YD

COMMUNICATION INDUSTRIAL STANDARD
OF THE PEOPLE'S REPUBLIC OF CHINA

M 33

YD/T 1117-2001

Specification of all optical fiber branching devices

全光纤型分支器件技术条件

Issued on: April 24, 2001 **Implemented on: July 01, 2001**

Issued by: Ministry of Information Industry of PRC

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Foreword

This standard refers to the relevant chapters of GB/T 13713-92 “Optic branching devices - Part 1: Generic specification”, IEC875-2 (1992) “Optical fiber branching devices - Part 2: Non-wavelength selective branching device specification”, IEC 875-3 (1992) “Optical fiber branching devices - Part 3: Wavelength selective branching device specification”, (TC86B/1246/CD) IEC 61753-2-3 “Performance specifications - Part 2-3: Non-connectorised single mode 1 x N and 2 x N non-wavelength-selective branching devices for category U – Uncontrolled environment”, and Bellcore GR-1209-CORE (1998) “General technical specifications for optical fiber branching device”, AND in accordance with the actual conditions of China, combine the wavelength selection and non-wavelength selection all optical fiber branching devices together.

This standard was proposed by AND shall be under the jurisdiction of the Ministry of Information Industry Telecommunications Research Institute.

This standard was drafted by Wuhan Institute of Posts and Telecommunications Science.

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Specification of all optical fiber branching devices

YD/T 1117-2001

1 Scope

This standard specifies the technical requirements, test methods, quality assessment procedures and marking, packaging, storage and other conditions of the "optical fiber broadband coupler" and "optical fiber wavelength division multiplexing coupler" series products of all optical fiber branching devices.

This standard is applicable to the design, production, inspection and use of single-mode optical fiber broadband coupler AND the optical fiber wavelength division multiplexing coupler.

2 Normative references

The following standards contain provisions which, by reference in this standard, constitute provisions of this standard. At the time of publication, the versions shown are valid. All standards will be revised and the parties using this standard shall explore the possibility of using the latest version of the following standards.

GB 2828-1987 Counting and sampling procedures and sampling tables for batch-by-batch inspection (for continuous batch inspection)

GB 2421-1989 Test specification for the basic environment of electric and electronic products – General principles

YD/T 826-1996 Technical requirements for FC-PC single-mode optical fiber cable connectors

YD/T 893- 1997 Technical requirements for optical fiber couplers

YD/T 895-1997 Technical requirements for SC/PC single-mode optical fiber connectors

YD/T 964-1998 Technical requirements and test methods for 1310nm/1550nm wavelength division multiplexers

IEC 61300-3-2 (1999) Optical fiber interconnecting devices and passive components - Basic test and measurement procedures – Part 3-2: Inspection and Measurement - Polarization dependent loss of single-mode optical fiber devices

3 Definition

This standard adopts the following definitions.

3.1 Port

An optical signal input or output port belonging to an optical passive device.

3.2 Optical fiber branching devices

It refers to the optical passive device which is used to realize the optical signal coupling and re-distribution between two or more optical fibers.

3.3 Optical fiber coupler

It is also known as “non-wavelength selective optical branching device”, which is an optical fiber device used to realize the power coupling and re-distribution functions of the optical signal of certain band.

3.4 Optical fiber wavelength division multiplexing coupler

It is also known as “wavelength selective optical branching device”, which is used to realize the multiplexing and demultiplexing function of two optical signals of different wavelengths.

3.5 Working bandwidth

It refers to the optical wavelength range to which the optical performance indicators of the devices as specified in this standard are applicable, expressed in nm.

3.6 Optical fiber standard coupler

It refers to the optical fiber coupler for which the working bandwidth ≤ “nominal center wavelength ± 20nm”.

3.7 Optical fiber broadband coupler

It refers to the optical fiber coupler for which the working bandwidth ≥ “nominal center wavelength ± 40nm”.

3.8 Optical fiber single window broadband coupler

It refers to, under a single optical communication window (such as 1310nm or 1550nm), the optical fiber coupler complying with the requirements that the working bandwidth ≥ “nominal center wavelength ± 40nm”.

3.9 Optical fiber dual window broadband coupler

It is the measurement of the input optical power as caused by the optical fiber branching device which is returned along the input path. It is expressed in decibels (dB) AND calculated in accordance with the formula (8):

$$RL_i = -10\lg\frac{P_r}{P_j} \quad (\text{dB}) \qquad (8)$$

Where:

P_j - The optical power incident on the input end, in mW;

P_r – The returned optical power as received at the same input end, in mW.

4 Optical fiber branching device description

4.1 Optical fiber broadband coupler

4.1.1 Classification

- It is divided into single window broadband coupler and the dual window broadband coupler based on the working window which is covered by the device performance;

- It is divided into tree broadband coupler (1 × N) and star broadband coupler (N × N) based on the device working state;

- It is divided into the pigtail type and connector type based on the configuration of the device leading out port.

4.1.2 Optical fiber for optical fiber broadband couplers

The optical fiber used is generally single-mode optical fiber.

4.2 Optical fiber wavelength division multiplexing coupler

4.2.1 Classification

Fused tapered optical fiber wavelength division multiplexers are typically two wavelength multiplexing/demultiplexing devices.

It is generally divided into the following types in accordance with the differences of the multiplexing wavelength:

a) 1310nm / 1550nm wavelength division multiplexing coupler;

b) 1480nm / 1550nm wavelength division multiplexing coupler;

c) 980nm / 1550nm wavelength division multiplexing coupler;

d) 980nm / 1310nm wavelength division multiplexing coupler.

- 30 dB spectral width: ≤ 5 nm (A = 1310 nm), 10 nm (λ = 1550 nm)

- Power stability: better than ± 0.05 dB (- 10 °C ~ +50 °C, 1 h)

6.3.2 Mode disturbance unit (E)

The mode disturbance unit used is a 1 km length single-mode fiber, or a 5 m single-mode fiber in the middle of which two in the middle of playing two Φ 30 mm circles are made, AND the fiber parameters shall comply with the provisions of YD/T 895.

6.3.3 Detection unit (D)

It uses the optical power meter, AND its performance indicators must comply with the following requirements:

- Wavelength: 0.75 ~ 1.7 μm;

- Absolute measurement accuracy (-23 dBm): ± 5%

- Dynamic range: - 80 ~ 0 dBm

- Linearity: Better than ± 0.05 dB

6.3.4 Spectrum analyzer (OSA)

The resolution of the spectrum analyzer shall be higher than the spectral width of the measuring light source.

6.3.5 Optical fiber standard connector (SR)

It shall comply with the requirements of clause 3.14 of this standard.

6.3.6 Temporary joints (TJ)

MAKE butt joint of the two ends of the optical fibers, the joint loss is < 0.1 dB, ND it is good in stability.

6.3.7 Device leading out fiber length (cable) length

The length of the device leading out fiber (cable) shall not be less than 1 m.

6.4 Measurement of excess loss (cutting method)

It shall be in accordance with clause 6.4 of YD/T 893-1997.

6.5 Measurement of insertion loss

It shall be in accordance with clause 6.4 in YD/T 893-1997 and clause 6.4 in YD/T 964-1998.

6.6 Directionality measurement

6) From the spectral region, RECORD the sample insertion loss and the isolation change; from the device indicator range as specified in Table 1 to Table 4, READ the maximum and the minimum wavelength value, AND the difference between the two is the working bandwidth of the device.

6.9 Measurement of polarization dependent losses

PERFORM measurement in accordance with the method A of IEC 61300-3-2 (1999).

6.10 Measurement of wavelength isolation

PERFORM measurement in accordance with the clause 6.6 of YD/T 964-1998.

6.11 Measurement of return loss

PERFORM measurement in accordance with the clause 6.5 of YD/T 964-1998.

7 Environmental and mechanical performance tests

The test conditions shall be the same as clause 6.1. Before the test, the sample shall be pre-treated in normal atmospheric conditions, AND it shall also be restored after the test under the after the normal atmospheric conditions.

7.1 Mechanical performance test

7.1.1 Vibration test

a) Condition

- Frequency range: 10 ~ 55 Hz;

- Sweep requirements: The scanning rate shall be one octave per minute, AND its tolerance is ±10%;

- Amplitude: 0.75 mm constant displacement;

- Duration along each direction: 30 min;

- Online optical performance monitoring against each sample.

b) Procedure

PRE-TREAT the sample at room temperature firstly; MEASURE its insertion loss and RECORD it; then FIX the sample onto the vibration bench; MAKE it be subjected to vibration along 3 perpendicular directions X, Y and Z; LET one direction parallel with the common axis of the device; AND the vibration duration along each direction is 30 min. OBSERVE and RECORD its insertion loss data.

c) After the test, the sample shall comply with the following requirements:

finally RESTORE it to room temperature; RECORD its insertion loss after 1 h.

c) After the test, the sample shall comply with the following requirements:

1) It shall be free from mechanical damage, such as deformation, cracks, or loosening, and so on, AND be free from broken fiber, optical cable pulled out, optical fiber end fault, or optical fiber seal damage.

2) Optical performance shall comply with the requirements of Table 5.

7.2.3 High and low temperature cyclic test

a) Condition

- Temperature range: low temperature T_A = - 25 °C, high temperature T_B = + 70 °C;

- Temperature change rate: the average rate within the period no more than 5 min is not greater than 1°C/min;

- High and low constant temperature duration: $t_1 = t_2$ = 1 h;

- Number of cycles: 12;

- No online optical performance monitoring for the sample.

b) Procedure

PRETREAT the sample at the room temperature firstly; MEASURE its insertion loss and RECORD it; then PLACE it into a high and low temperature incubator, as shown in Figure 4, the accuracy of which is ± 2 °C; REDUCE the temperature at the specified rate to T_A, and MAINTAIN the constant temperature for 1 h; then INCREASE the temperature to T_B, and MAINAIN the constant temperature for 1 h; finally RESTORE the temperature to room temperature at the specified rate. This forms a complete cycle. CONTINUE the second cycle by the same procedures. The test procedure is as shown in Figure 5.

After the specified number of cycles has been completed, TAKE out the sample; REMOVE the water; RESTORE it for 2 h at room temperature; MEASURE and RECORD its insertion loss.

1) It shall be free from mechanical damage, such as deformation, cracks, or loosening, and so on, AND be free from broken fiber, optical cable pulled out, optical fiber end fault, or optical fiber seal damage.

2) Optical performance shall comply with the requirements of Table 5.

7.2.5 Water immersion

a) Condition

- Immersion water: PH = 5.5 ± 0.5; temperature + (43 ± 2) °C;

- Immersion time: 7 d;

- No online optical performance monitoring for the sample.

b) Procedure

PRETREAT the sample at the room temperature firstly; MEASURE its insertion loss and RECORD it; then PLACE the sample into water for immersion for 7d which complies with the requirements, during which it shall regularly check and maintain the pH value (the pH is determined by mixing the standard buffer solvent and acetic acid which is diluted with hydrogen sodium). After the immersion period, TAKE out the sample and CLEAN and WIPE it; LET it dry naturally at room temperature for 24 h; START the insertion loss test.

c) After the test, the sample shall comply with the following requirements:

1) It shall be free from mechanical damage, such as deformation, cracks, or loosening, and so on, AND be free from broken fiber, optical cable pulled out, optical fiber end fault, or optical fiber seal damage.

2) Optical performance shall comply with the requirements of Table 5.

8 Quality assessment procedures

8.1 Certification approval procedures

8.1.1 Initial manufacturing phase

The initial manufacturing phase is defined as the phase during which the components which form a single element are assembled into the optical fiber branching device.

8.1.2 Structurally similar components

For the purposes of certification approval and the quality conformance testing, GROUP the structurally similar components in accordance with the following boundaries.

Structurally similar components shall:

a) Have the same structural pattern;

b) Manufactured by substantially the same material;

c) Designed and manufactured in substantially the same way;

d) Manufactured using substantially the same procedure and method;

e) Use the same port leading out technology;

f) Use the same optical fiber/cable retention technology.

They may:

a) Have different dimensions;

b) Have optical cables of different outer diameters;

8.1.3 Certification approval

This standard follows the fixed sample quality inspection procedure.

8.1.3.1 Fixed sample quality inspection

a) Certification sample

When identifying all components of a batch of products at the same time, the certification sample shall be a complete optical fiber branching device. The identified samples shall be products that are produced using the equipment and procedures which are used in the current production.

b) Sample

Randomly TAKE samples in accordance with the sample size as specified in Table 7; after finishing “0” group of sample inspection, the samples of other groups shall be taken randomly from the “0” group product.

c) Sample preparation

PERFORM the sample preparation and sample pretreatment in accordance with the relevant test methods.

d) Inspection procedures

PERFORM inspection in accordance with the methods and sequences as specified in Table 7, AND the inspection sample shall comply with the performance requirements as specified in this standard.

ratio for the inspection. The inspection is performed in accordance with the batch inspection requirements of clause 8.2.1.

9.2 Type inspection

When the optical fiber branching device is in one of the following cases, the type inspection is normally performed. The type inspection is carried out in accordance with the “Periodic inspection” in the quality assessment procedure, as shown in 8.2.2.

a) The trial production and finalization certification of the new products OR the old products which are produced at different plants;

b) When the product performance may be affected by the major change of structure, material and procedure after the formal production;

c) During normal production, this inspection shall be carried out regularly after periodic production or after the accumulation of a certain amount of production;

d) The production is restored after long term suspension;

e) When there is major difference between the exit-factory inspection results and the last type inspection;

f) When the national quality inspection institute proposes type inspection requirements.

10 Packaging, marking, transportation and storage

10.1 Marking

10.1.1 The product shall be indicated of the product name, model and specification, number, manufacturer, and date of production if position is allowable.

10.2 Packaging

Product shall be packaged well by packaging box; there shall be product performance indicator test data in the package, AND the packaging box shall be indicated of the product name, model and specification, and manufacturer.

10.3 Transportation

When the product needs long-distance transport, it is required to use the wooden box or cardboard box for packaging, AND the box shall be indicated of such text as “prohibited of forced throw, collision, or pressing”; AND it shall have the rainproof signs, so as to avoid damaging the product.

10.4 Storage