

# DKBA

Huawei Technologies Co., Ltd. Internal Specification

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**DLC/UPC-DLC/UPC-SM-GYFJH**  
**2G.657A2-L-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor**  
**Optical Cable Assembly Huawei Specification**

v1.2



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Working temperature range	-40°C~75°C	
Working humidity	0%~95%	
Min. installation temperature	-20°C	
Transport temperature range	-40°C~60°C	
Application	Indoor & Outdoor	
Service Life	≥15 years	
Reference Standards	Optical fiber	ITU-T G.657
	Optical cable	YD/T 2289.1, ITU-T G.657, IEC 60332-1, DKBA 6258
	Connector	YD/T 1272.1, IEC 61754-20, IEC61755-3-1, DKBA 6258
	Optical cable assembly	IEC61753-1, IEC61753-021-6, DKBA 6258
Remark	Other requirements not mentioned should fulfill the reference standards above.	

### 1 Outline drawing

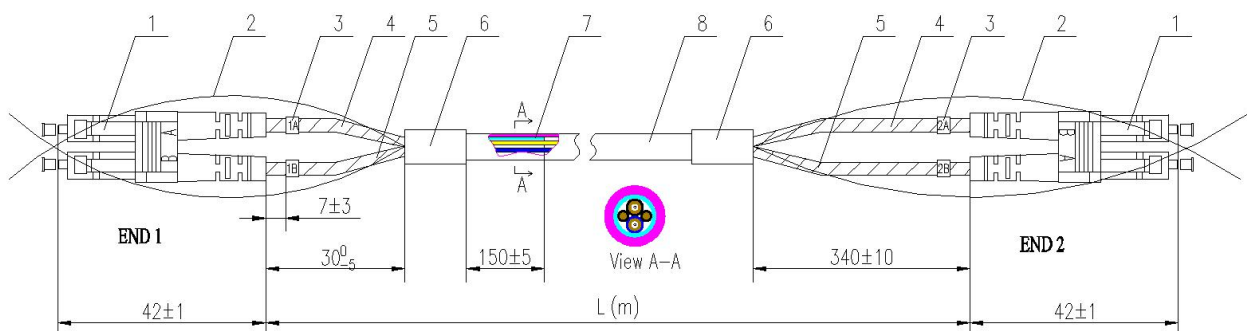


Figure 1 Optical Patch Cord outline drawing

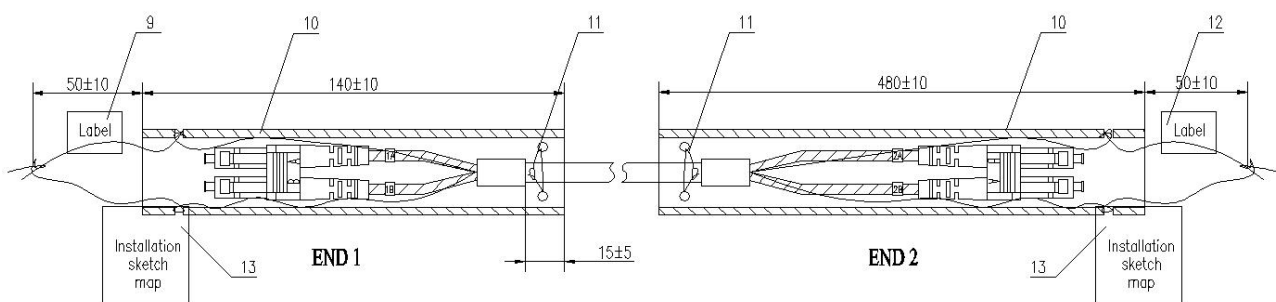


Figure 2 Corrugated tube protection

Table 1. Elements of the optical cable assembly shown in the figure above

No.	Element	Requirements	No.	Element	Requirements
1	DLC connector	/	8	7.0mm optical cable	See Annex A
2	Stuffing	/	9	Label 1	See table 3
3	Identifier	Contents: 1A, 1B, 2A and 2B	10	Corrugated tube	See table 3

		Length $\leq$ 6mm			
4	Break out cable (A)	Yellow internal simplex cable	11	Cable tie	/
5	Break out cable (B)	Blue internal simplex cable	12	Label 2	See table 3
6	Junction part	See table 3	13	Installation sketch map	See table 3
7	PBT tube	See table 3			

Notes: The unit is meter for L and millimeter for others.

The length of the optical cable assembly is the distance between DLC connectors as shown in figure 1.

## 2 Type and spec

### DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-L-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor

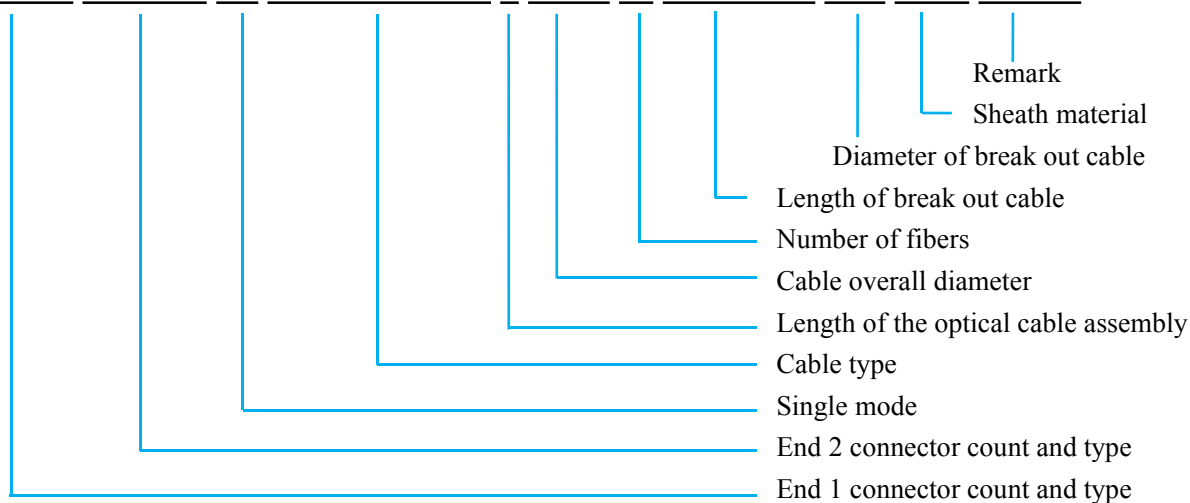


Table 2. List of patch cords of different length

No.	Huawei BOM	Type and Spec	Length (L)
1	14130930	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-2m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	2m
2	14130931	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-5m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	5m
3	14130932	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-8m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	8m
4	14130641	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-10m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	10m
5	14131642	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-15m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	15m
6	14130642	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-20m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	20m
7	14131644	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-25m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	25m
8	14130643	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-30m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	30m
9	14131624	Optical cable assembly,	35m

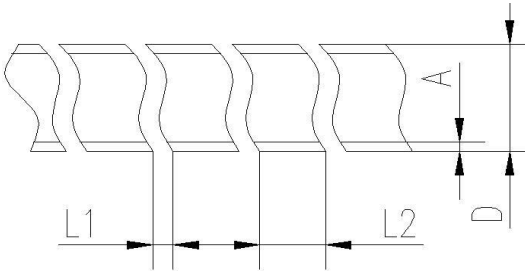
		DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-35m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	
10	14130644	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-40m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	40m
11	14131625	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-45m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	45m
12	14130645	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-50m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	50m
13	14131626	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-55m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	55m
14	14130646	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-60m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	60m
15	14131627	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-65m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	65m
16	14130647	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-70m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	70m
17	14132648	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-75m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	75m
18	14132649	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-80m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	80m
19	14132650	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-85m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	85m
20	14132651	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-90m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	90m
21	14132652	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-95m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	95m
22	14130648	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-100m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	100m
23	14130649	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-120m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	120m
24	14130650	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-150m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	150m
25	14130650-002	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-200m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	200m
26	14130650-003	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-250m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	250m
27	14130650-001	Optical cable assembly, DLC/UPC-DLC/UPC-SM-GYFJH-2G.657A2-300m-7.0mm-2C-0.03m/0.34m-2mm-LSZH-Outdoor	300m

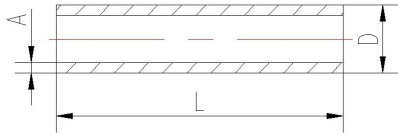
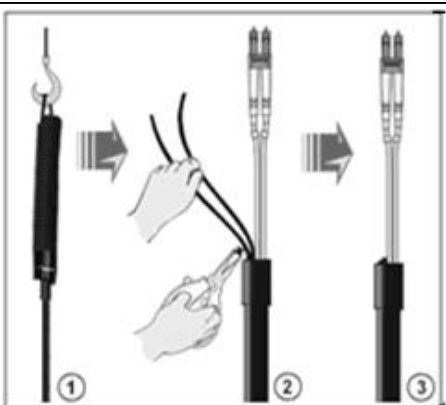
### 3 Performances of optical cable assembly (according to IEC 61753-1 and IEC 61753-021-6)

#### 3.1 Construction

Table 3. Construction parameters of the optical cable assembly

Item	Unit	Requirements
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<b>4&amp;5-Break out cable</b>					
Φ2.0mm simplex cable	Color	4-break out cable	/	Yellow	
		5-break out cable	/	Blue	
	Diameter		mm	2.0±0.1	
Armored Tube	Outline drawing		/		
	A		mm	0.20±0.05	
	L1		mm	0.05~0.1	
	L2		mm	0.8±0.1	
	D		mm	2.8±0.1	
	Material		/	Stainless steel	
Min bending radius			mm	10	
End 1	Break out length 1		mm	30 <sup>0</sup> <sub>-5</sub>	
	Relative length of break out cable		mm	≤5	
End 2	Break out length 2		mm	340±10	
	Relative length of break out cable		mm	≤10	
<b>10-Corrugated tube</b>					
Outer diameter			mm	20±2	
Color			/	Black	
Long term crush force			N	200	
Short term crush force			N	400	
Cold impact(-15℃,2N·M)			/	No crack	
<b>6-Junction part</b>					
Color			/	Black	

Material		/	Metal
Diameter		mm	8.5±0.5
Length		mm	20±0.5
<b>7-PBT tube</b>			
Outline drawing			
Material		/	PBT
Dimensions	Outer diameter(D)	mm	4.8±0.1
	Min-thickness(A)	mm	0.3
	Length(L)	mm	150±5
<b>Remark:</b>			
<i>The PBT tube shall be fasten in cable right against the junction part by adhesive as shown in figure 1.</i>			
<b>9,12&amp;13-Label and installation map</b>			
Label contents (print on both sides)	Size	/	50mm x20mm(tolerance:±2mm)
	End 1	/	Single Mode Fiber To: Remote Unit
	End 2	/	Single Mode Fiber To: BBU
Installation sketch map	Size	mm	50x70(tolerance:±10mm)
	Contents (print on both sides)		

### 3.2 Insertion loss

Test method: IEC61300-3-4 (insertion method B)

Test wavelength: 1310 nm and 1550 nm.

Insertion loss: see table 4.

Notes:

Insertion Loss=attenuation-(A\*L)

Attenuation is summed loss include one connector and the optical cable

A is optical cable attenuation per kilometer

L is length of optical cable in km

A\*L may be ignored for the patch cord length is not more than 100m

Table 4. Insertion loss and Return loss

Item	Connector 1(DLC/UPC)	Connector 2(DLC/UPC)
Insertion loss (Max)	0.3dB	0.3dB
Return loss (Min)	50dB	50dB

### 3.3 Return loss

Test method: IEC61300-3-6 (OTDR method)

Test wavelength: 1310 nm and 1550 nm

Return loss: see table 4.

### 3.4 Insertion loss (random mate)

Test method: IEC61300-3-34.

Test wavelength: 1310 nm and 1550 nm.

Mean IL $\leq$ 0.25dB, max 0.5 dB for  $\geq$ 97% of samples.

Notes:

Insertion Loss=attenuation-(A\*L)

Attenuation is summed loss include one connector and the optical cable

A is optical cable attenuation per kilometer

L is length of optical cable in km

A\*L may be ignored for the patch cord length is not more than 100m

### 3.5 Cold

Test method: IEC61300-2-17

Test wavelength: 1550 nm

Temperature: -40°C

Duration of exposure: 96h

Sampling rate (IL and RL): initial and after test and at a maximum interval of 1 h during the test.

Requirements: see table 5.

Table 5. Optical performance of initial ,during and after test

Item	Initial test	During test	After test
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Max. insertion loss	0.3dB	/	/
Maximum insertion loss variation for pigtail	/	0.2dB	0.2dB
Maximum insertion loss variation for patch cord	/	0.5dB	0.4dB
Min. return loss	50dB	50dB	50 dB

### 3.6 Dry heat-High temperature endurance

Test method: IEC61300-2-18

Test wavelength: 1310 nm and 1550 nm

Temperature: 75°C

Duration of exposure: 336h

Sampling rate (IL and RL): initially at room ambient, at least every 6h during the test and at the end of the test at room ambient.

Requirements: see table 5.

### 3.7 Change of temperature

Test method: IEC61300-2-22 (test Nb)

Test wavelength: 1310 nm and 1550 nm

High temperature dwell: 75°C

Room ambient dwell: 23°C

Low temperature dwell: -40°C

Duration at each dwell temperature: 1 hour

Ramp time: 1 hour

Number of cycles: 21

Sampling rate (IL and RL): initially at room ambient, after 0.5h during each dwell (measurements to be completed during dwell) and at the end of the test at room ambient.

Requirements: see table 5.

### 3.8 Damp heat (steady state)

Test method: IEC61300-2-19

Test wavelength: 1310 nm and 1550 nm

Temperature: 75 °C

Relative humidity: 90 %

Duration of exposure: 168h

Sampling rate (IL and RL): initially at room ambient, at least every 6 hours during the test and at the end of the test at room ambient.

Requirements: see table 5.

### 3.9 Temperature –humidity-condensation cycling test

Test method: IEC 61300-2-48

Test wavelength: 1310nm and 1550nm

High temperature dwell: 65°C

Room temperature dwell: 23°C

Low temperature dwell: -10°C

Relative humidity: 90%~100% during dwells at 23°C and 65°C. Uncontrolled but not dehumidified during ramps and at -10°C.

Cycle profile: 23°C to -10°C to 65°C to -10°C to 23°C.

Ramp time= 1 hour, except change from -10°C to 65°C and 65 °C to -10°C must occur faster (20 min max.) to maximize condensation.

Duration at each dwell temperature: 2 hours

Numbers of cycles: 14

Sampling rate (IL and RL): initially at room ambient, after 1 hour during each dwell (measurements to be completed during dwell) and at the end of the test at room ambient.

Requirements: see table 5.

### 3.10 Dry heat

Test method: IEC61300-2-18

Temperature: 75°C

Duration of exposure: 24 hours

Notes,

1. The connector samples shall not be uncoupled or cleaned anytime before, during, or after the test.
2. This procedure is to dry the connector after humidity-condensation test.

### 3.11 Change of temperature (After temperature-humidity-condensation cycling test)

Test method: IEC61300-2-22(Test Nb)

Test wavelength: 1310 nm and 1550 nm

High temperature dwell: 75°C

Room ambient dwell: 23°C

Low temperature dwell:-40°C

Duration at each dwell temperature: 1 hour

Ramp time: 1 hour

Number of cycles: 21

Sampling rate (IL and RL): initially at room ambient, after 1/2 hour during each dwell (measurements to be completed during dwell) and at the end of the test at room ambient.

Requirements: see table 5.

### 3.12 Vibration (sinusoidal)

Test method: IEC61300-2-1

Test wavelength: 1310nm and 1550nm

Frequency range: 45 Hz per min, 10Hz to 55Hz

Maximum frequency sweep: 2.5min

Endurance duration per axis: 2 hours

Number of axes: 3 orthogonal

Number of sweeps per axis: 120

Vibration amplitude: 1.5mm peak to peak

Sampling rate (IL and RL): initially and before and after each axis

Requirements: see table 5.

### 3.13 Optical fiber cable flexing

Test method: IEC61300-2-44

Test wavelength: 1310 nm and 1550 nm

Magnitude of the tensile load: 8.9N

(For LC connector, the load shall be 5.9N).

Rate of application of the tensile load: 1N/s

Cycle: 0° to 90° to 0° to -90° to 0° (continuous with reversing at ±90°)

Number of cycles: 100

Point of application of the tensile load: 220mm~280mm from the cable entrance to the plug.

Sampling rate (IL and RL): initially and at the end of the test with no load applied.

Requirements: see table 5.

### 3.14 Torsion test

Test method: IEC61300-2-5

Test wavelength: 1310 nm and 1550 nm

Magnitude of the tensile load: 13.3N

Rate of application of the tensile load: 1N/s

Cycle: ±900°

Number of cycles: 10

Point of application of the tensile load: 220mm~280mm from the cable entrance to the plug.

Sampling rate (IL and RL): initially and at the end of the test with no load applied.

Requirements: see table 5.

Notes,

This item is not necessary in condition that the length of the break out cable is less than 60 mm.

### 3.15 0°proof test

Test method: IEC61300-2-50

Test wavelength: 1310 nm and 1550 nm

Magnitude of the tensile load: 70N

Rate of the application of the tensile load: 5N/s

Duration of the test (maintaining the load):5s minimum

Point of application of the tensile load: 220mm~280mm from the cable entrance to the plug.

Sampling rate (IL and RL): initially and at least 10s after the end of the test with no load applied.

Requirements: see table 5.

### 3.16 90°proof test

Test method: IEC61300-2-50

Test wavelength: 1310 nm and 1550 nm

Magnitude of the tensile load: 22.6N

(For LC connector, the load shall be 14.7N).

Rate of the application of the tensile load: 5N/s

Duration of the test (maintaining the load):5s minimum

Point of application of the tensile load: 220mm~280mm from the cable entrance to the plug.

Sampling rate (IL and RL): initially and at least 10s after the end of the test with no load applied.

Requirements: see table 5.

### 3.17 Transmission with applied tensile load

Test method: IEC61300-2-51

Test wavelength: 1310 nm and 1550 nm

Orientation: 0 ° and 90° to the axis of the connector

Magnitude of the tensile load: 2.5N,6.9N,14.7N and 19.6N

(For LC connector, the 90° loads are reduced to 2/3 of the values listed above.)

Rate of the application of the tensile load: 5N/s

Duration of the test (maintaining the load): Until optical stability is reached.

Point of application of the tensile load: 220mm~280mm from the cable entrance to the plug.

Sampling rate (IL and RL): initially, at optical stability with the load applied and at the complication of all tests 20s after the last load is removed.

Requirements: see table 5.

### 3.18 Impact test

Test method: IEC61300-2-12 Method A

Test wavelength: 1310 nm and 1550 nm

Number of drops: 8 for each plug

Drop height: 1.5m

Sampling rate (IL and RL): initially and after the last drop.

Requirements: see table 5.

### 3.19 Mating durability

Test method: IEC61300-2-2

Test wavelength: 1310 nm and 1550 nm

Number of the cycles: 500 minimum

Sampling rate (IL and RL): measurements are recorded after every mating.

Requirements: see table 5

### 3.20 Connector installation

Test method: IEC61300-2-49

Test wavelength: 1550 nm

Distance from adapter mounting surface to panel: 70mm

Duration of the test (panel at specified distance): until optical stability is reached.

Sampling rate (IL and RL): loss shall be measured initially and with the panel at the specified distance.

Requirements: see table 5.

### 3.21 Salt mist test

Test method: IEC61300-2-26

Test wavelength: 1310nm and 1550 nm

Salt solution 5% NaCl (PH 6.5-7.2)

Temperature: +35°C

Relative humidity: >85%

Duration of the test: 96h

Sampling rate (IL and RL): initially and after the test at normal ambient conditions.

Requirements:

1. See table 5.
2. There is no visible evidence of the formation of corrosion under 5 x magnifications.

### 3.22 Tensile test of the $\Phi$ 2.0mm stuff cords

Test method: Huawei requirement

Tensile load: 300N

Min-duration the stuff cord applied tensile load: 2 min

Requirements:

The relative offset of the stuffed cord and junction part is not more than 2mm.

### 3.23 Tensile strength of coupling mechanism

Test method: IEC61300-2-6

Test wavelength: 1550 nm

Load: 40 N at 2 N/s

Duration: 120 s

Sampling rate (IL and RL): initially and after the load has reached its maximum level and been maintained for 120 s.

Requirements: see table 5.

### 3.24 Dust

Test method: IEC61300-2-27

Test wavelength: 1550 nm

Dust particle size:  $d < 150 \mu\text{m}$

Dust type: talc

Dust concentration:  $10.6 \text{ g/m}^3 \pm 7.1 \text{ g/m}^3$

Temperature: +35 °C

Relative humidity: 60 %

Duration of test: 10 min

Sampling rate (IL and RL): initially and after the test at normal ambient Conditions.

Requirements: see table 5.

### 3.25 Insertion loss and return loss test after all tests criteria

Test method: IEC61300-3-4 (Method B), IEC61300-3-6 (OTDR method)

Test wavelength: 1310nm and 1550 nm

Insertion loss (Max): 0.5dB

Return loss (Min): 50dB

### 3.26 Visual inspection

Test method: IEC61300-3-1 and IEC61300-3-35

Requirements:

1. No crack, distortion, damage and other potentially service-affecting damage to the cable assembly elements.
2. Ferrule endface geometry shall meet the requirements in table 6.
3. Ferrule end-face cracks, chips or scratches at 400X magnification.

### 3.27 Dual 85 test

Test method: Huawei requirements

Temperature: 85 °C

Relative humidity: 85%

Duration of test: 1000 h

Requirements: there shall be no damage to the patch cord under visual inspection.

### 3.28 Cracking resistance test in high temperature and pressure for cable assembly

Test method: Huawei requirements

Sample: part of cable with a pcs of PBT tube inside;

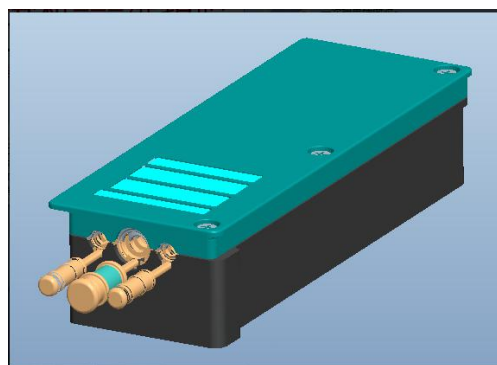
Temperature and duration: 85 °C for 48 hours

Procedure:

- 1, Assemble the optical cable with PBT tube to the Huawei test tool
- 2, Fasten the screw by a screwdriver with 14kgf torque;
- 3, Put sample under test into a temperature box(85 °C) and keep for 48 hours
- 4, Take sample out of temperature box and check

Requirements:

- 1, IPX5 passed
- 2, There shall be no crack to the cable sheath under visual inspection;
- 3, see table 5



*Figure 3 Huawei test tool*

### 3.29 CE declaration

The patch cord should comply with 2011/65/EU (ROHS).

## 4 Connector requirements

### 4.1 LC connectors requirements

1. LC connectors conform IEC 61754–20, YD 1272.1 and TIA/EIA 604–10 Standards.
2. LC connectors shall be produced by a licensed producer and can be sold and used in world wide.
3. The supplier shall present the license if requested.

## 4.2 Ferrule interface View

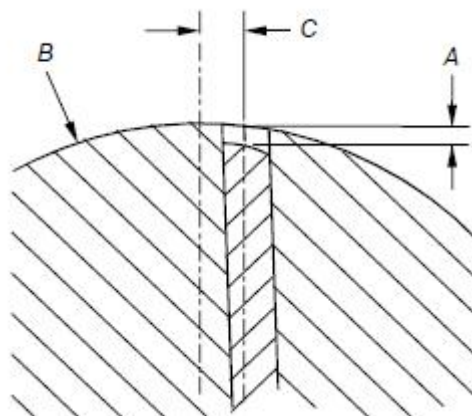


Figure 4 Interface dimension

## 4.3 Ferrule dimension

Table 6. Ferrule dimension

Item	Connector 1(DLC/UPC)	Connector 2(DLC/UPC)
Fiber height (A,note1)	-100nm~A <sub>max</sub> (note 2)	-100nm~A <sub>max</sub> (note 2)
Radius of curvature(B)	5mm~30mm	5mm~30mm
Apex offset(C)	0~70μm	0~70μm
Ferrule diameter	1.2485mm~1.2495mm	1.2485mm~1.2495mm

Note 1 A negative value indicates fiber protrusion.

Note 2  $A_{max}=1798 \times B^{(-0.795)} - B \times 10^6 + (B^2 \times 10^6 - C^2)^{0.5} \times 10^3 - 60$

## 4.4 Color

Table 7. Connector color

Item	Connector 1(DLC/UPC)	Connector 2(DLC/UPC)
Housing color	RAL5015, ΔE<2	RAL5015, ΔE<2
Boot color	RAL9010, ΔE<2	RAL9010, ΔE<2

## 4.5 Ferrule compression force

Table 8. Ferrule compression force

Item	Connector 1(DLC/UPC)	Connector 2(DLC/UPC)
Ferrule compression force	5N-7N(note 3)	5N-7N(note 3)

Note 3 Ferrule compression force shall be 5 N to 7 N, when the dimension B (see IEC 61754-20 figure 1) is moved to the range 9.6 mm to 10.2 mm.

## 5 Cable requirements

See Annex A

## 6 Edition record

Date	Author	Reviewer	Version	Revision declaration
2014-04-15	Chuguanghu 00210000	Tu xiuyu/ 00119794; Wang wei/00117966,	V1.0	First Version

Date	Author	Reviewer	Version	Revision declaration
2016-02-25	Chuguanghu 00210000	Tu xiuyu/ 00119794; Wang wei/00117966,	V1.1	Delete 14130645-001 from bom code list and Add 14130650-001,14130650-002 and 14130650-003 to bom code list of table 2
2017-01-06	Chuguanghu/00210000	TMG group	V1.2	1, Add a pcs of PBT between cable sheath and cable core before assembling the junction part; 2, Decrease the diameter of stuffing cord in cable to 1.3mm; 3, Add Cracking resistance test in high temperature and pressure for cable assembly



## **GYFJH-2G.657A2 Outdoor Optical Fiber Cable 80°C Huawei Specification**



Huawei Technologies Co., Ltd.

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Working temperature range	-40°C~80°C
Min. installation temperature	-20°C
Storage and transport temperature range	-40°C~60°C
Applications	Indoor & outdoor
Service life	≥15 years
Reference standards	ITU-T G.657, YD/T 2289.1, IEC 60811, IEC 60794-1-2, IEC 61034, IEC 60754, IEC 60332-1, UL 1581 and Huawei requirements
Remark	Other requirements not mentioned should fulfill the reference standards above.

### 1 Cross section

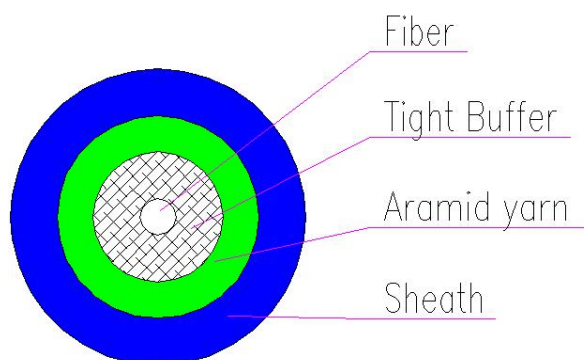


Figure 1. Section view of the  $\Phi$ 2.0mm simplex cable

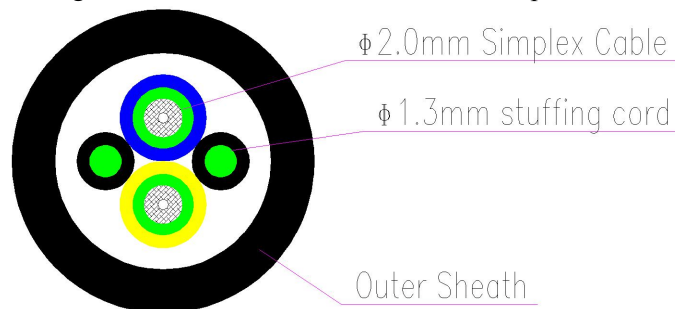


Figure 2. Section view of the  $\Phi$ 7.0mm outdoor optical cable

### 2 Type

GYFJH-2G.657A2

### 3 Cable dimensions

Table 1. Cable dimensions

Item	Unit	Requirements
------	------	--------------

Φ2.0mm simplex cable	Diameter of tight buffer	mm	0.85±0.05
	Nominal thickness of sheath	mm	0.35
	Min. thickness of sheath	mm	0.3
	Diameter of sheath	mm	2.0±0.1
Stuffing cord	Min. thickness of sheath	mm	0.3
	Diameter of sheath	mm	1.3±0.1
Finished cable	Nominal thickness of outer sheath	mm	1.0
	Min. thickness of outer sheath	mm	0.9
	Diameter of finished cable	mm	7.0 <sup>0</sup> <sub>-0.2</sub>
	Reference weight	kg/km	44±2

Note: Mean value of thickness:  $\geq$  nominal value of thickness.

## 4 Requirements of the cable elements

### 4.1 Fiber

Table 2. Fiber requirements

Item	Unit	Requirements		
Fiber type	/	G.657A2		
<b>Geometrical characteristics</b>				
Mode field diameter	wavelength	1310nm		
	Range of nominal values	8.6μm -9.5μm		
	Tolerance	± 0.4 μm		
Cladding diameter	Nominal	125.0μm		
	Tolerance	±0.7 μm		
Core concentricity error		≤0.5μm		
Cladding non-circularity		≤1%		
Coating diameter	Nominal	245μm		
	Tolerance	±10μm		
Coating-cladding concentricity error		≤12.5μm		
<b>Transmission characteristics</b>				
Cut-off wavelength		≤1260 nm		
Uncabled fiber macro-bending loss(note)	Radius(mm)	15	10	7.5
	Number of turns	10	1	1
	Max. at 1550 nm(dB)	0.03	0.1	0.5
	Max. at 1625 nm (dB)	0.1	0.2	1.0
Dynamic fatigue parameter		≥20		

Chromatic dispersion coefficient	$\lambda_{0min}$	1300 nm
	$\lambda_{0max}$	1324 nm
	$S_{0max}$	$0.092 \text{ ps/nm}^2 \times \text{km}$
<b>Mechanical characteristics</b>		
Min. proof stress	Minimum	0.69 GPa
Strip force (average)	N	$1.0 \leq F_{ave.strip} \leq 5.0$
Strip force (peak)	N	$1.0 \leq F_{peak.strip} \leq 8.9$
Note: The macrobending loss can be evaluated by method A in IEC 60793-1-47.		

## 4.2 Tight buffer

### 4.2.1 Requirements for the material of tight buffer

Material: LSZH

Hardness:  $55 \pm 3$  Shore D

Color: nature

Tensile strength before aging:  $\geq 10 \text{ N/mm}^2$

Elongation at rupture before aging:  $\geq 125\%$

Aging condition:  $113^\circ\text{C}$  for 168 hours

Tensile strength variation after aging:  $\leq \pm 20\%$

Elongation at rupture variation:  $\leq \pm 20\%$

### 4.2.2 Stripability of coating and buffer

Test method: IEC 60793-1-32(GB60793-1-32)

Condition:

$L=15\text{mm}$

Stripping rate:  $100\text{mm/min}$

Nominal hole size:  $175 \mu\text{m}$

Requirements:

The force of striping coating and buffer shall be between  $1.3\text{N} \sim 13.3\text{N}$ .

### 4.2.3 Buffered fiber movement in compression

Test method: IEC 60794-2-50 Annex D

Condition:

Compression distance:  $1\text{mm}$

Numbers of movements: 5

Requirements:

The maximum increase in attenuation during the test  $\leq 0.3\text{dB}$ ;

The reaction force  $\leq 1\text{N}$  at  $0.4 \text{ mm}$ .

### 4.2.4 Shrinkage test

Test method: YD/T 1258.2

Condition:

Cable length under test: 500mm

Temperature and duration: 85°C for 2hours

Requirements: the shrinkage percentage shall be no more than 1%.

#### 4.3 Strength member for simplex cable and stuffing cord

Material: aramid yarn

Min-liner density of aramid yarn in simplex cable: 4400 dtex

Min-liner density of aramid yarn in a stuffing cord: 4400 dtex

Breaking force  $\geq 0.14 \times$  liner density

Breaking tenacity:  $\geq 1400$  mN/tex

Elongation at break: 1.8%~4.0%

Force at specified elongation(FASE-0.5):  $\geq 0.025 \times$  liner density

Chord modulus(CM):  $\geq 45$  N/tex

#### 4.4 Sheath of simplex cable and stuffing cord

##### 4.4.1 Requirements for the material of sheath of simplex cable and stuffing cord

Material: LSZH

Hardness: 90  $\pm$ 3 Shore A

Color of simplex cable: yellow, blue

Color of stuffing cord: black (PANTONE black 3C)

Tensile strength before aging:  $\geq 10$  N/mm<sup>2</sup>

Elongation at rupture before aging:  $\geq 125\%$

Aging condition: 113°C for 168 hours

Tensile strength variation after aging:  $\leq \pm 20\%$

Elongation at rupture variation:  $\leq \pm 20\%$

##### 4.4.2 Sheath pull-off force

Method: IEC 60794-2-50 Annex B

Condition:

Rate of separation:  $\leq 200$ mm/min

Strip length: 50mm

Requirement: the force to strip the sheath shall not be greater than 15N.

##### 4.4.3 Shrinkage test

Test method: IEC 60811-1-3

Condition:

Temperature and duration: 80°C for 5 hours

Requirement:

Requirements: the shrinkage percentage shall be no more than 2%.

#### 4.4.4 Bending test at low temperature for inner sheath

Test method: IEC 60811-1-4

Condition:

Temperature and duration: **-40°C for 16 hours**

Diameter of the mandrel: 8mm

Number of turns: 10

Requirements: No breakage to fiber and no crack to the inner sheath.

#### 4.4.5 Impact test at low temperature

Test method: IEC 60811-1-4

Condition:

Temperature and duration: -40°C for 16 hours

Mass of hammer: 100g

Requirements: No breakage to fiber and no crack to the inner sheath.

#### 4.4.6 Pressure test at high temperature

Test method: IEC 60811-3-1

Condition:

Temperature and duration: 80°C for 4 hours

Compressing force: 0.7N

Width of the blade: 0.7mm±0.01mm

Requirements: The indentation value shall be no more than 50% of the mean value of thickness.

#### 4.4.7 Test for resistance to cracking

Test method: IEC 60811-3-1

Condition:

Temperature and duration: 130°C for 1 hours

Diameter of mandrel: 5mm

Number of turns: 6

Requirements: There shall be no breakage to fiber and no crack to cable sheath.

#### 4.4.8 Test for resistance to cracking

Test method: IEC 60811-3-1

Condition:

Temperature and duration: 80°C for 5 hours

Diameter of mandrel: 5mm

Number of turns: 6

Requirements: There shall be no breakage to fiber and no crack to cable sheath.



## 4.5 Outer sheath

### 4.5.1 Requirements for the material of outer sheath

Material: LSZH  
Hardness: 90 ±3 Shore A  
Color of outer cable sheath: Black (PANTONE black 3C)  
Tensile strength before aging: ≥10 N/mm<sup>2</sup>  
Elongation at rupture before aging: ≥125%  
Aging condition: 113°C for 168 hours  
Tensile strength variation after aging: ≤±20%  
Elongation at rupture variation: ≤±20%

### 4.5.2 Water absorption test

Test method: IEC 60811-1-3(gravimetric method)  
Condition:  
Temperature and duration: 85°C for 336 hours  
Requirements: ≤1mg/cm<sup>2</sup> (Density≤1g/cm<sup>3</sup>); ≤5mg/cm<sup>2</sup> (Density>1g/cm<sup>3</sup>).

### 4.5.3 Shrinkage test

Test method: IEC 60811-1-3  
Condition:  
Temperature and duration: 80°C for 5 hours  
Requirement:  
Requirements: the shrinkage percentage shall be no more than 5%.

### 4.5.4 Pressure test at high temperature

Test method: IEC 60811-3-1  
Condition:  
Temperature and duration: 80°C for 4 hours  
Compressing force: 2.2N  
Width of the blade: 0.7mm±0.01mm  
Requirements: The indentation value shall be no more than 50% of the mean value of thickness.

### 4.5.5 Resistance to environmental stress cracking

Test method: IEC 60811-4-1(Procedure B)  
Condition:  
Temperature and duration: 50°C for 96 hours  
Requirements: No failed piece.

### 4.5.6 Sunlight resistance test

Test method: Section 1200 of UL 1581.  
Conditions: 720h.

Requirements:

Tensile strength retention rate:  $\geq 80\%$ .

Elongation retention rate at rupture:  $\geq 80\%$ .

## 5 Marking

### 5.1 The surface markings should include following contents:

- a) Manufacture name
- b) GYFJH 2G.657A2
- c) IEC 60332-1
- d) SUN. RES.
- e) Month/Day/Year (e.g. 02/20/2010)
- f) Length: XXXX m

### 5.2 Continuity of marks

The distance between the beginning of the mark and the beginning of the next identical mark shall be 1000 mm (tolerance: 0mm~10mm). Each specified mark shall be regarded as continuous

### 5.3 Durability

Test method: IEC 60794-1-2 E2B

Requirement: The surface marking words should be clear enough to identify after rubbing 5 times with a piece of cotton wool or cloth soaked in water.

### 5.4 Legibility

All markings shall be clear and natty, have no overprint and lack of printing. The colors of the identification threads shall be easy to recognize or easily made recognizable.

## 6 Transmission requirements of cabled fiber

Table 3. Transmission requirements

	Wavelength	Requirements
Attenuation coefficient	1310nm	$\leq 0.4\text{dB/km}$
	1383nm	$\leq 0.4\text{dB/km}$
	1550nm	$\leq 0.3\text{dB/km}$
	1625nm	$\leq 0.4\text{dB/km}$

## 7 Mechanical and physical characteristics

(Remark: All tests shall be done at 1550nm wavelength.)

## 7.1 Tensile strength

Test method: IEC 60794-1-2 E1

Condition:

Diameter of the chuck drums: 250mm

Length of the cable under tension: no less than 50m

Rate of tension increase: 100mm/min

Tensile load and duration: long term tensile force: 200N for 1min, short term tensile force: 400N for 5 min

Requirements:

1. With the long term tensile force, fiber additional attenuation absolute value should be no more than 0.03dB/km, and the fiber stress-strain no more than 0.2%;
2. With the short term tensile force, fiber stress-strain should be no more than 0.4%;
3. After releasing the load fiber additional attenuation absolute value should be no more than 0.03dB;
4. There shall be no damage to the cable elements under visual inspection.

## 7.2 Crush

Test method: IEC 60794-1-2 E3

Condition: long term crush force: 1100N for 1min, short term crush force: 2200N for 1 min

Requirements:

1. With the long term crush force, fiber additional attenuation absolute value should be no more than 0.03dB;
2. With the short term crush force, fiber additional attenuation absolute value should be no more than 0.4dB;
3. After releasing the short term crush load, fiber additional attenuation absolute value should be no more than 0.03dB;
4. There shall be no damage to the cable elements under visual inspection.

## 7.3 Impact

Test method: IEC 60794-1-2 E4

Condition:

Impact energy: 0.45kg\*1m

Radius of the striking surface: 12.5mm

Number of impacts: not less than 3 times,

Distance between the nearest impacts locations: no less than 500mm

Requirements:

1. Fiber additional attenuation absolute value should be no more than 0.4dB
2. There shall be no damage to the cable elements under visual inspection.

## 7.4 Repeated bend

Test method: IEC 60794-1-2 E6

Condition:

Mass of the weight: 150N

Bending Radius: 70mm

Number of cycles: 25 times

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB;
2. There shall be no damage to the cable elements under visual inspection.

### 7.5 Torsion

Test method: IEC 60794-1-2 E7

Condition:

Tension load to be applied: 150N

Test length: 1m

Angle range for cable to be twist:  $\pm 180^\circ$

Number of cycles: 10

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB;
2. There shall be no damage to the cable elements under visual inspection.

### 7.6 Flexing

Test method: IEC 60794-1-2 E8

Condition:

Mass of weight: 40N

Radius of pulley: 70mm

Number of cycles: 30

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB;
2. There shall be no damage to the cable elements under visual inspection.

### 7.7 Bend

Test method: IEC 60794-1-2 E11A

Condition:

Test mandrel Radius: 70mm

Number of cycles: 10

Number of turns: 6

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB;
2. There shall be no damage to the cable elements under visual inspection.

## 8 Environment Requirements

*(Remark: All tests shall be done at 1550nm wavelength.)*

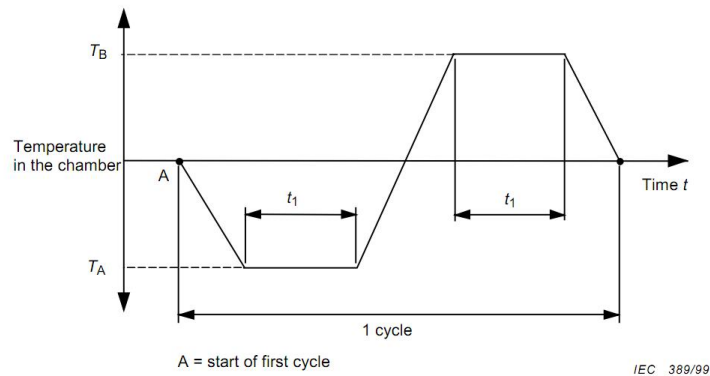
## 8.1 Temperature cycling

Test method: IEC 60794-1-2 F1

Condition:

Cable sample length: 1km

Temperature cycle diagram:



Temperature range:  $T_A = -40\text{ }^{\circ}\text{C}$ ;  $T_B = 80\text{ }^{\circ}\text{C}$

Duration of temperature plateau  $t_1$ : 8h

Rate of temperature changing:  $1\text{ }^{\circ}\text{C}/\text{min}$

Number of cycles: 2

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB/km;
2. There shall be no damage to the cable elements under visual inspection.

## 8.2 Cable bending at high temperature

Test method: IEC 60794-1-2 E11A

Condition:

Test temperature:  $80\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  for 8 hours

Test mandrel radius: 70mm

Number of turns: 4

Number of cycles: 4

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB/km;
2. There shall be no damage to the cable elements under visual inspection.

## 8.3 Cable bending at low temperature

Test method: IEC 60794-1-2 E11A

Condition:

Test temperature:  $-40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  for 8 hours

Test mandrel radius: 70 mm

Number of turns: 4

Number of cycles: 4

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB/km;
2. There shall be no damage to the cable elements under visual inspection.

#### 8.4 Cold impact

Test method: IEC 60794-1-2 E4

Condition:

Test temperature:  $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$  for 8 hours

Impact energy: 0.45kg\*1m

Radius of the striking surface: 12.5mm

Number of impacts: not less than 3 times,

Distance between the nearest impacts locations: no less than 500mm

Requirements:

1. Fiber additional attenuation should be no more than 0.4dB/km;
2. There shall be no damage to the cable elements under visual inspection.

#### 8.5 Test for resistance to cracking

Test method: IEC 60811-3-1

Condition:

Temperature and duration:  $130^{\circ}\text{C}$  for 1 hours

Diameter of mandrel: 19mm

Number of turns: 4

Requirements: There shall be no breakage to fiber and no crack to cable sheath.

#### 8.6 Test for resistance to cracking

Test method: IEC 60811-3-1

Condition:

Temperature and duration:  $80^{\circ}\text{C}$  for 5 hours

Diameter of mandrel: 19mm

Number of turns: 4

Requirements: There shall be no breakage to fiber and no crack to cable sheath.

#### 8.7 Dual 85 test

Test method: Huawei requirements

Condition:

Temperature:  $85^{\circ}\text{C}\pm 2^{\circ}\text{C}$

Relative humidity:  $85\%\pm 5\%$

Duration of test: 1000 h

Requirement: there shall be no damage to the cable elements under visual inspection.

## 8.8 Flammability

Table 4. Flame resistant index of the finished cable

No	Item	Unit	Technology index
1	Flame propagation test	-	IEC 60332-1
2	Burning occur gas acidity	pH	$\geq 4.3$ (IEC 60754-2)
3	Acid gas emission	mg/g	$\leq 5$ (IEC 60754-1)
4	Burning release gas photic rate	%	$\geq 60$ (IEC 61034-2)
5	Conductivity	uS/mm	$\leq 10$ (IEC 60754-2)

## 9 CE declaration

The finished cable shall comply with 2011/65/EU (ROHS).

## 10 Edition record

Date	Author	Reviewer	Version	Revision declaration
2014-08-25	Chu guanghu/00210000	Tu Xiuyu 00119794	v1.0	First Version
2017-01-04	Chu guanghu/00210000	CBG group	V1.1	Decrease the diameter of the stuffing cord to 1.3mm ;