

AQ2200 Series

Bit Error Rate Tester

AQ2200-601
10 Gbit/s BERT Module



Compact Bit Error Rate Tester Dedicated to High-speed 10 Gbit/s Band

- PPG, ED and SG integrated design
- Handles multiple bit rates (9.95 Gbit/s to 11.32 Gbit/s)
- Adjust output amplitude, offset and crosspoint
- Clock and Data Recovery (CDR) function included
- Compact and lightweight
- Combine with other optical modules to create a variety of tests
- Combine with an optical modulator, receiver, and attenuator to measure error rate curves.
- 64 Mbit long program pattern generation capability

Please note the following when purchasing the AQ2200-601.

* The AQ2201 or AQ2202 frame controller must also be purchased in order to use the AQ2200-601.
* See the AQ2201/AQ2202 catalog for details on the specifications of the AQ2201 or AQ2202 frame controller in which your AQ2200-601 is to be installed.

Bulletin AQ2200-601E

The AQ2200-601 integrates a pulse pattern generator (PPG), error detector (ED) and signal generator (SG) in a compact module, so a single unit can handle bit error rate (BER) measurements. The AQ2200 Series has all the modules you need for optical device/system characterization, including optical modulators, receivers, power meters, and attenuators. The AQ2200 Series also includes equipment designed especially for using the 10 Gbit/s band BERT standalone function (using the AQ2201 3-slot mainframe). The small size and light weight of the AQ2200-601 provides the following advantages:

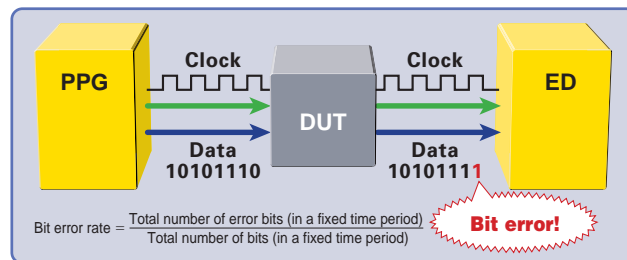
- Optimize the use of lab bench space
- Take measurements in close proximity to the system/device being measured
- Easily portable

PPG Function

- **Support for multiple bit rates:**
9.95 Gbit/s to 11.32 Gbit/s, variable in steps of 1 kHz
- **Output amplitude:**
0.5 Vp-p to 2.0 Vp-p, variable in steps of 10 mV
- **Offset:**
-2.0 V to +3 V, variable in steps of 10 mV
- **Crosspoint:**
30% to 70%, variable in steps of 1%
- **Data and data bar:**
2 outputs
- **Trigger output for oscilloscope synchronization**
- **Port for external 10G clock synchronization input and 1/16 or 1/64 synchronization input**
It is possible to perform an error rate test with jitter deliberately added to the data pattern by inputting a synchronization signal with added jitter to this port.

Bit Error Rate Test (BERT)

A BERT is a type of code error measurement made through digital communication using a PPG as the signal source and an ED as the error detector.



ED Function

- **CDR function included as standard feature**
The CDR signal extracts the clock from the data signal and performs synchronization when a data signal is the only input. In optical communications, the CDR function is a useful tool because the data signal is often transmitted alone.
- **In addition to the CDR input port, there are ports for inputting separate data and clock signals. When these ports are used, the phases of the data and clock signals must be matched externally.**
- **Input ranges:**
0.1 Vp-p to 0.7 Vp-p (with CDR), 0.1 Vp-p to 0.6 Vp-p (without CDR)

Test Patterns

- There are two types of test patterns: pseudo-random (PRBS) patterns and program patterns.
- The PRBS pattern is selected from settings ranging from PRBS7 to PRBS31.
- In the standard configuration, the AQ2200-601 program pattern consists of 256 bits. A 64 Mbit option is also available.

Supported Bit Rates

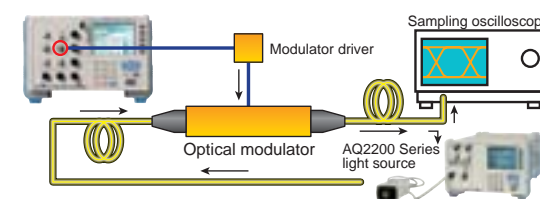
Network name	Standard	Standard bit rate	FEC
SDH/ SONET	STM-64/OC-192	9.953280 Gbit/s	10.664228 Gbit/s
	STM-16/OC-48		10.796778 Gbit/s
10G Ethernet	10GBASE-R	10.312500 Gbit/s	11.095728 Gbit/s
Fibre Channel	10G-FC	10.518750 Gbit/s	11.317642 Gbit/s
OTN	OTU2	10.709225 Gbit/s	

10G Bit/s Bit Error Rate



Example Applications

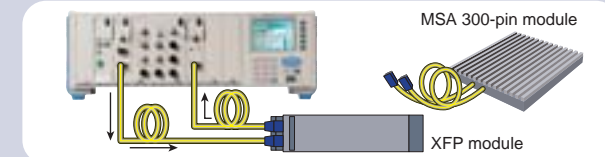
Optical Device Characteristics Evaluation Test



The AQ2200-601 can be used to test and evaluate the characteristics of optical devices such as optical modulators and transmitter optical subassemblies (TOSA). Waveform characteristics can be observed using instruments such as an oscilloscope, optical spectrum analyzer, and optical power meter while varying the amplitude, offset, and crosspoint of the data input signal being input to the modulator driver.

- Rise and fall times: Tr/Tf, Crosspoint position
- Overshoot percentage
- Jitter measurements: Peak to peak and RMS
- Extinction ratio
- Pulse mask test
- Output power (peak, average), light wavelength

XFP Module Characteristics Evaluation Test

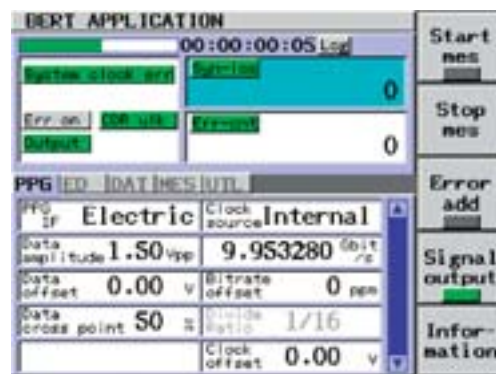


The XFP module is an MSA which is an optical transceiver containing an optical transmitter and an optical receiver. XFP technology is very flexible, with support for STM-64/OC-192, 10G Fibre Channel, and 10G Ethernet. The XFP module requires the following tests:

- Jitter test
- Optical reception sensitivity test
- Optical output eye mask test

With AQ2200 Series modules, it is possible to install the BERT, optical modulator, optical receiver, optical ATTN, and other equipment in a 19-inch rack to form an extremely compact test system. The AQ2200 Series can also handle optical receiver sensitivity tests.

AQ2200 Mainframe Screenshot



BERT Screen

1 Measurement Status Display

- ①-1 Elapsed Time Display
: Displays the elapsed time.
- ①-2 Logging Display
: Displays an indicator which indicates the logging execution status.
- ①-3 Operation Status Display
: System clock error: Displays the system clock status.
Err on: Displays the PPG error addition ON/OFF status.
Output: Displays the PPG output signal ON/OFF status.
CDR ulk: Displays the ED CDR function operation status.
Sync-los: Displays the ED synchronization status.
Bit-err: Displays the ED bit error detection status.
- ①-4 Measurement Result Display
: Syn-los: Displays the ED synchronization loss time (in microseconds).
Err-cnt: Displays the ED received data error count (in bits).
Err-rate: Displays the ED received data error rate as a numerical value.

2 Function Keys Start mes

- Start mes: Starts measurement.
- Stop mes: Stops measurement.
- Error add: Turns error addition ON/OFF.
- Signal output: Turns PPG data output and clock output ON/OFF.
- Information: Displays the firmware version and other information.

3 Settings Display

- Displays the settings. Use the tab key to switch the display.

Specifications

PPG and ED

Item	Product specifications
Internal clock	
Internal frequency variation	Variable frequency range: 9.95 GHz to 11.32 GHz Minimum setting increment: 1 kHz
External reference	
Frequency	1/64 or 1/16 bit rate
Input level	0.4 to 1.0 Vp-p: 50 Ω AC
External clock input	
Frequency	1/1 bit rate
Input level	0.4 to 1.0 Vp-p: 50 Ω AC
Trigger output	
Clock trigger	1/64 or 1/16 clock output frequency
Pattern trigger	PRBS, PROGRAM
Output level	0.6Vp-p ± 0.3V

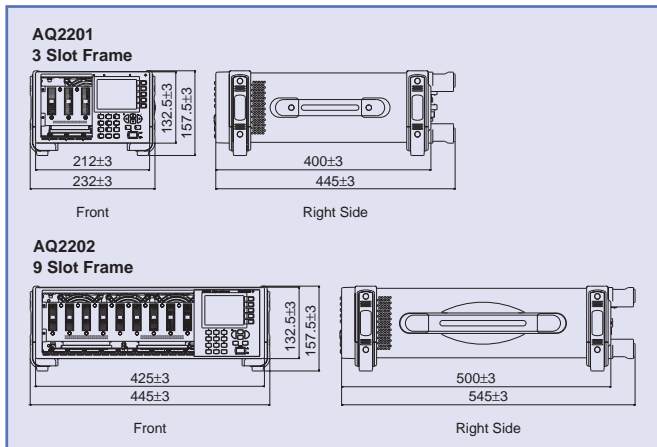
PPG only

Item	Product specifications
Data output	
Bit rate	9.95 Gbit/s to 11.32 Gbit/s
Output level	0.50 to 2.00 Vp-p (in steps of 10 mV)
Offset voltage	-2 V to +3 V (in steps of 10 mV)
Crosspoint variation	30% to 70% (in steps of 1%)
Connector	3.5 mm female 50 Ω AC termination or DC termination
Clock output	
Output level	0.6 Vp-p (AC coupled)
Offset	-2 V to +3 V (in steps of 10 mV)
Connector	SMA female 50 Ω AC termination or DC termination
Transmit patterns	
PRBS	7, 9, 10, 11, 15, 23, or 31
PROGRAM	① 16 to 256 bits (in steps of 1 bit) ② Option for 256-67,108,864 bits (in steps of 128 bits)

ED only

Item	Product specifications
DATA IN (CDR)	
Bit rate	9.95 Gbit/s to 11.32 Gbit/s
Input level range	0.1 to 0.7 Vp-p
Input threshold value variation	±0.35 V (in steps of 1 mV)
Connector	3.5 mm female: 50 Ω AC coupling
DATA IN	
Bit rate	9.95 Gbit/s to 10.71 Gbit/s
Input level range	0.1 to 0.6 Vp-p
Input threshold value variation	±0.3 V (in steps of 1 mV)
Connector	3.5 mm female: 50 Ω AC coupling
Clock input	
Frequency	Frequency with same bit rate synchronized to data input
Input level	0.2 to 0.6 Vp-p
Connector	SMA female: 50 Ω AC coupling
Receiving patterns	Same as PRBS and PROGRAM sending patterns

Frame Controller External Diagrams



Specifications

AQ2201 Frame Controller

Item	Product specifications	
Number of slots	3	
Display device	Color LCD, 320×240 pixels	
Interface	GB-IB	IEEE-488.2-compliant
	Ethernet	10BASE-T-compliant, RJ-45 connector
	USB (planned)	Rev. 1.1-compliant, Type A/B connector
Storage media	Compact flash card	
Power source	100-240 V 50/60Hz	
	170VA	

AQ2202 Frame Controller

Item	Product specifications	
Number of slots	9	
Display device	Color LCD, 320×240 pixels	
Interface	GB-IB	IEEE-488.2-compliant
	Ethernet	10BASE-T-compliant, RJ-45 connector
	USB (planned)	Rev. 1.1-compliant, Type A/B connector
Storage media	Compact flash card	
Power source	100-240 V 50/60Hz	
	580VA	

Note: See the GS810518900E for details.

Model

Product	Model	Remarks
AQ2201 Frame Controller	810518900	-□ -M: Domestic standard -D: UL3P power cord -F: CEE-C7 power cord -G: SAA-3P power cord -Q: BS3P square -H: BS3P round
AQ2202 Frame Controller	810518920	-□ -M: Domestic standard, 3 to 2pin Converter -D: UL3P power cord -F: CEE-C7 power cord -G: SAA-3P power cord -Q: BS3P square -H: BS3P round
AQ2200-601 BERT Module	810518801	/M: 64 Mbit program pattern
AQ2200-621 10 Gbit/s optical modulator (1.55 μm)	810518802	-□ -□ -A: X-cut -B: Z-cut -S: SC output connector -F: FC output connector /P: PMF (FC-SC) for 1.5 μm /U: U link coax cable

Product	Model	Remarks
AQ2200-622 10 Gbit/s optical modulator (1.31 μm)	810518804	-□ -□ -A: X-cut -B: Z-cut -S: SC output connector -F: FC output connector /P: PMF (FC-SC) for 1.3 μm /U: U link coax cable
AQ2200-631 10 Gbit/s optical receiver (1.31/1.55 μm)	810518803	-□ -S: SC input connector -F: FC input connector /U: U link coax cable
AQ2200-111 DFB-LD Module	810518901	-□ -□ -□ -□ -□ -: Wavelength (ask us about this) -FCA: Optical connector FC/Angled PC -P10: Optical output 10mW -P20: Optical output 20mW -SMF: SM fiber -PMF: PM fiber -MODN: No external modulation -MODS: External modulation (sine) -MODC: External modulation (chop)

Note: The AQ2200-111 must have the PMF option when used in combination with AQ2200-621/622.

Note



Pursuant to the Foreign Exchange and Foreign Trade Control Law, Japanese government approval may be required to export this product from Japan.
The information presented in this bulletin is subject to change without notice due to performance and quality improvements.

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