

# 10 GHz JITTER ANALYZER MP1777A

STM-16 to 64, OC-48 to 192



2

## For Evaluating STM-64/OC-192 Jitter



The MP1777A is a measurement solution for jitter evaluation. It supports both the STM-16/32/64 and OC-48/96/192 bit rates. In addition to supporting the bit rates of 2488.32, 4976.64, and 9953.28 MHz two additional bit rates used in submarine cable systems can be added as options.

The MP1777A can evaluate jitter characteristics, including jitter tolerance, jitter transfer, and output jitter, which are parameters most commonly used to evaluate digital lines.

The MX177701A Jitter Performance Test Software (bundled with MP1777A) allows the MP1777A to be controlled remotely. When the Jitter Performance Test Software is used together with specified auxiliary measuring instruments, jitter tolerance and jitter transfer characteristics can be measured automatically.

### Functions

#### • Conforms to 0.172 new recommendations

The MP1777A meets the STM-64/OC-192 measurement standards. It is compatible with bandwidths up to 80 MHz and jitter modulation amplitudes up to 3200 Ulp-p.

#### • Four optional series of bit rates

Current submarine cable systems add FEC (forward error correction) to signals to enhance quality. The MP1777A can also support two series of bit rates by adding Option 01 (2494.16, 4988.32, 9976.64 MHz), Option 02 (2666.0571, 5332.1142, 10664.2284 MHz), Option 04 (3062.2629, 6124.7259, 12249.4517 MHz) and Option 05 (3069,6138,12276 MHz).

#### • Automatic jitter measurement

The MX177701A Jitter Performance Test Software is used for automatic jitter measurement and can be used with the MP1777A to configure an automatic measurement system for jitter tolerance and jitter transfer characteristics\*1.

\*1: Requires MS4630B Network Analyzer, MP1763C Pulse Pattern Generator and MP1764C Error Detector for automatic measurement of jitter tolerance. Requires MS4630B Network Analyzer and MP1763C Pulse Pattern Generator for automatic measurement of jitter transfer. Also requires controller, MX177701A Jitter Performance Test Software, GPIB card, and cables.

### Application examples

#### • Jitter Generation

To generate jitter, an external signal generator is required to source a modulation signal. The MX177701A Jitter Performance Test Software and a GPIB card are required for automatic measurement. It is also possible to perform manual measurements, which does not require these items.

#### • Jitter measurement

The MP1777A can measure the jitter of input signals directly without using an external BPF. When Option 10 (High Sensitive Input) is installed, it can measure the jitter of input signals with amplitudes down to 150 mVp-p. In this case, it can perform evaluation by direct device connection. The MX177701A Jitter Performance Test Software and a GPIB card are required for automatic measurement. Manual measurement is also possible and the measurement results are checked on the MP1777A screen. Furthermore, Ulp-p, Ul+p, Ul-p, and Ulrms can also be measured.

By combining the MP9677B E/O, O/E converter, the MP1777A can measure the jitter measurement of optical interfaces.

#### • Jitter tolerance measurement

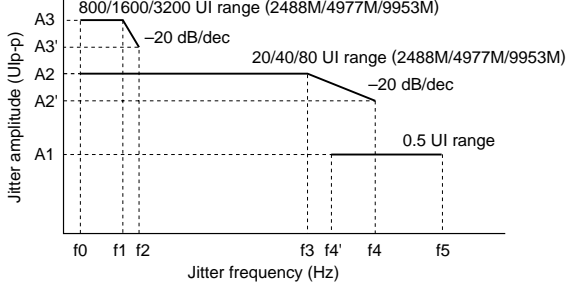
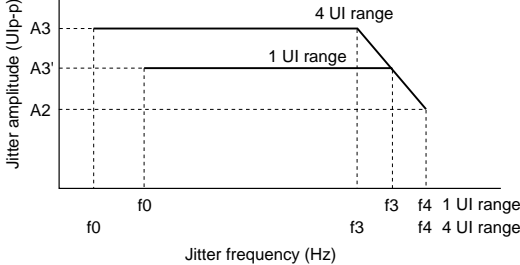
By combining the O/E and E/O converters, the MP1777A can measure the jitter tolerance of optical interfaces. The MX177701A Jitter Performance Test Software and a GPIB card are required for automatic measurement. It is also possible to perform manual measurements without these items.

#### • Measuring Jitter Transfer Characteristics

The MP1777A can evaluate jitter transfer characteristics up to 80 MHz in applications such as 10 Gbit/s clock recovery module (O/E converter) evaluation. Automatic (using MX177701A external software/GPIB) and manual measurements are possible.

By combining the MP9677B E/O, O/E converter, the MP1777A can evaluate the jitter transfer characteristics up to 80 MHz at optical interfaces.

## Specifications

Bit rate	Standard: 2488.32, 4976.64, 9953.28 Mbit/s Option 01: 2494.16, 4988.32, 9976.64 Mbit/s Option 02: 2666.0571, 5332.1143, 10664.2286 Mbit/s Option 04: 3062.3629, 6124.7259, 12249.4517 Mbit/s Option 05: 3069.6138, 12276 Mbit/s *The Option 02 and 04 cannot be mounted at the same time.																																																				
Jitter generation	Modulation frequency: 10 Hz to 80 MHz Amplitude: 0 to 3200 Ulp-p Resolution: 0.001 Ulp-p (0.5 UI range), 0.01 Ulp-p (20, 40, 80 UI range), 1 Ulp-p (800, 1600, 3200 UI range)  <table border="1" data-bbox="347 705 1353 846"> <thead> <tr> <th>Bit rate (bit/s)</th> <th>f0 (Hz)</th> <th>f1 (Hz)</th> <th>f2 (Hz)</th> <th>f3 (kHz)</th> <th>f4 (MHz)</th> <th>f4' (kHz)</th> <th>f5 (MHz)</th> <th>A1 (Ulp-p)</th> <th>A2' (Ulp-p)</th> <th>A2 (Ulp-p)</th> <th>A3' (Ulp-p)</th> <th>A3 (Ulp-p)</th> </tr> </thead> <tbody> <tr> <td>2488M</td> <td>10</td> <td>15</td> <td>480</td> <td>100</td> <td>2</td> <td>100</td> <td>20</td> <td>0.5</td> <td>1</td> <td>20</td> <td>25</td> <td>800</td> </tr> <tr> <td>4977M</td> <td>10</td> <td>15</td> <td>480</td> <td>100</td> <td>2</td> <td>100</td> <td>40</td> <td>0.5</td> <td>2</td> <td>40</td> <td>50</td> <td>1600</td> </tr> <tr> <td>9953M</td> <td>10</td> <td>15</td> <td>480</td> <td>100</td> <td>2</td> <td>100</td> <td>80</td> <td>0.5</td> <td>4</td> <td>80</td> <td>100</td> <td>3200</td> </tr> </tbody> </table> Accuracy: ±5% ±10 Ulp-p/Fr (3200 UI range), ±5% ±8 Ulp-p/Fr (1600 UI range), ±5% ±5 Ulp-p/Fr (800 UI range), ±5% ±0.8 Ulp-p/Fr (80 UI range), ±5% ±0.6 Ulp-p/Fr (40 UI range), ±5% ±0.3 Ulp-p/Fr (20 UI range), ±5% ±0.1 Ulp-p/Fr (0.5 UI range/10G), ±5% ±0.08 Ulp-p/Fr (0.5 UI range/5G), ±5% ±0.05 Ulp-p/Fr (0.5 UI range/2.5G) Fr: 100 kHz (0.5, 20, 40, 80 UI range), 10 Hz (800, 1600, 3200 UI range) Frequency response error (Fr Hz): ±5% (10 to 20 Hz), ±2% (20 Hz to 300 kHz), ±3% (300 kHz to 1 MHz), ±5% (1 to 3 MHz), ±10% (3 to 10 MHz), ±15% (10 to 80 MHz)	Bit rate (bit/s)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (MHz)	f4' (kHz)	f5 (MHz)	A1 (Ulp-p)	A2' (Ulp-p)	A2 (Ulp-p)	A3' (Ulp-p)	A3 (Ulp-p)	2488M	10	15	480	100	2	100	20	0.5	1	20	25	800	4977M	10	15	480	100	2	100	40	0.5	2	40	50	1600	9953M	10	15	480	100	2	100	80	0.5	4	80	100	3200
Bit rate (bit/s)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (MHz)	f4' (kHz)	f5 (MHz)	A1 (Ulp-p)	A2' (Ulp-p)	A2 (Ulp-p)	A3' (Ulp-p)	A3 (Ulp-p)																																									
2488M	10	15	480	100	2	100	20	0.5	1	20	25	800																																									
4977M	10	15	480	100	2	100	40	0.5	2	40	50	1600																																									
9953M	10	15	480	100	2	100	80	0.5	4	80	100	3200																																									
Frequency offset	Range: ±50 ppm (0.1 ppm steps) Accuracy: ±0.1 ppm (after power-on, calibrates after 60 min. warm-up 23 ±5°C)																																																				
Auxiliary interface	External modulation input, external 10 MHz reference input, DCS input, external reference clock input																																																				
Jitter measurement	Modulation frequency: 100 Hz to 80 MHz Amplitude: 0 to 4.00 Ulp-p, 0 to 1.41 Ulrms Resolution: 0.001 Ulp-p/0.001 Ulrms (1 UI range), 0.01 Ulp-p/0.01 Ulrms (4 UI range)  <table border="1" data-bbox="347 1461 1010 1692"> <thead> <tr> <th>Bit rate (bit/s)</th> <th>A2 (Ulp-p)</th> <th>A3' (Ulp-p)</th> <th>A3 (Ulp-p)</th> <th>f0 (Hz)</th> <th>f3 (MHz)</th> <th>f4 (MHz)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">2488M</td> <td>1 UI range</td> <td>0.5</td> <td>1</td> <td>—</td> <td>100</td> <td>10</td> </tr> <tr> <td>4 UI range</td> <td>0.5</td> <td>—</td> <td>4</td> <td>100</td> <td>2.5</td> </tr> <tr> <td rowspan="2">4977M</td> <td>1 UI range</td> <td>0.5</td> <td>1</td> <td>—</td> <td>100</td> <td>20</td> </tr> <tr> <td>4 UI range</td> <td>0.5</td> <td>—</td> <td>4</td> <td>100</td> <td>5</td> </tr> <tr> <td rowspan="2">9953M</td> <td>1 UI range</td> <td>0.5</td> <td>1</td> <td>—</td> <td>100</td> <td>40</td> </tr> <tr> <td>4 UI range</td> <td>0.5</td> <td>—</td> <td>4</td> <td>100</td> <td>10</td> </tr> </tbody> </table>	Bit rate (bit/s)	A2 (Ulp-p)	A3' (Ulp-p)	A3 (Ulp-p)	f0 (Hz)	f3 (MHz)	f4 (MHz)	2488M	1 UI range	0.5	1	—	100	10	4 UI range	0.5	—	4	100	2.5	4977M	1 UI range	0.5	1	—	100	20	4 UI range	0.5	—	4	100	5	9953M	1 UI range	0.5	1	—	100	40	4 UI range	0.5	—	4	100	10						
Bit rate (bit/s)	A2 (Ulp-p)	A3' (Ulp-p)	A3 (Ulp-p)	f0 (Hz)	f3 (MHz)	f4 (MHz)																																															
2488M	1 UI range	0.5	1	—	100	10																																															
	4 UI range	0.5	—	4	100	2.5																																															
4977M	1 UI range	0.5	1	—	100	20																																															
	4 UI range	0.5	—	4	100	5																																															
9953M	1 UI range	0.5	1	—	100	40																																															
	4 UI range	0.5	—	4	100	10																																															

Continued on next page

Jitter measurement	Accuracy [Ulp-p]: $\pm 5\%$ $\pm W$ Ulp-p (Fr Hz) [Ulrms]: $\pm 5\%$ $\pm Y$ Ulrms (Fr Hz), Fr: 100 kHz Frequency response error (Fr Hz): $\pm 5\%$ (10 to 20 Hz), $\pm 2\%$ (20 Hz to 300 kHz), $\pm 3\%$ (300 kHz to 1 MHz), $\pm 5\%$ (1 to 3 MHz), $\pm 10\%$ (3 to 10 MHz), $\pm 15\%$ (10 to 80 MHz)																											
	<table border="1"> <thead> <tr> <th rowspan="2">Bit rate (bit/s)</th> <th colspan="2">W (Ulp-p)<sup>*1</sup></th> <th colspan="2">Y (Ulrms)<sup>*2</sup></th> </tr> <tr> <th>1 UI</th> <th>4 UI</th> <th>1 UI</th> <th>4 UI</th> </tr> </thead> <tbody> <tr> <td>2488M</td> <td>0.05</td> <td>0.22</td> <td>0.008</td> <td>0.08</td> </tr> <tr> <td>4977M</td> <td>0.07</td> <td>0.24</td> <td>0.009</td> <td>0.09</td> </tr> <tr> <td>9953M</td> <td>0.09</td> <td>0.26</td> <td>0.010</td> <td>0.10</td> </tr> </tbody> </table>	Bit rate (bit/s)	W (Ulp-p) <sup>*1</sup>		Y (Ulrms) <sup>*2</sup>		1 UI	4 UI	1 UI	4 UI	2488M	0.05	0.22	0.008	0.08	4977M	0.07	0.24	0.009	0.09	9953M	0.09	0.26	0.010	0.10			
	Bit rate (bit/s)		W (Ulp-p) <sup>*1</sup>		Y (Ulrms) <sup>*2</sup>																							
		1 UI	4 UI	1 UI	4 UI																							
2488M	0.05	0.22	0.008	0.08																								
4977M	0.07	0.24	0.009	0.09																								
9953M	0.09	0.26	0.010	0.10																								
<p>*1: With HP1 + LP, *2: With HP + LP Filters: LP, HP1 + LP, HP1' + LP, HP2 + LP, HP + LP, HP' + LP</p> <table border="1"> <thead> <tr> <th>Bit rate (bit/s)</th> <th>HP1 (kHz)</th> <th>HP1' (kHz)</th> <th>HP2 (MHz)</th> <th>HP (kHz)</th> <th>HP' (kHz)</th> <th>LP (MHz)</th> </tr> </thead> <tbody> <tr> <td>2488M</td> <td>5</td> <td>—</td> <td>1</td> <td>12</td> <td>—</td> <td>20</td> </tr> <tr> <td>4977M</td> <td>8</td> <td>—</td> <td>2</td> <td>12</td> <td>—</td> <td>40</td> </tr> <tr> <td>9953M</td> <td>10</td> <td>20</td> <td>4</td> <td>12</td> <td>50</td> <td>80</td> </tr> </tbody> </table>	Bit rate (bit/s)	HP1 (kHz)	HP1' (kHz)	HP2 (MHz)	HP (kHz)	HP' (kHz)	LP (MHz)	2488M	5	—	1	12	—	20	4977M	8	—	2	12	—	40	9953M	10	20	4	12	50	80
Bit rate (bit/s)	HP1 (kHz)	HP1' (kHz)	HP2 (MHz)	HP (kHz)	HP' (kHz)	LP (MHz)																						
2488M	5	—	1	12	—	20																						
4977M	8	—	2	12	—	40																						
9953M	10	20	4	12	50	80																						
Auxiliary interface	Demodulation output																											
Internal memory	Measurement conditions: 10																											
Others	GPIO, Buzzer, Time																											
Dimensions and mass	426 (W) x 221.5 (H) x 451 (D) mm, $\leq 23$ kg (with options)																											
Power	100 to 240 Vac, 47.5 to 63 Hz, $\leq 350$ VA																											
Temperature	10° to 40°C																											
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)																											
LVD	EN610101-1: 1993/A2, 1995 (Installation Category II, Pollution degree 2)																											

### • Operation environment

Applicable instruments	Pulse Pattern Generators: MP1763C (12.5 GHz), MP1570A (SONET/SDH/PDH/ATM Analyzer) Error Detectors: MP1764C (12.5 GHz), MP1570A (SONET/SDH/PDH/ATM Analyzer) Network Analyzer: MS4630B (300 MHz, with Option 10)
Recommended controller	Personal computer: IBM-PC/AT compatible OS: Windows®95 (English) or Windows®98 (English) CPU: Pentium (75 MHz or faster) Memory size: 16 Mbyte min. HDD free space: $\geq 300$ kbyte for full install GPIO interface: National Instruments AT-GPIO/TNT (PnP), AT-GPIO/TNT+, PCMCIA-GPIO, or PCMCIA-GPIO+ and Windows® driver (for Windows®95 or Windows®98) Swap file size: $\geq 40$ Mbyte guaranteed Display colors: Set to 256 Number of applications running simultaneously: 1 (unable to run other applications simultaneously)

Windows®95 and Windows®98 are registered trademarks of Microsoft® Corporation.

### Ordering information

Please specify model/order number, name, and quality when ordering.

Model/Order No.	Name
MP1777A	<b>Main frame</b> 10 GHz Jitter Analyzer
	<b>Standard accessories</b>
F0014	AC power cord: 1 pc
B0329D	Fuse, 6.3 A: 2 pcs
W1497AE	Front cover: 1 pc
W1498AE	MP1777A operation manual: 1 copy
J0496	MP1777A remote control operation manual: 1 copy
J0900E	APC 3.5 J-J connector: 2 pcs
J0776C	SMA cable (50 $\Omega$ ), 1.5 m (AA-165-1500): 2 pcs
J0008	BNC cable (50 $\Omega$ ), 1 m: 3 pcs
MX177701A	GPIO cable, 2 m: 1 pc
W1499AE	Jitter Performance Test Software <sup>*1</sup> : 1 pc MX177701A operation manual: 1 copy

Model/Order No.	Name
	<b>Options</b>
MP1777A-01	2494M/4988M/9977M jitter <sup>*2</sup>
MP1777A-02	2666M/5332M/10664M jitter <sup>*3</sup>
MP1777A-04	3062M/6124M/12249M jitter <sup>*4</sup>
MP1777A-05	3069M/6138M/12276M jitter <sup>*5</sup>
MP1777A-10	High sensitive input (0.15 to 1.3 Vp-p)
	<b>Application equipment</b>
MS4630B	Network Analyzer (10 Hz to 300 MHz, with Option 10)
MP1763C	Pulse Pattern Generator (12.5 GHz)
MP1764C	Error Detector (12.5 GHz)
MP1570A	SONET/SDH/PDH/ATM Analyzer
MP9677B	E/O, O/E Converter

\*1: Please confirm the operating system.

\*2: 2494.16, 4988.32, 9976.64 MHz

\*3: 2666.0571, 5332.1142, 10664.2284 MHz

\*4: 3062.3629, 6124.7259, 12249.4517 MHz

\*5: 3069.6138, 12276 MHz