or individually.
Mode	Manual, Single, Repeat
Manual	Start / Stop
Single/Repeat	User-defined timed gating period from 1 to 999 seconds, 1 to 999 minutes or 1 to 999 hours. Single or repetitive gating with no dead time between measurement periods.

Status Indicators

Front Panel

Access	Indicates module is being addressed via VXI control bus.
Signal (1 green + 1 red per port)	Green LED indicates when the receiver has an input. Red LED indicates LOS alarm.
Frame (1 green + 1 red per port)	Green LED indicates received signal is correctly framed. Red LED indicates OOF or LOF alarm.
Errors (1 per port)	Indicates the presence of any type of error in the received signal.

VXIbus Characteristics

Device Type	Register based module.

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Receiver Modules (continued)

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

J4226A

dc Volts	dc Current	Dynamic Current
+24 V	1.1 A	680 mA
+12 V	1.1 A	77 mA
+5 V	8.4 A	710 mA
–2 V	50 mA	31 mA
–5.2 V	2.7 A	340 mA
–12 V	180 mA	55 mA
–24 V		

J4227A

dc Volts	dc Current	Dynamic Current
+24 V	1.2 A	910 mA
+12 V	1.1 A	110 mA
+5 V	9.0 A	1.4 mA
–2 V	60 mA	60 mA
–5.2 V	2.2 A	460 mA
–12 V	60 mA	60 mA
–24 V		

Power Dissipation — 89 W max

Cooling Requirements

Airflow — 6 litres/second/slot for 10 °C rise

Back Pressure — 0.2 mm H_2O

Physical

Size — 2-slot, C-size VXI module

Weight — 3.1 kg (6.8 lb) (nominal)

Dimensions — 262 mm (H) × 60 mm (W) × 355 mm (D) (nominal)

Options

Option 100 (J4227A) — Replaces standard FC/PC optical connectors with ST type.

Option 200 (J4227A) — Adds 1.244 Gb/s unframed PRBS operation.

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DWDM Controller (J4223A)

The J4223A DWDM controller is a message based VXI module and is required to communicate with the register based transmitter and receiver modules. An important function of the J4223A is to concentrate the measurement results from all receivers to allow them to be efficiently communicated to the system control PC or workstation.

Status Indicators

Front Panel

Failed	Indicates detection of failure during module self test. Illuminated during self test, switched off on successful completion
Error	Indicates presence of module error message. Switched off when error message is read via VXI control bus.
Access	Indicates module is being addressed via VXI control bus.
Gating	Indicates that measurement is in progress.

VXIbus Characteristics

Device Type	Message based module.

Power Requirements

Current — Maximum current drawn from VXIbus dc voltage rails:

dc Volts	dc Current	Dynamic Current
+24 V +12 V +5 V –2 V –5.2 V –12 V –24 V	1.6 A 10 mA	0.32 A 0.6 mA

Power Dissipation — 15 W max

Cooling requirements

Airflow	0.4 litres/second/slot for 10 °C rise
Back Pressure	0.1 mm H_2O

Physical

Size	1-slot, C-size VXI module
Weight	1.6 kg (3.5 lb) (nominal)
Dimensions	262 mm (H) × 30 mm (W) × 355 mm (D) (nominal)

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Mainframe (J4222A)

J4222A is the recommended mainframe for use with SpectraIBER Multi-rate. It comprises an E8404A VXI mainframe, an E1406A slot 0 command module, a J4223A DWDM controller, a manual set and other accessories (for example a GPIB cable and EMC filler panels for unused VXI slots).

The E8404A VXI mainframe provides 13 C-size VXI slots. The E1406A module supplied with the mainframe requires one slot, as does the J4223A DWDM controller. The remaining 11 slots can be used by up to five SpectraIBER Multi-rate modules in any combination, or any other C-size VXI product (assuming dc power capacity is not exceeded).

Detailed specifications of the E8404A VXI mainframe can be found on the Internet at:
http://www.tm.agilent.com

Remote Control

Control of the measurement hardware is via a GPIB interface provided on the E1406A slot 0 command module. SpectraIBER provides a GPIB command set based on the industry standard SCPI format. SpectraIBER is also supplied with Universal Instrument Driver (UID) software.

Graphical User Interface

SpectraIBER Multi-rate is supplied with Graphical User Interface (GUI) software. This is a standalone virtual front panel application that runs on Windows 95/98/NT/2000, Solaris.

A PC or workstation equipped with a GPIB interface (not supplied) is required to use SpectraIBER.

For PC hardware requirements, please see Configuration Guide.

General

Environmental

Operating Temperature	+5°C to +40°C
Storage Temperature	–10°C to +70°C
Humidity	15% to 95% RH
EMC	Meets test specifications EN 55011:1991 (Group 1, Class A) / CISPR 11 (1990) (Group 1, Class A) EN 50082-1:1992
Product Safety	Meets EN 61010-1:1993 / IEC 61010-1 (1990) +A1(1992) +A2(1995) EN 60825-1:1994 / IEC 825-1 (1993) FDA 21 CFR Ch.1 1040.10 See Transmitter Module specifications for safety classification.

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Europe:
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(fax) (31 20) 547 2390

Japan:
(For test solutions at 2.5 Gb/s and below)
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Japan:
(For test solutions at 10 Gb/s)
ANDO Electric Co., Ltd
(tel) (81) 44 549 7300
(fax) (81) 44 549 7467

Latin America:
(tel) (305) 267 4245
(fax) (305) 267 4286

Australia:
(tel) 1 800 629 485
(fax) (61 3) 9272 0749

New Zealand:
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(fax) (852) 2506 9284

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Warranty

Agilent Technologies provides a standard 1-year return-to-Agilent warranty on both mainframes and modules.

Class 1 laser product
EN 60825-1:1994 / IEC 825-1 (1993)

Class I laser product
FDA 21 CFR Ch.1 1040.10

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