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YOKOGAWA

AQ2200 Series

Multi Application Test System



Ideal Measurement Solution for Optical Devices and Optical Transmission Systems

- A broad lineup of measurement modules
- A variety of measurement applications
- Hot-swappable modules
- Easy-to-view TFT display
- A variety of external interfaces (GP-IB, Ethernet, USB)

Bulletin AQ2200-10E

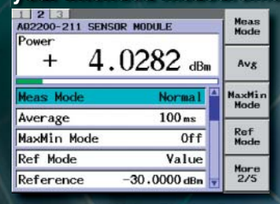
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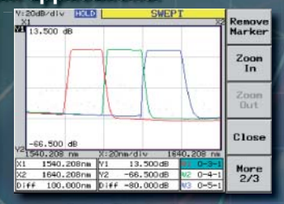
Ideal Measurement Solution for Optical Devices and Optical Transmission Systems

The AQ2200 Multi Application Test System is the ideal system for measuring and evaluating a wide range of optical devices and optical transmission systems. A variety of measurement modules are available, including the following: a high-stability light source, a wideband tunable laser source, a high-speed optical sensor with low PDL, a high-resolution variable optical attenuator, a small-sized bit error module with an integrated pulse pattern generator (PPG) and error detector (ED), an optical modulator with variable extinction ratio, and an optical receiver supporting two wavelengths (1310 and 1550 nm) and XFP interface module. These modules can be installed in any combination on a single platform, providing an ideal measurement system for a variety of applications.

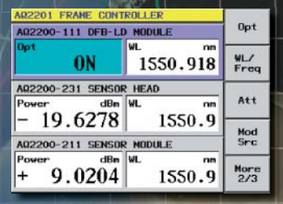
The AQ2200 Multi Application Test System is available in two different frame controller platforms. Each model has a certain number of slots for connecting modules, so you can select the best platform size for your intended measurement applications.



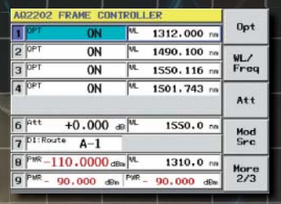
Measurement Value Display Screen



Graph Display Screen



AQ2201 Frame Controller



AQ2202 Frame Controller

Fully Equipped Module Display Screen

Easy-to-view color display

The AQ2201 and AQ2202 both have a 320×240-dot, wide-viewing-angle, high-resolution color TFT display for easy viewing. Even detailed graphs are easy to view on this display.

USB Memory and Compact Flash (CF) card for data storage

The USB and CF card slots make it easy to quickly save and load data. Measurements are saved in CSV format, so they can be easily imported into almost any PC application.



Hot-swappable Modules

Measurement modules can be inserted or removed without turning off the power. This hot-swapping capability makes it easier to reconfigure your system. (warm-up time still required to ensure accurate measurements.)



Frame and Measurement Module Lineup

- **Frame Controller**
  - AQ2201 Frame controller (3 slots)
  - AQ2202 Frame controller (9 slots)
- **Light Source Module**
  - AQ2200-111 DFB-LD module (C&L Band)
  - AQ2200-136 TLS module (1.44μm to 1.64μm)
  - AQ2200-141 FP-LD module (1.31μm or 1.55μm)
  - AQ2200-142 DUAL FP-LD module (1.31μm and 1.55μm)
- **Sensor Module and Sensor Head**
  - AQ2200-211 Sensor module (high sensitivity, long wavelength)
  - AQ2200-221 Sensor module (2-channel, long wavelength)
  - AQ2200-215 Sensor module (high power +30dBm)
  - AQ2200-201 Interface module
  - AQ2200-231 Optical sensor head (large diameter, long wavelength)
  - AQ2200-241 Optical sensor head (large diameter, short wavelength)
- **Optical Attenuator Module**
  - AQ2200-311 ATTN module (standard, monitor output option)
  - AQ2200-331 ATTN module (with a built-in optical power meter)
- **Optical Switch Module**
  - AQ2200-421 OSW module (1 × 2 or 2 × 2)
  - AQ2200-411 OSW module (1 × 4 or 1 × 8)
  - AQ2200-412 OSW module (1 × 16)
- **10 Gbit/s BERT Module**
  - AQ2200-601 10 Gbit/s BERT module
  - AQ2200-621 10 Gbit/s optical modulator (1.55 μm)
  - AQ2200-622 10 Gbit/s optical modulator (1.31 μm)
  - AQ2200-631 10 Gbit/s optical receiver (1.31 and 1.55 μm)
  - AQ2200-641 XFP interface module

Remote monitoring and measurement through a LAN

The AQ2201 and AQ2202 support Ethernet as well as GP-IB, which is the standard interface for measuring instruments. The Ethernet makes remote monitoring and control even easier.

Built-in functions supporting a variety of measurement applications

Functions for a variety of measurement applications are included as standard features in the AQ2201 and AQ2202 platforms, so you can get to work right away without connecting an external PC or setting up a control program.

Optical power stability measurement:
Measures and records optical power over extended periods of time. Fluctuations in optical power can be graphed and analyzed (maximum value, minimum value, etc.).

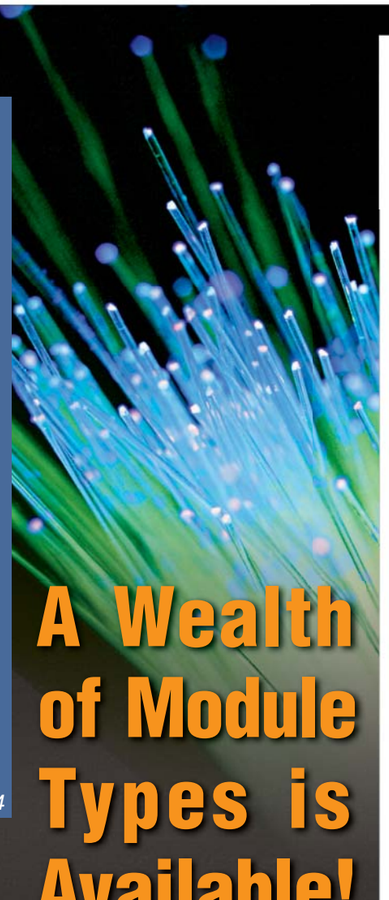
Short-term optical power fluctuation measurement:
Measures and records momentary fluctuations in optical power. Fluctuations in optical power can be graphed and analyzed (maximum value, minimum value, etc.).

Wavelength dependent loss measurement:
Measures loss characteristics over wavelength, synchronizing the wavelength sweep of the TLS module with the sensor module.

Bit error rate test:
Can be used to measure the bit error rate using the pulse pattern generator (PPG) and error detector (ED) built into the 10 Gbit/s BERT module. Measurement conditions can be set and operating status information (elapsed measurement time, logging display, measurement results display, etc.) can be displayed.

Multi Application Test System AQ2200 Series

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A Wealth of Module Types is Available!

Multi Application Test System

AQ2200 Series

Module Lineup

Sensor Module Improved measurement throughput

High-Sensitivity & Low Polarization (AQ2200-211)

- Power range: –110 to +10 dBm
- Polarization dependence : 0.005 dBp-p or less
- Noise level: 0.2 pW or less
- Averaging time : 100 µs (minimum sampling intervals)



Large-diameter (AQ2200-231/-241)

- AQ2200-231: 800-1700 nm
- AQ2200-241: 400-1100 nm
- Power range: –90 to +10 dBm
- Averaging time : 100 µs (minimum sampling intervals)



High-Power (AQ2200-215)

- High Power Measurement: +30dBm
- Power range: -70 to +30 dBm
- Averaging time: 100 µs (minimum sampling intervals)

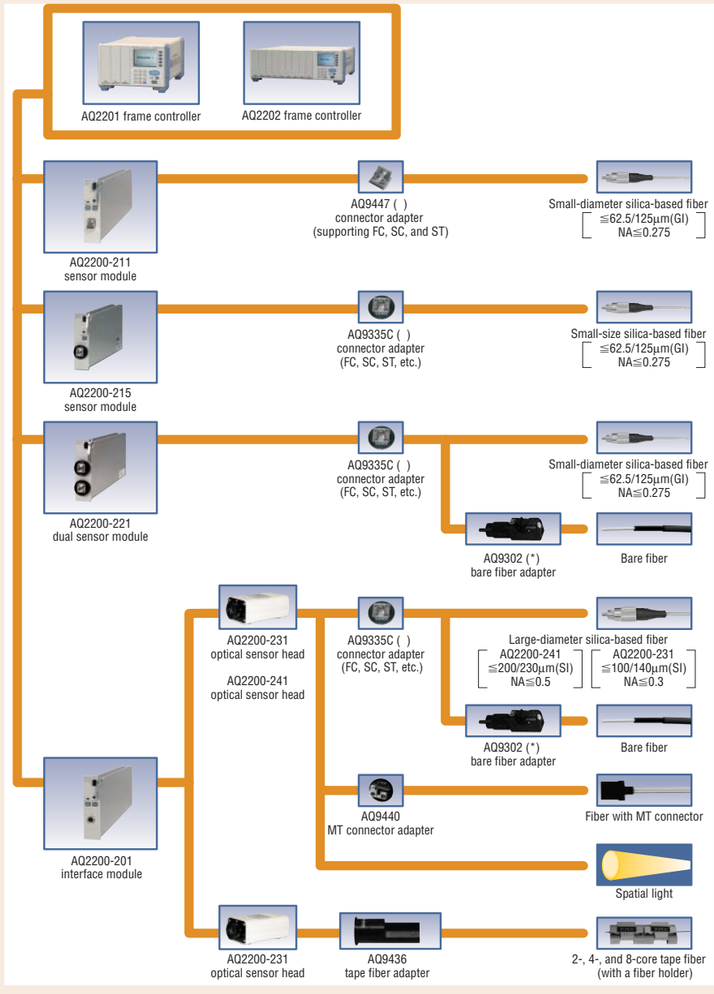


Dual-Channel (AQ2200-221)

- Compact: Two high-performance sensors in a module.
- Power range: -70 dBm to +10 dBm
- Averaging time : 200 µs (minimum sampling intervals)



Sensor Module Selection Guide



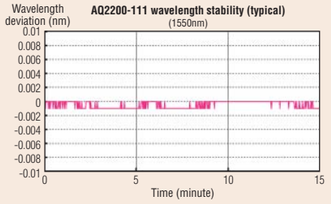
Light Source Module Ideal Reference Light Sources for Optical Device Measurements

DFB-LD Light Source (AQ2200-111)

- Wavelength: 1524.111 to 1620.500 nm 1310 nm, 1490 nm
- Wavelength stability : ± 0.005 dB or less

Note: Other wavelengths are also available on request

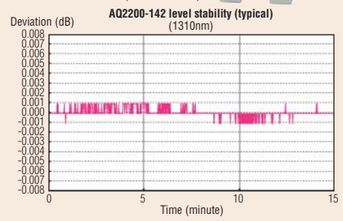




FP-LD Light Source (AQ2200-141/-142)

- Wavelength: 1310 nm, 1550 nm
- AQ2200-141: Single-wavelength
- AQ2200-142: Dual-wavelength
- Output level stability : ± 0.003 dB or less (AQ2200-141)





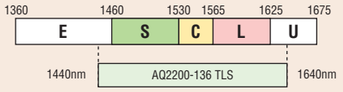
Tunable Laser Source (AQ2200-136)

- Wavelength range: 1440 to 1640 nm
- Wavelength accuracy: ±100 pm
- Output level: +7 dBm or more (at peak)



200 nm Tuning Range

S-, C-, and L-bands are covered in a single unit



Optical Attenuator Module Providing low insertion loss

Standard type (AQ2200-311)

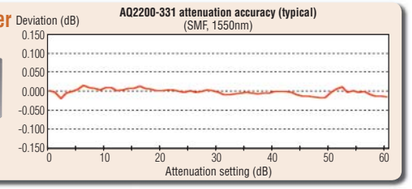
- Low insertion loss: 1.0 dB (typical)
- Wide attenuation range: 0 dB to 60 dB (in steps of 0.001 dB)
- Wide wavelength range: 1200 nm to 1700 nm
- Monitor output (optional)
- Low polarization dependence loss: 0.08 dBp-p or less
- SMF (10 / 125 µm)



ATTN w/ Built-in Optical Power Meter (AQ2200-331)

- Attenuation accuracy: within ±0.1 dB
- The output monitor function allows for directly setting the optical power
- SMF (10 / 125 µm) or MMF (62.5 / 125 µm)



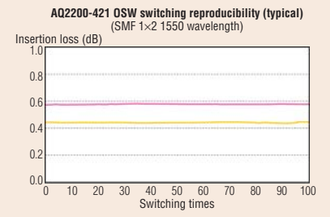


Optical Switch Module Superior switching reproducibility

1×2, 2×2 Dual Optical Switch (AQ2200-421)

- Compact: Optical switches of 1 × 2 or 2 × 2 port configuration in a one-slot size module
- Supports SMF (10 / 125 µm) or MMF (62.5 / 125µm)
- Low insertion loss: 1.0 dB (typ.)
- Switching reproducibility: ±0.01dB

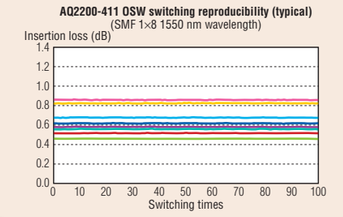




1×4,1×8 Optical Switch (AQ2200-411)

- SMF (10 / 125 µm) or MMF (62.5 / 125µm)
- Switching reproducibility: ±0.01dB
- Low insertion loss: 1.0 dB (typ.)

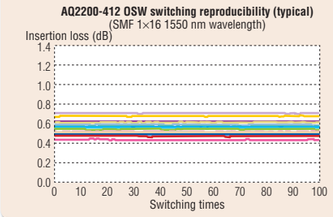




1×16 Optical Switch (AQ2200-412)

- SMF (10 / 125 µm)
- Switching reproducibility: ±0.01dB
- Low insertion loss: 1.0 dB (typ.)





10Gbit/s BERT Module Electrical & Optical Test System

10Gbit/s BERT module (AQ2200-601)

- PPG, ED and SG integrated design
- Bit rates: 9.95 to 11.32 Gbit/s
- Variable output amplitude, offset and cross point
- Clock and Data Recovery (CDR) function included
- 64 Mbit long program pattern generation capability (option)



XFP interface module (AQ2200-641)

- With AQ2200-601 10 Gbit/s BERT modules, builds an optical 10 Gbit/s BERT system
- A commercial XFP transceiver can be used
- Adapts to various wavelengths and fiber types by changing the XFP transceiver
- XFP transceiver status such as temperature and alarms can be monitored



10Gbit/s Optical Modulator (AQ2200-621 / -622)

- AQ2200-621: 1550nm
- AQ2200-622: 1310nm
- Extinction ratio adjustment fuction
- Closs point adjustment fuction
- Auto-Bias Control function



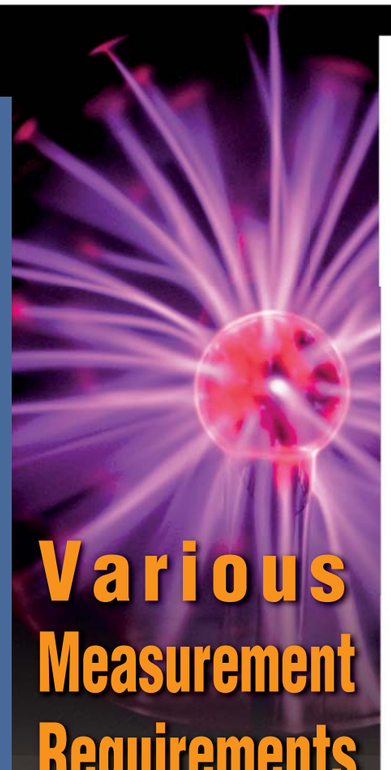
10Gbit/s Optical Receiver (AQ2200-631)

- Wavelength: 1310nm and 1550nm
- Data threshold value adjustment function
- Optical power monitor function



Other connectors and fiber types not listed are available on request
i.e. Angled PC connector, GI 50 (50/125µm), etc.

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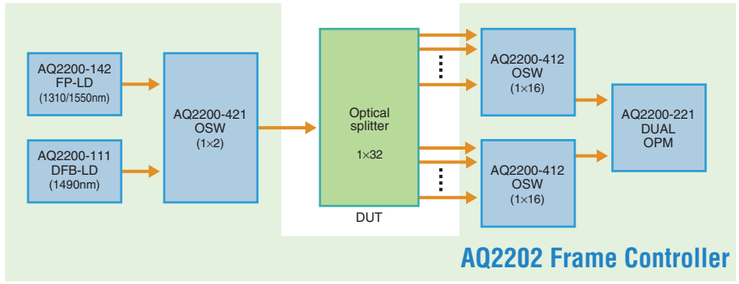
Measurement Applications

Optical Splitter Measurement System for PON

An optical splitter is an optical device to split an optical signal into 8 to 32 ports, and is used for FTTH systems such as PON or GE-PON. This measurement system allows for measuring insertion losses for each port fast and accurately.

[Measurement items]

- Insertion loss for each port (1310 nm, 1490 nm, and 1550 nm)

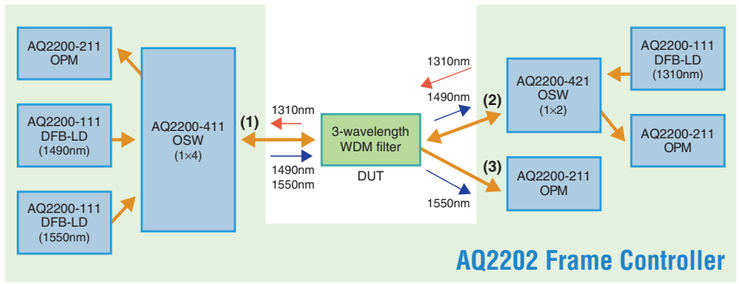


3-wavelength Optical Filter Measurement System for GE-PON

A 3-wavelength optical filter for GE-PON splits 1490 nm and 1550 nm optical signals, and pass a 1310 nm optical signal in the return direction.
This measurement system measures the insertion losses of wavelengths passing between ports and the isolation of wavelengths blocked.

[Measurement items]

- Insertion loss: (1) to (2) 1490 nm, (1) to (3) 1550 nm, (2) to (1) 1310 nm
- Isolation: (1) to (2) 1550 nm, (1) to (3) 1490 nm, (2) to (3) 1310 nm

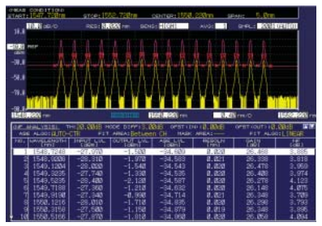


Optical Fiber Amplifier Measurement System

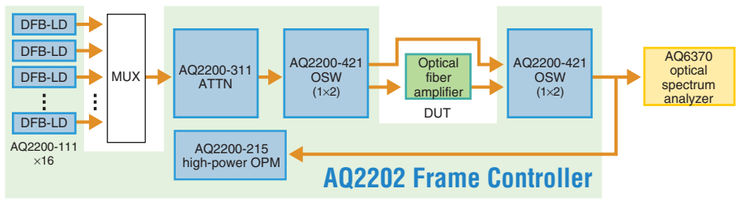
An optical fiber amplifier is an indispensable device for WDM transmission systems. This measurement system characterizes gains and noise figures (NF) of the fiber amplifier by measuring input light to an optical fiber amplifier, which was multiplexed using multiple DFB-LDs, as well as amplified output light with an optical spectrum analyzer. A high-power sensor allows for measuring total output power.

[Measurement items]

- Gain, NF, and total output power



AQ6370 Measurement Screen

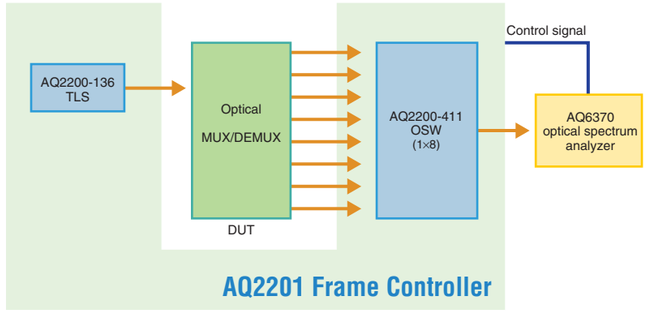


MUX/DEMUX Measurement System for WDM

A multiplexer (MUX) and de-multiplexer (DEMUX) are key devices for WDM systems. This measurement system measures loss-wavelength characteristics of each port with an optical spectrum analyzer by switching ports with an optical switch. The wavelength sweep function of the Tunable Laser Source (TLS) enables extremely fast measurement and the system can sequentially measure multiple ports. By using the Macro programming function of the optical spectrum analyzer, an external PC can be eliminated. The filter effect of diffraction grating built in the optical spectrum analyzer enables measurements of the filter's transmission characteristics and stopband characteristics in a high dynamic range of 90 dB or more.

[Measurement items]

- Loss-wavelength characteristic, center wavelength, insertion loss, filter bandwidth, flatness, and cross-talk





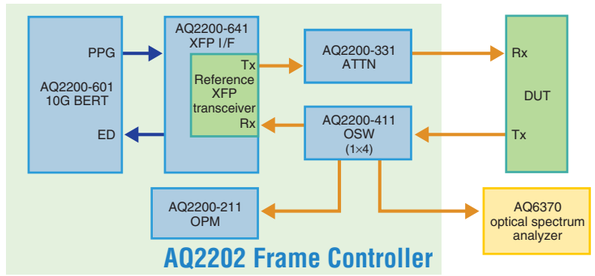
AQ6370 Measurement Screen

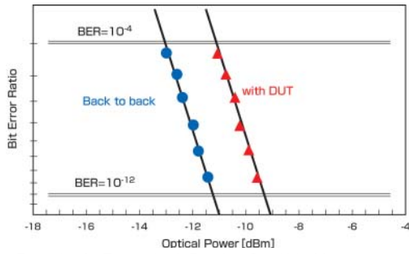
10 Gbit/s Transceiver Measurement System

10 Gbit/s optical transceiver modules such as an XFP are used for 10 G Ethernet system.
Employing commercial XFP transceivers in the AQ2200-641 XFP interface module makes it easy to build optical BERT systems. Changing XFP transceivers enables the adaptation to various wavelengths and fiber types. This measurement system measures major parameters of an optical transceiver defined in the IEE 803.2ae standard.

[Measurement items]

- Receiving sensitivity (BER curve), center wavelength, spectrum width, average optical power, etc.





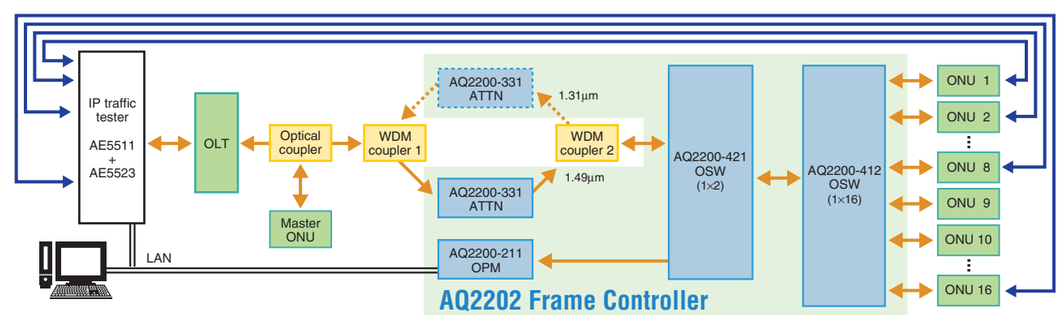
Example of a Transceiver's Receiver Sensitivity Measurement

GE-PON Test System

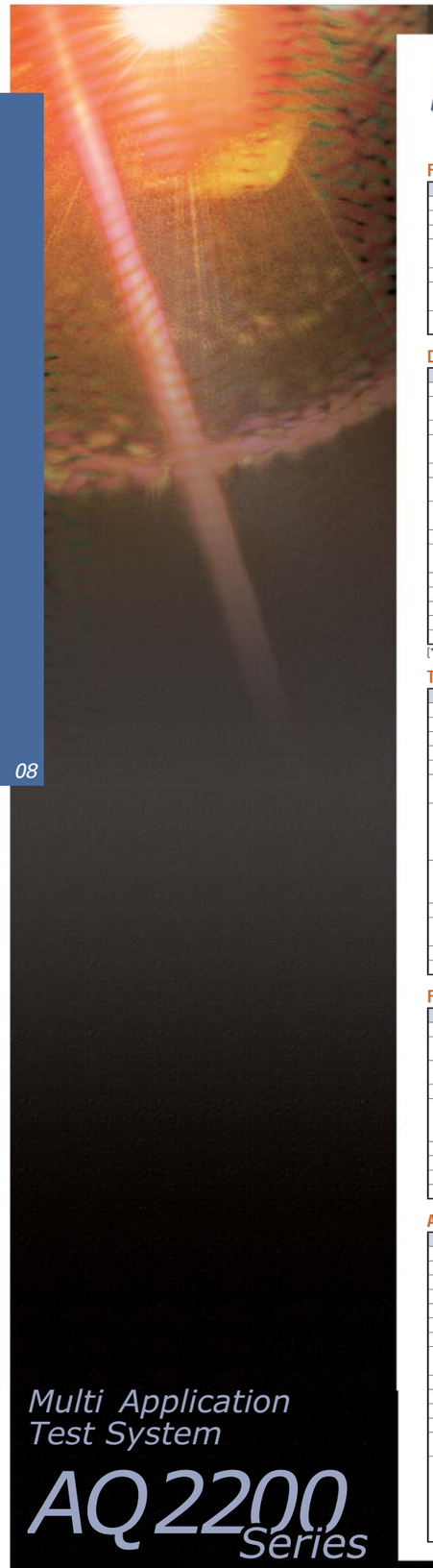
To evaluate GE-PON systems used for FTTH networks, optical characteristics and IP traffic tests are performed. Since a GE-PON consists of OLTs and multiple ONUs, efficient measurement of multiple ports is required. Use of multiple-port optical switches of the AQ2200 series and the IP traffic load generator and tester (AE5511 Traffic Tester Pro) equipped with multi-port interfaces makes it possible to build an efficient automated measurement system. By AQ2200-331 Optical Attenuator equipped with an optical power meter the ONU optical-receiving level can be adjusted without changing the fiber connection.

[Measurement items]

- LAN interface test (auto-negotiation, auto-MDIX, flow control, etc.)
- PON interface test (uplink burst control, etc.)
- Alarm test (optical input disruption notification, etc.)
- Traffic test (throughput and delay)
- Optical characteristic test (optical power and optical-receiving sensitivity)



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Multi Application Test System

AQ2200 Series

Product Specifications

For details, refer to “GS810518900.”

Frame Controller (AQ2201/2202)

Item		Product Specs	
Product name		AQ2201	AQ2202
Number of slots		3	9
Display		LCD, 320 × 240 pixels	
Interface	GP-IB	IEEE-488.2 compliant	
	Ethernet	10BASE-T compliant, RJ-45 connector	
Storage media		USB memory, compact flash card	
Power supply		100 V to 240 V 50/60 Hz	100 V to 240 V 50/60 Hz
		170 VA (including modules)	580 VA (including modules)
External dimensions		Approx. 212 (W) × 132.5 (H) × 400 (D) mm (excluding protrusions)	Approx. 425 (W) × approx. 132.5 (H) × approx. 500 (D) mm (excluding protrusions)

DFB-LD Module (AQ2200-111)

Item		Product Specs
Wavelength's specified range		1310 nm, 1490 nm, 1524.111 to 1620.500 nm [*1]
Wavelength accuracy		1310 nm, 1490 nm: Within ±0.05 nm 1524.111 to 1620.500 nm: Within ±0.02 nm
Wavelength setting resolution		0.001 nm
Spectral width	Narrow	5 MHz (typical)
	Wide	100 MHz (typical)
Optical output level		+10 dBm or more
SMSR		1310 nm, 1490 nm: 30 dB or more 1524.111 to 1620.500 nm: 45 dB (typical)
Output level stability	15 minutes	±0.005 dB or less
	24 hours	±0.03 dB or less
Optical attenuation range		10 dB (0.01 dB step)
Wavelength stability	15 minutes	±0.005 nm or less
	24 hours	±0.01 nm or less
Wavelength adjustment range		1.6 nm or more
RIN		-145 dB/Hz (typical)
Internal modulation function		Available
Applicable optical fiber		Select any of SMF (ITU-T G.652) or PMF
Optical connector		FC/Angled PC

[*1] Refer to the list of supported wavelengths in the ordering information. Other wavelengths are also available on request.

TLS Module (AQ2200-136)

Item		Product Specs
Wavelength tuning range		1440 nm to 1640 nm
Wavelength setting resolution		1 pm
Absolute wavelength accuracy		±100 pm or less
Relative wavelength accuracy		±50 pm or less
Wavelength stability		±5 pm/h or less
Spectrum line width	Narrow	1 MHz or less
	Wide	50 MHz or more
Optical output level	Max. output wavelength	+7 dBm or more
	1520 to 1610 nm	+5 dB or more
	1475 to 1625 nm	+1 dBm or more
	Total wavelength range	-8 dBm or more
Output level stability	5 minutes	±0.01 dB or less
	1 hour	±0.05 dB or less
	24 hours	±0.1 dB or less
Optical output reproducibility(relative to wavelength)		±0.04 dB or less
Monitor output	Max. optical output	+5 dBm or less
	Min. optical output	-25 dBm or more
Applicable optical fiber		SMF (ITU-T G.652)
Optical connector		FC/Angled PC

FP-LD Module (AQ2200-141/-142)

Item		Product Specs	
Product Name		AQ2200-141	AQ2200-142
Center wavelength		1310 ±20 nm (when selecting 1310 nm) 1550 ±20 nm (when selecting 1550 nm)	1310 ±20 nm, 1550 ±20 nm
Spectral width		5 nm or less (when selecting 1310 nm) 10 nm or less (when selecting 1550 nm)	5 nm or less (1310 nm) 10 nm or less (1550 nm)
Optical output level		+0 dBm or more	-1 dBm or more
Output level stability	Temperature stability	0.2 dBp-p or less (5 to 40˚C, 8 hours)	0.3 dBp-p or less (5 to 40˚C, 8 hours)
	Time stability	±0.003 dB or less (15 minutes)	±0.005 dB or less (15 minutes)
Optical attenuation range		Within ±0.03 db (24 hours)	
Internal modulation function		6 dB (0.01 dB step)	
Applicable optical fiber		270 Hz, 1 kHz, 2 kHz	
Optical connector		SMF (ITU-T G.652)	
		AQ9441 (*) universal adapter	

ATTN Module (AQ2200-311/-331)

Item		Product Specs		
Product name		AQ2200-311	AQ2200-331	
Wavelength range		1200 to 1700 nm	1200 to 1700 nm	800 to 1370 nm
Insertion loss		1.0 dB (typical) 1.6 dB or less	1.9 dB (typical) 2.3 dB or less	
Max. attenuation		60 dB	60 dB	45 dB
Attenuation accuracy		±0.1 dB or less	±0.1 dB or less	
Repeatability		±0.01 dB or less	±0.01 dB or less	
Monitor power meter accuracy		—	±5% or less	
Optical return loss		45 dB or more (when selecting PC connector)	45 dB or more	20 dB or more
		60 dB or more when selecting angled PC connector)	—	—
Polarization dependence		0.08 dBp-p or less	0.1 dBp-p or less	—
Max. input power		+23 dBm		—
Shutter isolation		90 dB or more		
Applicable optical fiber		SMF (ITU-T G.652)		MMF (62.5/125) (IEC 60793-2)
Optical connector		Select any of FC/PC, SC/PC, FC/Angled PC, or SC/Angled PC	Select any of FC/PC or SC/PC	
Monitor port option				
Monitor port output		-13 dB (typical)		
Insertion loss		2.3 dB or less		
Optical return loss		45 dB or more (when selecting PC connector)		
		50 dB or more (when selecting angled PC connector)		
Polarization dependence		0.1 dBp-p or less		

Sensor Module (AQ2200-211/-215/-221/-231/-241)

Item		Product Specs				
Product name		AQ2200-211	AQ2200-215	AQ2200-221	AQ2200-231[*1]	AQ2200-241[*1]
Number of channels		1	1	2	1	1
Detector type		InGaAs		InGaAs ϕ3 mm	InGaAs ϕ5 mm	Si □10 mm
Wavelength range		700 to 1700 nm	970 to 1660 nm	800 to 1700 nm	800 to 1700 nm	400 to 1100 nm
Power range	CW light	-110 to +10 dBm	-70 to +30 dBm	-70 to +10 dBm	-90 to 10 dBm	
	CHOP light	-110 to +7 dBm	—	—	-90 to +7 dBm	
Applicable fiber type		≦62.5/125 µm (GI), NA≦0.275		≦62.5/125 µm (GI), NA≦0.275	≦100/140 µm (SI), NA≦0.3	≦200/230 µm (SI), NA≦0.5
Uncertainty under reference conditions		±2%	±3%	±3%	±2%	±2.5%
Total uncertainty		±3.5% ±0.5 pW	±5.0% ±2.0 nW	±5.0% ±50 pW	±3.5% ±50 pW	±5% ±50 pW
Polarization dependence		0.005 dBp-p or less	0.03 dBp-p (typical)	0.02 dBp-p (typical)	0.025 dBp-p or less	—
Linearity		±0.015 dB ±0.2 pW	±0.05 dB ±2.0 nW	±0.02 dB ±50 pW	±0.015 dB ±50 pW	±0.05 dB ±50 pW
Noise level		0.2 pW or less	2.0 nW or less	50 pW or less		
Averaging time (min.)		100 µs		200 µs	100 µs	
Optical connector		AQ9447 (*) connector adapter	AQ9335C (*) connector adapter			

[*1] An AQ2200-201 interface module is required.

OSW Module (AQ2200-411/-412/-421)

Item	Product Specs								
Product name	AQ2200-411				AQ2200-412	AQ2200-421			
Port configuration	1×4	1×8	1×4	1×8	1×16	1×2	2×2	1×2	2×2
Number of switch	1		1		1	2		2	
Wavelength	1310 nm/1550nm		850 nm/1300 nm		1310 nm/1550 nm			850 nm/1310 nm	
Insertion loss	1 dB (typical) 1.4 dB or less								
Reproducibility	±0.01 dB or less								
Crosstalk	-60 dB or less		-50 dB or less		-60 dB or less	-50 dB or less			
Return loss	45 dB or more		20 dB or more		45 dB or more	45 dB or more		20 dB or more	
Polarization dependence	0.08 dBp-p or less		—		0.08 dBp-p or less			—	
Applicable optical fiber	SM (ITU-T G.652)		MMF (62.5/125) (IEC 60793-2)		SMF (ITU-T G.652)	SMF (ITU-T G.652)		MMF (62.5/125) (IEC 60793-2)	
Optical connector	Select any of FC/PC or SC/PC								

10 Gbit/s BERT Module (AQ2200-601)

•Clock & Trigger

Item		Product Specs
Internal clock		
	Internal frequency variation	Variable frequency range: 9.95 to 11.32 GHz
		Setting resolution: 1 kHz
External reference		
	Frequency	1/16 or 1/64 of bit rate
	Input level	0.4 to 1.0 Vp-p (50 Ω AC)
External clock input		
	Frequency	1/1 of bit rate
	Input level	0.4 to 1.0 Vp-p (50Ω AC/DC)
Trigger output		
	Trigger type	Clock trigger, pattern trigger, error trigger
	Output level	0.6 Vp-p ±0.3 V (50 Ω AC/DC)

•PPG Output

Item		Product Specs
Data output		
	Bit rate	9.95 Gbit/s to 11.32 Gbit/s
	Output level	0.5 to 2.0 Vp-p (10 mV step)
Offset voltage		-2 V to +3 V (10 mV step)
	Cross point, variation	30 to 70% (1% step)
	Output termination	50Ω AC termination or DC termination
Clock output		
	Output level	0.6 Vp-p±0.2 V
	Offset	-2 V to +3 V (10 mV step)
	Output termination	50Ω AC termination or DC termination
Transmit pattern		
	PRBS	2^n - 1 (n:7, 9, 10, 11, 15, 23, and 31)
	PROGRAM	(1) 16 to 256 bit (1 bit step) (2) 256 to 67, 108, 864 bit (128 bit step) option

•ED Input

Item		Product Specs
DATA IN1 (CDR)		
	Bit rate	9.95 to 11.32 Gbit/s
	Input level range	0.1 to 0.7 Vp-p
	Input threshold, variation	±0.35 V (1 mV step)
	Input termination	50Ω AC combined
DATA IN2		
	Bit rate	9.95 to 10.71 Gbit/s
	Input level range	0.1 to 0.6 Vp-p
	Input threshold, variation	±0.3 V (1 mV step)
	Input termination	50Ω AC combined
Clock input		
	Frequency	Frequency synchronized with DATA IN2 at the same rate
	Input level	0.2 to 0.6 Vp-p
	Input termination	50Ω AC combined
	Receiving pattern	Identical to PRBS and PROGRAM transmit pattern

10 Gbit/s Optical Modulator (AQ2200-621/-622)

Item	Product Specs
Wavelength range	AQ2200-621: 1530 nm to 1570 nm
	AQ2200-622: 1290 nm to 1330 nm
Wavelength stability	As per AQ2200-111 DFB-LD module specification
Optical power stability	As per AQ2200-111 DFB-LD module specification
LN cut type	Select any of X-cut or Z-cut
Optical insertion loss	7 dB typical, 10 dB max.
Max. optical input	16 dBm
Performance guaranteed optical input range	9 dBm to 13 dBm
Extinction ratio	AQ2200-621: 12 dB or more @1550 nm
	AQ2200-622: 12 dB or more @1310 nm
Electrical input level	0.5 Vp-p ±0.1 V AC combined
Optical connector (LD IN)	SC/PC
Optical connector (OPT OUT)	Select any of SC/PC or FC/PC
Applicable optical fiber	SMF (ITU-T G.652) or PMF Use PMF inside the module (slow axis key)

10 Gbit/s Optical Receiver (AQ2200-631)

Item	Product Specs
Wavelength range	1290 nm to 1330 nm, 1530 nm to 1570 nm
Min. optical receiving sensitivity	< -15 dBm @ 1550 nm, Ex = 12 dB, 9.953 Gbit/s, PRBS31
	< -14 dBm @ 1310 nm, Ex = 12 dB, 9.953 Gbit/s, PRBS31
Max. optical input	6 dBm peak, 3 dBm average
Overload	-1 dBm or more
Electrical output level	0.3 Vp-p or more AC combined
Optical connector	Select any of SC/PC or FC/PC
Applicable optical fiber	SMF (ITU-T G.652)

XFP Interface Module (AQ2200-641)

Item			Product Specs
Data input	DATA IN	Data format	NRZ
		Connector	3.5 mm female
		Note	Direct input to XFP transceiver
	$\overline{\text{DATA}}$ IN	Data format	NRZ
		Connector	3.5 mm female
		Note	Direct input to XFP transceiver
Data output	DATA OUT	Data format	NRZ
		Connector	3.5 mm female
		Note	Direct output to XFP transceiver
	$\overline{\text{DATA}}$ OUT	Data format	NRZ
		Connector	3.5 mm female
		Note	Direct output to XFP transceiver
Reference clock input	REF CLOCK IN	Input level	0.6 Vp-p ±0.3V
		Input frequency	1/64 of bit rate
		Connector	SMA female
Allowable times for insertion and removal of XFP transceiver			200

[*] XFP transceiver is not included in this module.

Other connectors and fiber types not listed are available on request
i.e. Angled PC connector, GI 50 (50/125µm), etc.

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Ordering Information

AQ2201 Frame Controller

Model	Spec Code	Specs
810518900	—	—
	-M	Domestic 3P with 2 to 3 pin conversion adapter
	-D	UL/CSA standard type UL3P
	-F	VDE standard type CEEC7
	-G	SAA standard type SAA3P
	-Q	BS standard type rectangular BS3P
	-H	BS standard type round BS3P

AQ2202 Frame Controller

Model	Spec Code	Specs
810518920	—	—
	-M	Domestic 3P with 2 to 3 pin conversion adapter
	-D	UL/CSA standard type UL3P
	-F	VDE standard type CEEC7
	-G	SAA standard type SAA3P
	-Q	BS standard type rectangular BS3P
	-H	BS standard type round BS3P

AQ2200-111 DFB-LD Module

Model	Spec Code	Specs
810518901	—	—
	-M0290	Frequency 191.600 THz, wavelength 1564.679 nm
	-M0275	Frequency 191.650 THz, wavelength 1564.271 nm
	-M0270	Frequency 191.700 THz, wavelength 1563.863 nm
	-M0255	Frequency 191.750 THz, wavelength 1563.455 nm
	-M0250	Frequency 191.800 THz, wavelength 1563.047 nm
	-M0235	Frequency 191.850 THz, wavelength 1562.640 nm
	-M0230	Frequency 191.900 THz, wavelength 1562.233 nm
	-M0215	Frequency 191.950 THz, wavelength 1561.826 nm
	-M0210	Frequency 192.000 THz, wavelength 1561.419 nm
	-M0195	Frequency 192.050 THz, wavelength 1561.013 nm
	-M0190	Frequency 192.100 THz, wavelength 1560.606 nm
	-M0175	Frequency 192.150 THz, wavelength 1560.200 nm
	-M0170	Frequency 192.200 THz, wavelength 1559.794 nm
	-M0155	Frequency 192.250 THz, wavelength 1559.389 nm
	-M0150	Frequency 192.300 THz, wavelength 1558.983 nm
	-M0135	Frequency 192.350 THz, wavelength 1558.578 nm
	-M0130	Frequency 192.400 THz, wavelength 1558.173 nm
	-M0115	Frequency 192.450 THz, wavelength 1557.768 nm
	-M0110	Frequency 192.500 THz, wavelength 1557.363 nm
	-M0095	Frequency 192.550 THz, wavelength 1556.959 nm
	-M0090	Frequency 192.600 THz, wavelength 1556.555 nm
	-M0075	Frequency 192.650 THz, wavelength 1556.151 nm
	-M0070	Frequency 192.700 THz, wavelength 1555.747 nm
	-M0055	Frequency 192.750 THz, wavelength 1555.343 nm
	-M0050	Frequency 192.800 THz, wavelength 1554.940 nm
	-M0035	Frequency 192.850 THz, wavelength 1554.537 nm
	-M0030	Frequency 192.900 THz, wavelength 1554.134 nm
	-M0015	Frequency 192.950 THz, wavelength 1553.731 nm
	-M0010	Frequency 193.000 THz, wavelength 1553.329 nm
	-M0005	Frequency 193.050 THz, wavelength 1552.926 nm
	-M0000	Frequency 193.100 THz, wavelength 1552.524 nm
	-M000H	Frequency 193.150 THz, wavelength 1552.122 nm
	-M0020	Frequency 193.200 THz, wavelength 1551.721 nm
	-M0025	Frequency 193.250 THz, wavelength 1551.319 nm
	-M0040	Frequency 193.300 THz, wavelength 1550.918 nm
	-M0045	Frequency 193.350 THz, wavelength 1550.517 nm
	-M0060	Frequency 193.400 THz, wavelength 1550.116 nm
	-M0065	Frequency 193.450 THz, wavelength 1549.715 nm
	-M0080	Frequency 193.500 THz, wavelength 1549.315 nm
	-M0085	Frequency 193.550 THz, wavelength 1548.915 nm
	-M0100	Frequency 193.600 THz, wavelength 1548.515 nm
	-M0105	Frequency 193.650 THz, wavelength 1548.115 nm
	-M0120	Frequency 193.700 THz, wavelength 1547.715 nm
	-M0125	Frequency 193.750 THz, wavelength 1547.316 nm
	-M0140	Frequency 193.800 THz, wavelength 1546.917 nm
	-M0145	Frequency 193.850 THz, wavelength 1546.518 nm
	-M0160	Frequency 193.900 THz, wavelength 1546.119 nm
	-M0165	Frequency 193.950 THz, wavelength 1545.720 nm
	-M0180	Frequency 194.000 THz, wavelength 1545.322 nm
	-M0185	Frequency 194.050 THz, wavelength 1544.924 nm

Model	Spec Code	Specs
810518901	—	—
	-M0200	Frequency 194.100 THz, wavelength 1544.526 nm
	-M0205	Frequency 194.150 THz, wavelength 1544.128 nm
	-M0220	Frequency 194.200 THz, wavelength 1543.730 nm
	-M0225	Frequency 194.250 THz, wavelength 1543.333 nm
	-M0240	Frequency 194.300 THz, wavelength 1542.936 nm
	-M0245	Frequency 194.350 THz, wavelength 1542.539 nm
	-M0260	Frequency 194.400 THz, wavelength 1542.142 nm
	-M0265	Frequency 194.450 THz, wavelength 1541.746 nm
	-M0280	Frequency 194.500 THz, wavelength 1541.349 nm
	-M0285	Frequency 194.550 THz, wavelength 1540.953 nm
	-M0300	Frequency 194.600 THz, wavelength 1540.557 nm
	-M0305	Frequency 194.650 THz, wavelength 1540.162 nm
	-M0320	Frequency 194.700 THz, wavelength 1539.766 nm
	-M0325	Frequency 194.750 THz, wavelength 1539.371 nm
	-M0340	Frequency 194.800 THz, wavelength 1538.976 nm
	-M0345	Frequency 194.850 THz, wavelength 1538.581 nm
	-M0360	Frequency 194.900 THz, wavelength 1538.186 nm
	-M0365	Frequency 194.950 THz, wavelength 1537.792 nm
	-M0380	Frequency 195.000 THz, wavelength 1537.397 nm
	-M0385	Frequency 195.050 THz, wavelength 1537.003 nm
	-M0400	Frequency 195.100 THz, wavelength 1536.609 nm
	-M0405	Frequency 195.150 THz, wavelength 1536.216 nm
	-M0420	Frequency 195.200 THz, wavelength 1535.822 nm
	-M0425	Frequency 195.250 THz, wavelength 1535.429 nm
	-M0440	Frequency 195.300 THz, wavelength 1535.036 nm
	-M0445	Frequency 195.350 THz, wavelength 1534.643 nm
	-M0460	Frequency 195.400 THz, wavelength 1534.250 nm
	-M0465	Frequency 195.450 THz, wavelength 1533.858 nm
	-M0480	Frequency 195.500 THz, wavelength 1533.465 nm
	-M0485	Frequency 195.550 THz, wavelength 1533.073 nm
	-M0500	Frequency 195.600 THz, wavelength 1532.681 nm
	-M0505	Frequency 195.650 THz, wavelength 1532.290 nm
	-M0520	Frequency 195.700 THz, wavelength 1531.898 nm
	-M0525	Frequency 195.750 THz, wavelength 1531.507 nm
	-M0540	Frequency 195.800 THz, wavelength 1531.116 nm
	-M0545	Frequency 195.850 THz, wavelength 1530.725 nm
	-M0560	Frequency 195.900 THz, wavelength 1530.334 nm
	-W1310	Wavelength 1310 nm
	-W1490	Wavelength 1490 nm
	-FCA	FC/Angled PC
	-P20	Optical output 20 mW
	-P10	Optical output 10 mW
	-SMF	SM fiber
	-PMF	PM fiber
	-MODN	Without external modulation
	-MODS	External modulation (SINE)
	-MODC	External modulation (CHOP)

AQ2200-141 FP-LD Module

Model	Spec Code	Specs
810518902	—	—
	-W1310	Wavelength: 1310 nm
	-W1550	Wavelength: 1550 nm
	/FCC	AQ9441 (FC) connector adapter
	/SCC	AQ9441 (SC) connector adapter

AQ2200-142 Dual FP-LD Module

Model	Spec Code	Specs
810518903	—	—
	-W135D	Wavelength: 1310/1550 nm
	-FCC	AQ9441 (FC) connector adapter
	-SCC	AQ9441 (SC) connector adapter

AQ2200-136 TLS Module

Model	Spec Code	Specs
810518904	—	—
	-FCA	Optical connector: FC/Angled PC
	-SMF	Optical fiber: SMF
	-WLSTD	WL = 1440 to 1640 nm

AQ2200-201 Interface Module

Model	Spec Code	Specs
810518905	—	—

AQ2200-211 Sensor Module

Model	Spec Code	Specs
810518908	—	—
	/FCC	AQ9447 (FC) connector adapter (with a light shielding cap)
	/SCC	AQ9447 (SC) connector adapter (with a light shielding cap)
	/STC	AQ9447 (ST) connector adapter (with a light shielding cap)

AQ2200-215 Sensor Module

Model	Spec Code	Specs
735125	—	—
	-NON	Without optical connector adapter
	-FCC	AQ9335C (FC) connector adapter (with a light shielding cap)
	-SCC	AQ9335C (SC) connector adapter (with a light shielding cap)
	-STC	AQ9335C (ST) connector adapter (with a light shielding cap)
	-LCC	AQ9335C (LC) connector adapter (with a dust protection cap)
	-MUC	AQ9335C (MU) connector adapter (with a dust protection cap)

AQ2200-221 Sensor Module

Model	Spec Code	Specs
735122	—	—
	-NON	Without connector adapter
	-FCC	AQ9335C (FC) connector adapter (with 2 light shielding caps)
	-SCC	AQ9335C (SC) connector adapter (with 2 light shielding caps)
	-STC	AQ9335C (ST) connector adapter (with 2 light shielding caps)
	-LCC	AQ9335C (LC) connector adapter (with 2 dust protection caps)
	-MUC	AQ9335C (MU) connector adapter (with 2 dust protection caps)

AQ2200-231 Optical Sensor Head

Model	Spec Code	Specs
810518906	—	—
	/FCC	AQ9335C (FC) connector adapter (with a light shielding cap)
	/SCC	AQ9335C (SC) connector adapter (with a light shielding cap)
	/STC	AQ9335C (ST) connector adapter (with a light shielding cap)

AQ2200-241 Optical Sensor Head

Model	Spec Code	Specs
810518907	—	—
	/FCC	AQ9335C (FC) connector adapter (with a light shielding cap)
	/SCC	AQ9335C (SC) connector adapter (with a light shielding cap)
	/STC	AQ9335C (ST) connector adapter (with a light shielding cap)

AQ2200-311 ATTN Module

Model	Spec Code	Specs
810518915	—	—
	-FCC	Optical connector: FC/PC
	-SCC	Optical connector: SC/PC
	-FCA	Optical connector: FC/Angled PC
	-SCA	Optical connector: SC/Angled PC
	/MON	Monitor port

AQ2200-331 ATTN Module

Model	Spec Code	Specs
735133	—	—
	-SA	Optical fiber: SMF
	-G6	Optical fiber: MMF (62.5/125)
	-FCC	Optical connector: FC/PC
	-SCC	Optical connector: SC/PC

AQ2200-411 OSW Module

Model	Spec Code	Specs
735141	—	—
	-04	Port configuration: 1×4
	-08	Port configuration: 1×8
	-SA	Optical fiber: SMF
	-G6	Optical fiber: MMF (62.5/125)
	-FCC	Optical connector: FC/PC
	-SCC	Optical connector: SC/PC

AQ2200-412 OSW Module

Model	Spec Code	Specs
735143	—	—
	-16	Port configuration: 1×16
	-SA	Optical fiber: SMF
	-FCC	Optical connector: FC/PC
	-SCC	Optical connector: SC/PC

AQ2200-421 OSW Module

Model	Spec Code	Specs
735142	—	—
	-21	Port configuration: Dual 1×2
	-22	Port configuration: dual 1×2
	-SA	Optical fiber: SMF
	-G6	Optical fiber: MMF (62.5/125)
	-FCC	Optical connector: FC/PC
	-SCC	Optical connector: SC/PC

AQ2200-601 10 Gbit/s BERT Module

Model	Spec Code	Specs
810518801	—	—
	/M	64 Mbit program pattern
		128 to 67, 108, 864 bit length/128 bit step

AQ2200-621 10 Gbit/s Optical Modulator (1550 nm)

Model	Spec Code	Specs
810518802	—	—
	-A	X cut
	-B	Z cut
	-S	Optical connector: SC/PC
	-F	Optical connector: FC/PC
	/P	PMF (FC/APC - SC/PC, for 1550 nm) Patch cord
	/U	U-link co-axial cable

AQ2200-622 10 Gbit/s Optical Modulator (1310 nm)

Model	Spec Code	Specs
810518804	—	—
	-A	X cut
	-B	Z cut
	-S	Optical connector: SC/PC
	-F	Optical connector: FC/PC
	/P	PMF (FC/APC - SC/PC, for 1310 nm) Patch cord
	/U	U-link coaxial cable

AQ2200-631 10 Gbit/s Optical Receiver (1310 nm/1550 nm)

Model	Spec Code	Specs
810518803	—	—
	-S	Optical connector: SC/PC
	-F	Optical connector: FC/PC
	/U	U-link coaxial cable

AQ2200-641 XFP Interface Module

Model	Spec Code	Specs
735161	—	—

Other connectors and fiber types not listed are available on request
i.e. Angled PC connector, GI 50 (50/125µm), etc.

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Accessories

Product Name	Model	Specs
AQ2200-901 blank panel	810518926	1 slot size
19-inch rack mount kit A (132.5)	819601000	For AQ2202 mounting
19-inch rack mount kit C (132.5)	819601200	For AQ2201 right-side mounting
19-inch rack mount kit D (132.5)	819601300	AQ2201 left-side mounting
AQ9441 (FC) universal adapter	813917321-FCC	FC connector for AQ2200-141/AQ2200-142
AQ9441 (SC) universal adapter	813917321-SCC	SC connector, for AQ2200-141/AQ2200-142
AQ9447 (FC) connector adapter	810804602-FCC	FC connector for AQ2200-211
AQ9477 (SC) connector adapter	810804602-SCC	SC connector for AQ2200-211
AQ9477 (ST) connector adapter	810804602-STC	ST connector for AQ2200-211
AQ9335C (FC) connector adapter	810518909-FCC	FC connector for AQ2200-215/-221/-231/-241
AQ9335C (SC) connector adapter	810518910-SCC	SC connector for AQ2200-215/-221/-231/-241
AQ9335C (ST) connector adapter	810518911-STC	ST connector for AQ2200-215/-221/-231/-241
AQ9335C (LC) connector adapter	M3407JD	LC connector for AQ2200-215/-221/-231/-241 with a dust protection cap
AQ9335C (MU) connector adapter	M3407JE	MU connector for AQ2200-215/-221/-231/-241 with a dust protection cap
Light shielding cap (FC)	810518912-FCC	Light shielding cap for FC connector
Light shielding cap (SC)	810518913-SCC	Light shielding cap for SC connector
Light shielding cap (ST)	810518914-STC	Light shielding cap for ST connector
Dust protection cap (LC)	M3407HD	Dust protection cap for LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for MU connector
AQ9346 tape fiber adapter	810517917	
AQ9302 (125) bare fiber adapter	819705500-0125	
AQ9440B MT connector	810517921-B	Supports 2, 4, 8, and 12 cores

Other connectors and fiber types not listed are available on request
i.e. Angled PC connector, GI 50 (50/125μm), etc.

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YOKOGAWA

YOKOGAWA CORPORATION OF AMERICA
2 Dart Road, Newnan, Georgia 30265-1094, U.S.A.
Phone: (1)-770-253-7000, Fax: (1)-770-251-6427

YOKOGAWA EUROPE B.V.
Databankweg 20, 3821 AL, Amersfoort, THE NETHERLANDS
Phone: (31)-33-4641858, Fax: (31)-33-4641859

YOKOGAWA ENGINEERING ASIA PTE. LTD.
5 Bedok South Road, Singapore 469270
Phone: (65)-62419933, Fax: (65)-62412606

YOKOGAWA MEASURING INSTRUMENTS KOREA CORP.
Phone: (82)-2-551-0660, Fax: (82)-2-551-0665

YOKOGAWA SHANGHAI TRADING CO., LTD.
Phone: (86)-21-5405-0303, Fax: (86)-21-6880-9254

YOKOGAWA ELECTRIC CORPORATION
Communication & Measurement Business Headquarters
2-9-32 Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Phone: (81)-422-52-6768, Fax: (81)-422-52-6624

E-mail: tm@cs.jp.yokogawa.com

Represented by :

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