Technical Specifications for the Telecommunications Terminal Equipment for Fiber-Optics Network

National Communications Commission

July 23 2020

Technical Specifications for the Telecommunications Terminal Equipment for Fiber-Optics Network

1. Source of law
   The Specifications are promulgated pursuant to Paragraph 1, Article 44 of the Telecommunications Management Act.

2. Scope of application
   The Specifications apply to telecommunications terminal equipment for fiber-optics network.

3. Technical standards
   The Specifications are based on CNS 13438, CNS 14336-1, and other applicable international technical standards.

4. Test items and acceptance criteria
   See Appendix 1 for the test items and acceptance criteria for telecommunications terminal equipment for fiber-optics network.

5. Test method
   See Appendix 2 for the test method for telecommunications terminal equipment for fiber-optics network.

Appendix 1 Test items and acceptance criteria for telecommunications terminal equipment for fiber-optics network

No.	Test item	Acceptance criteria
1	Operating Wavelength Range	(1) GPON system: 1,260nm~1,360nm (1310nm±50nm); (2) EPON system: 1,260nm~1,360nm (1310nm±50nm); (3) XG-PON system: 1,260nm~1,280nm (1270nm±10nm); (4) 10G-EPON system: 1,260nm~1,280nm (1270nm±10nm).
2	Average Launch Power	(1) GPON system: -3dBm~+7dBm; (2) EPON system: -1dBm~+4dBm; (3) XG-PON system: +2dBm~+7dBm; (4) 10G-EPON system: -1dBm~+9dBm;
3	Extinction Ratio	(1) GPON system: ≥10dB; (2) EPON system: ≥6dB; (3) XG-PON system: ≥8.2dB; (4) 10G-EPON system: ≥6dB.
4	Minimum Receiver Sensitivity	(1) GPON system: ≤-21dBm; (2) EPON system: ≤-24dBm; (3) XG-PON system: ≤-21.5dBm; (4) 10G-EPON system: ≤-20.5dBm.
5	Minimum Overload	(1) GPON system: ≥-8dBm; (2) EPON system: ≥-6dBm; (3) XG-PON system: ≥-8dBm; (4) 10G-EPON system: ≥-9dBm.
6	Surge Testing	Equipment shall function properly after the surge test.
7	Electric safety	Compliance with CNS 14336-1
8	Electromagnetic compatibility	Compliance with CNS 13438

Note: for the minimum receiver sensitivity and minimum overload, the bit error rate shall meet the following:

GPON system: $\leq 10^{-10}$;
EPON system: $\leq 10^{-12}$;
XG-PON system: $\leq 10^{-12}$;
10G-EPON system: $\leq 10^{-12}$.

Appendix 2 Test method for telecommunications terminal equipment for fiber-optics network

The test applicant shall provide the equipment needed for the test item(s) to be performed.

1. Test item: operating wavelength range

1.1 Test setup: see Figure 1.

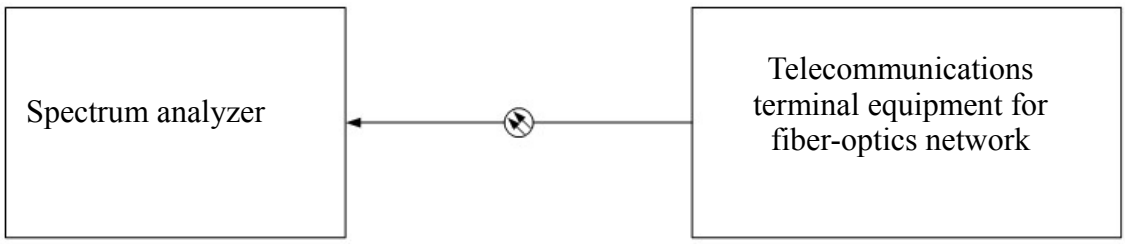


Figure 1

1.2 Test steps:

1.2.1 See Figure 1; connect the output of the telecommunications terminal equipment for fiber-optics network to be tested to the input of spectrum analyzer using an optical fiber jumper cable.

1.2.2 Set the spectrum analyzer at the receiving test mode.

1.2.3 Set the telecommunications terminal equipment for fiber-optics network to be tested at offline status. Set the output center wavelength according to the applicable standard for the telecommunications terminal equipment for fiber-optics network to be tested.

1.2.4 Set the telecommunications terminal equipment for fiber-optics network at transmitting status. Perform the wavelength test and record the measurements of spectrum analyzer. The telecommunications terminal equipment for fiber-optics network stops transmitting.

1.2.5 Repeat test step 1.2.4 five times.

2. Test item: average launch power

2.1 Test setup: see Figure 2.

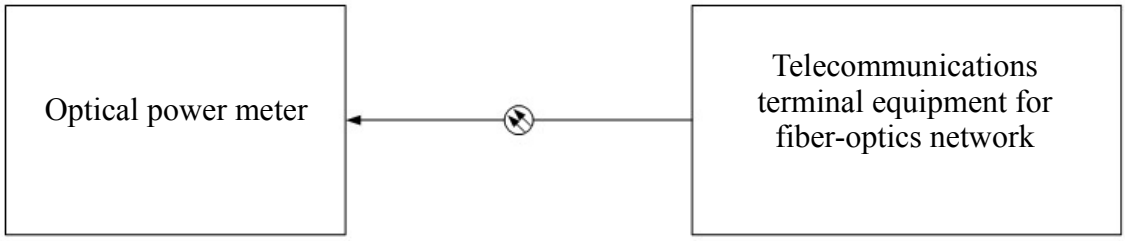


Figure 2

2.2 Test steps:

2.2.1 See Figure 2; connect the telecommunications terminal equipment for fiber-optics network to be tested to the input of optical power meter using an optical fiber jumper cable.

2.2.2 Set the telecommunications terminal equipment for fiber-optics network to be tested at transmitting status. Perform the average launch power test. Record the measurements of optical power meter. The telecommunications terminal equipment for fiber-optics network stops transmitting.

2.2.3 Repeat test step 2.2.2 five times.

3. Test item: extinction ratio

The extinction ratio is determined as $ER=10 \log(P_1/P_0)$.

3.1 Test setup: see Figure 3.

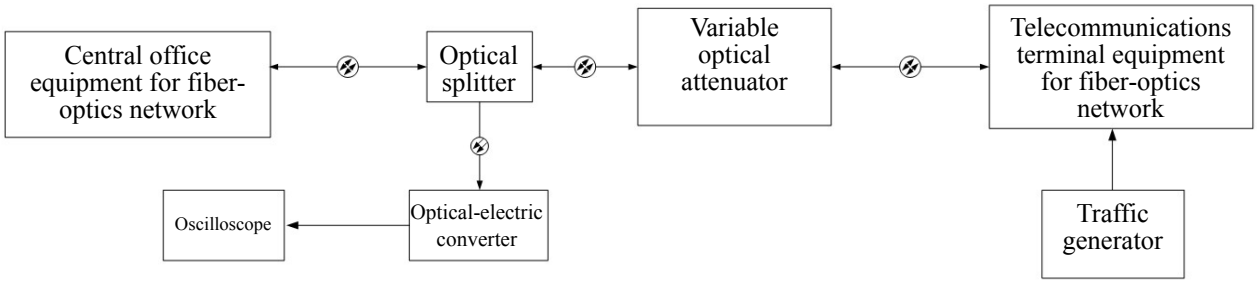


Figure 3

3.2 Test steps:

3.2.1 See Figure 3; connect the central office equipment for fiber-optics network, optical splitter, variable optical attenuator, optical-electric converter, oscilloscope, traffic generator and the telecommunications terminal equipment for fiber-optics network to be tested.

3.2.2 Set the telecommunications terminal equipment for fiber-optics network and central office equipment for fiber-optics network at the normal operating mode. Set the traffic generator to generate and send test signals to the central office equipment for fiber-optics network via telecommunications terminal equipment for fiber-optics network.

3.2.3 Regulate the variable optical attenuator to meet the allowable optical signal receiving power range of the optical-electric converter.

3.2.4 Perform the extinction ratio test. Record the measurements of optical signal power of logic 1, P_1, and optical signal power of logic 0, P_0, shown on the oscilloscope.

4. Test item: minimum receiver sensitivity

4.1 Test setup: see Figure 4.

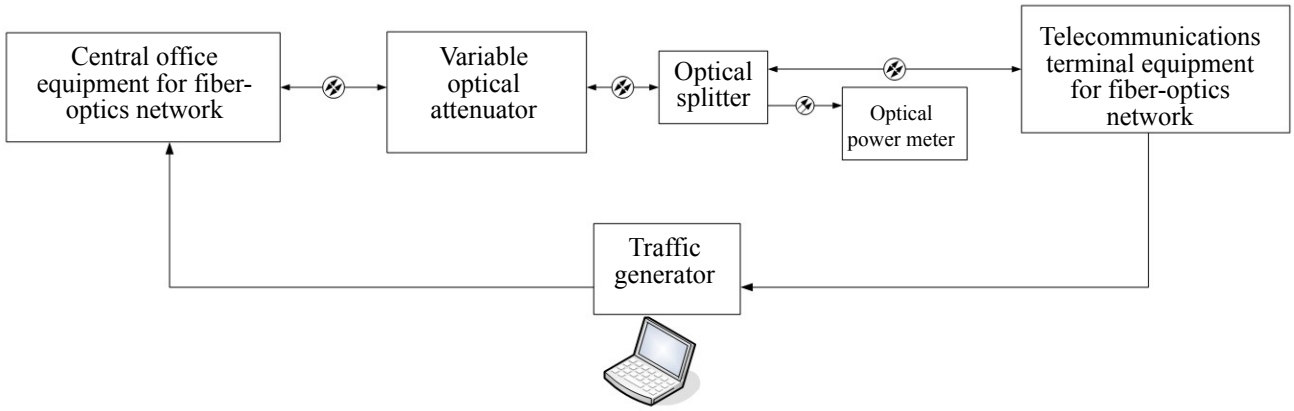


Figure 4

4.2 Test steps:

4.2.1 See Figure 4; connect the central office equipment for fiber-optics network, traffic generator, optical splitter, variable optical attenuator, optical power meter, and the telecommunications terminal equipment for fiber-optics network to be tested.

4.2.2 Set the telecommunications terminal equipment for fiber-optics network and central office equipment for fiber-optics network at the normal operating mode. Set the traffic generator to generate and send test signals to telecommunications terminal equipment for fiber-optics network via the central office equipment for fiber-optics network.

4.2.3 Regulate the variable optical attenuator until the optical power meter indicates the compliance with the minimum receiver sensitivity criterion for the telecommunications terminal equipment for fiber-optics network to be tested, as shown in Appendix 1, the test items and acceptance criteria for the telecommunications terminal equipment for fiber-optics network.

4.2.4 Erase the traffic generator errors and data that have been sent and received. Start the transmission of test data.

4.2.5 Perform the receiver sensitivity test. Record the power readings on the optical power meter and the measurements of bit error rate on the traffic generator.

5. Test item: minimum overload

5.1 Test setup: see Figure 4.

5.2 Test steps:

5.2.1 See Figure 4; connect the central office equipment for fiber-optics network, traffic generator, optical splitter, variable optical attenuator, optical power meter, and the telecommunications terminal equipment for fiber-optics network to be tested.

5.2.2 Set the telecommunications terminal equipment for fiber-optics network and central office equipment for fiber-optics network at the normal operating mode. Set the traffic generator to generate and send test signals to the telecommunications terminal equipment for fiber-optics network via the central office equipment for fiber-optics network.

5.2.3 Regulate the variable optical attenuator until the optical power meter indicates the compliance with the minimum receiver sensitivity criterion for the telecommunications terminal equipment for fiber-optics network to be tested, as shown in Appendix 1, the test items and acceptance criteria for the telecommunications terminal equipment for fiber-optics network.

5.2.4 Erase the traffic generator errors and data that have been sent and received. Start the transmission of test data.

5.2.5 Perform the minimum overload test. Record the power readings on the optical power meter and the measurements of bit error rate on the traffic generator.

6. Test item: surge test

6.1Test setup: see Figure 5.

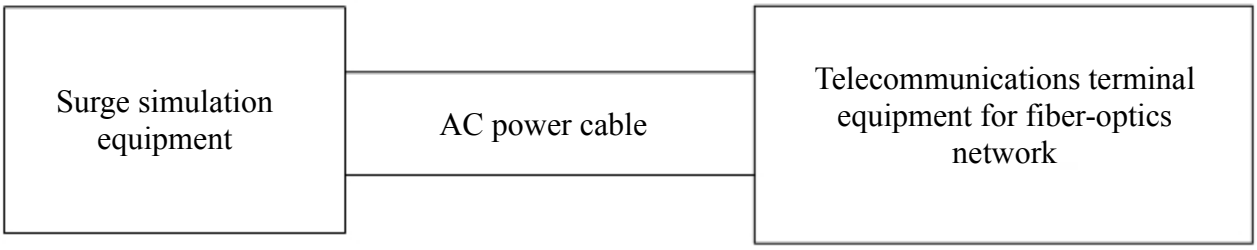


Figure 5

6.2 Test steps:

6.2.1 See Figure 5; connect the surge simulation equipment and the telecommunications terminal equipment for fiber-optics network to be tested.

6.2.2 For the surge voltage waveform for AC power cable, set the front time (T_f) $\leqq$2us, impact time (T_d) $\geqq$10us and peak voltage $\geqq$2500V. The surge generator shall be capable of peak current energy at 1000A or more.

6.2.3 Set the telecommunications terminal equipment for fiber-optics network ON.

6.2.4 Apply the surge at both ends of the power cable three times in forward direction and three times in reverse direction.

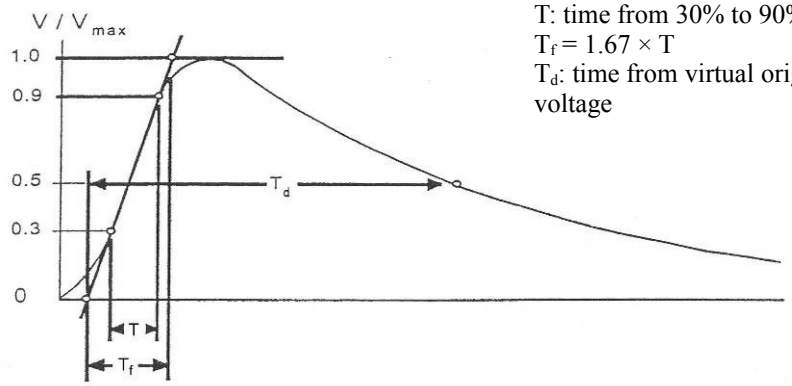
6.2.5 Record and check the function of the telecommunications terminal equipment for fiber-optics network.

6.2.6 Set the telecommunications terminal equipment for fiber-optics network to be tested OFF. Repeat test steps 6.2.4 and 6.2.5.

Note: the surge voltage waveform is shown as follows:

Front time (T_f)=1.67 × T (time from 30% to 90% of peak voltage);

Impact time (T_d): time from virtual origin point to 50% of peak voltage.

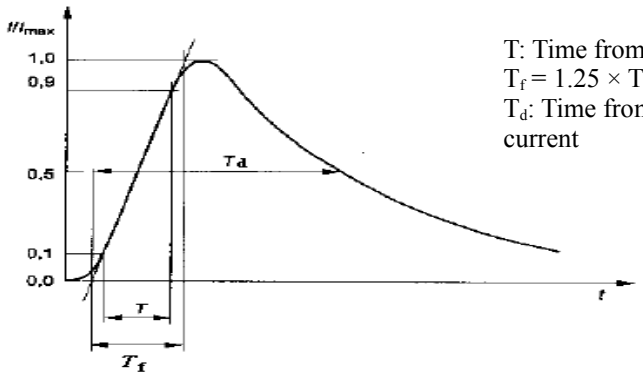


T: time from 30% to 90% of peak voltage
T_f = 1.67 × T
T_d: time from virtual origin point to 50% of peak voltage

Note: The surge current waveform is shown as follows:

Front time (T_f)=1.25 × T (time from 10% to 90% of peak current);

Impact time (T_d): time from virtual origin point to 50% of peak current.



T: Time from 10% to 90% of peak current
T_f = 1.25 × T
T_d: Time from virtual origin point to 50% of peak current