

FIBER OPTIC SPLITTER

(Splitter in passive optical network)

1 GENERAL

- 1.1 This specification covers requirement of the fiber optic splitter to be supplied to TOT Public Company Limited (TOT) intended to use for optical devices in passive optical network (PON) such as FTTX namely Fiber To The Home (FTTH), Fiber To The Curb (FTTC) etc.
- 1.2 The fiber optic splitter herein after referred to as the "Splitter" shall be installed in fiber optic splice closure/terminal (SDP/SDP-T), Outdoor fiber cross connect cabinet (OFCCC) and fiber distribution frame (FDF) etc.
- 1.3 The scope of use, the splitter according to this specification shall be applied to use for bidirectional transmission or to distribute a signal to two or more service points.
- 1.4 Full details of this following information shall be provided in bidding document by bidder.
 - 1.4.1 Product specification issued by product manufacturer.
 - 1.4.2 The material and grade of material used as per Section 3 in this specification.
 - 1.4.3 Test method and test report issued by manufacturer or third party laboratory or TOT to certify the product offered meeting the requirements as specified herein or meeting international standard.

2 GENERAL REQUIREMENTS

- 2.1 The splitter shall be able to use in indoor and outdoor which the split ratios shall cover the specification are 1:N symmetric splitters with output port such as 1:2, 1:4, 1:8, 1:16, 1:32, 1:64, 2:2, 2:4, 2:8, 2:16, 2:32, 2:64 etc. The splitter device in active optical network is not concerned in this specification.

2.2 The splitter type shall be classified as per Figure 1. The splitter type A, herein after means the splitter type A1 and A2, shall be installed in the splitter tray such as inside the FTTX closure/terminal etc. The splitter type B shall be installed in rack of Outdoor fiber cross connect cabinet (OFCCC) and rack of fiber distribution frame etc.



Type A1 Splitter (Non-Connectorized)



Type B Modular splitter (Connectorized)



Type A2 Splitter (Connectorized)

Figure 1 Typical of splitter

2.3 All types of splitter specify shall be compatible and be able to apply for TOT standard equipment as described in Section 2.2.

2.4 The splitter can be produced by any manufacturing technology such as Fused Biconical Taper Technology, Planar Waveguide Technology or Planar Light Wave Circuit Technology etc. The bidder can propose the different manufacturing technology or different design from those specified in Figure 1 which having better performance and easier operation. TOT bidding evaluation committee or a person entrusted will considerate the manufacturing technology and make a decision.

2.5 The splitter shall be specified for use in the O, S, C and L-band that operated in nominal optical bandpass ranges which show in Table 1.

Band	Description	Nominal Range
O - Band	Original	1260 - 1360
S - Band	Short wavelength	1460 - 1530
C - Band	Conventional	1530 - 1565
L - Band	Long wavelength	1565 - 1625

Table 1 Nominal Optical Bandpass Ranges

- 2.6 The fiber used in both sides (input and output) of all splitter types shall conform to ITU-T Recommendation G.657.A1, TOT specification OES-004-049-XX (latest issue) Optical Fiber Drop Cable (Round Type). The lengths of fiber from each end of the splitter body shall be in accordance with Section 6 ordering information.
- 2.7 The required fiber color identification shall be specified in the Table 2 which in accordance with EIA/TIA-598-A (Optical Fiber Cable Color Coding). This Table 2 shall be applied only for splitter type A1 and the coloring shall be stable during the lifetime of cable.

Fiber No.								Fiber
1	9	17	25	33	41	49	57	Blue
2	10	18	26	34	42	50	58	Orange
3	11	19	27	35	43	51	59	Green
4	12	20	28	36	44	52	60	Brown
5	13	21	29	37	45	53	61	Slate
6	14	22	30	38	46	54	62	White
7	15	23	31	39	47	55	63	Red
8	16	24	32	40	48	56	64	Black

Table 2 Fiber Color Identification

- 2.8 Splitter dimensions
 - 2.8.1 The dimensions of the splitter type A1 and A2 shall be suitable for the splitter tray except split ratios 1:64 and 2:64 shall be suitable for rack as specified Section 2.8.2.
 - 2.8.2 The dimensions of the splitter type B shall be suitable for rack of Outdoor fiber cross connect cabinet (OFCCC), rack of fiber distribution frame (FDF) and TOT standard rack as specified in Section 2.3.
- 2.9 The splitter shall have no sharp edges, corners, burrs or other hazardous features that could result in damage to the fiber or injury to splicer or craftsman.
- 2.10 The splitter shall be easy for handling and installation which the splitter shall allow easy fiber access during installation and maintenance.



3 MATERIAL REQUIREMENTS

- 3.1 All device materials which are likely to come into contact with personal shall be non-toxic and shall not be a potential environmental hazard.
- 3.2 All parts of metallic materials shall be resistant to the corrosive influences they may encounter in normal use for indoor and outdoor applications.
- 3.3 For high reliability and high performance. The material of both fiber array and chip of splitter shall be quartz based material or better materials.
- 3.4 The polymeric materials of the splitter body used shall be stated by the bidder. TOT bidding evaluation committee or a person entrusted will considerate the polymeric and make a decision.
- 3.5 The materials of both sides (input and output) of splitter shall be as follows:

3.5.1 In case of the splitter type A.

- The splitter type A1: The single fiber \varnothing 250 microns (0.25 mm) shall be used in this case. The fiber color identification shall be as per Section 2.7.
- The splitter type A2: The loose tube \varnothing 900 microns (0.9 mm) or tight buffer tube \varnothing 900 microns (0.9 mm) shall be used in this case. The fiber number identification marking shall be identified near the connector and see Section 5.

3.5.2 In case of the splitter type B, the materials of reinforced cable shall be as follows:

Outer jacket: Polymer of polyethylene (PE) filled with FR (Flame Retardant, UL94-V0), LS (Low smoke) and ZH (Zero Halogen or Halogen Free). Fiber jacket overall diameter 2.0 mm.

Jacket color: Jacket color of output side shall be yellow but jacket color of input side shall be different from output side.

Strain relief: Aramid yarns (fully completely cover around the tight buffer, no adhesion to jacket or buffer tube).

Tight buffer tube: Jelly free, tight buffer tube \varnothing 900 microns (0.9 mm), non-blocking, made from TPE (Thermo plastic elastomer) or PBT (Polybutylen terephthalate) or PA (Polyamide), filled with FR (Flame Retardant, UL94-V0).

Cable label -

Identification: The fiber number identification marking shall be firmly installed and identified near the connector and see Section 5.

4 TECHNICAL REQUIREMENTS

For each mechanical or environmental requirements, the Non-Connectorized splitter shall be tested for this specified. In case of Connectorized splitter, the connectors on their own shall meet the requirements of TOT specification OES-004-036-XX (latest issue) Single Mode Fiber Patch Cord and Pigtail (SC/APC, LC/APC). If there is no specified in some testing procedure, the test method should be done in practical way based on TOT application.

4.1 Optical Performance Criteria

4.1.1 Optical Performance Criteria (for Non-Connectorized splitter)

Splitter Ratio	Insertion Loss (dB)	Uniformity (dB)	Return Loss (dB)	Polarization Dependent Loss (dB)	Directivity (dB)
1:2	≤ 4.0	≤ 0.6	≥ 55	≤ 0.2	≥ 55
1:4	≤ 7.2	≤ 0.6	≥ 55	≤ 0.2	≥ 55
1:8	≤ 10.5	≤ 1.0	≥ 55	≤ 0.2	≥ 55
1:16	≤ 13.8	≤ 1.2	≥ 55	≤ 0.2	≥ 55
1:32	≤ 17.0	≤ 1.7	≥ 55	≤ 0.2	≥ 55
1:64	≤ 20.5	≤ 2.0	≥ 55	≤ 0.3	≥ 55
2:2	≤ 4.2	≤ 0.8	≥ 55	≤ 0.3	≥ 55
2:4	≤ 7.5	≤ 1.2	≥ 55	≤ 0.3	≥ 55
2:8	≤ 11.0	≤ 1.6	≥ 55	≤ 0.4	≥ 55
2:16	≤ 14.3	≤ 1.6	≥ 55	≤ 0.4	≥ 55
2:32	≤ 17.5	≤ 2.0	≥ 55	≤ 0.4	≥ 55
2:64	≤ 21.0	≤ 2.5	≥ 55	≤ 0.4	≥ 55



4.1.2 Optical Performance Criteria (for Connectorized splitter)

Splitter Ratio	Insertion Loss (dB)	Uniformity (dB)	Return Loss (dB)	Polarization Dependent Loss (dB)	Directivity (dB)
1:2	≤ 4.4	≤ 0.6	≥ 60	≤ 0.2	≥ 60
1:4	≤ 7.5	≤ 0.6	≥ 60	≤ 0.2	≥ 60
1:8	≤ 11.0	≤ 1.0	≥ 60	≤ 0.2	≥ 60
1:16	≤ 14.4	≤ 1.2	≥ 60	≤ 0.2	≥ 60
1:32	≤ 17.5	≤ 1.7	≥ 60	≤ 0.2	≥ 60
1:64	≤ 20.7	≤ 2.0	≥ 60	≤ 0.3	≥ 60
2:2	≤ 4.6	≤ 0.8	≥ 60	≤ 0.3	≥ 60
2:4	≤ 7.9	≤ 1.2	≥ 60	≤ 0.3	≥ 60
2:8	≤ 12.5	≤ 1.6	≥ 60	≤ 0.4	≥ 60
2:16	≤ 15.0	≤ 1.6	≥ 60	≤ 0.4	≥ 60
2:32	≤ 17.8	≤ 2.0	≥ 60	≤ 0.4	≥ 60
2:64	≤ 21.5	≤ 2.5	≥ 60	≤ 0.4	≥ 60

4.2 Optical Requirements

Performance	Conditions	Requirements	Reference
4.2.1 Insertion loss (IL) and Uniformity	<ul style="list-style-type: none"> Wavelength range: 1250 nm – 1650 nm Linewidth: 5 nm max. Wavelength step: ≤ 10 nm Source: broadband light source with power ≥ -35 dBm/nm 	<ul style="list-style-type: none"> See Section 4.1 	<ul style="list-style-type: none"> IEC 61300-3-5 Using cutback method and measurement “Insertion method C” as described in IEC 61300-3-4
4.2.2 Directivity	<ul style="list-style-type: none"> Source wavelength: 1310 nm ± 20 nm 1490 nm ± 20 nm 1550 nm ± 20 nm 1625 nm ± 20 nm 	<ul style="list-style-type: none"> See Section 4.1 	<ul style="list-style-type: none"> IEC 61300-3-20

Performance	Conditions	Requirements	Reference
4.2.3 Return loss (RL)	<ul style="list-style-type: none"> Source wavelength: 1310 nm ± 20 nm 1490 nm ± 20 nm 1550 nm ± 20 nm 1625 nm ± 20 nm 	<ul style="list-style-type: none"> See Section 4.1 	<ul style="list-style-type: none"> IEC 61300-3-6 Method A
4.2.4 Polarization Dependent Loss	<ul style="list-style-type: none"> Source wavelength: 1310 nm ± 20 nm 1490 nm ± 20 nm 1550 nm ± 20 nm 1625 nm ± 20 nm 	<ul style="list-style-type: none"> See Section 4.1 	<ul style="list-style-type: none"> IEC 61300-3-2 Option 1 method A
4.2.5 Change in attenuation and Return loss	<ul style="list-style-type: none"> Source wavelength: 1310 nm ± 20 nm 1490 nm ± 20 nm 1550 nm ± 20 nm 1625 nm ± 20 nm 	<ul style="list-style-type: none"> $\Delta IL \leq 0.3$ dB measured between each combination of input and output port during and after test $\Delta RL \leq 5$ dB per port (Return loss) 	<ul style="list-style-type: none"> IEC 61300-3-3

4.3 Mechanical Requirements

Performance	Conditions	Requirements	Reference
4.3.1 Appearance	<ul style="list-style-type: none"> Examination with the unaided naked eye 	<ul style="list-style-type: none"> No defects which will adversely affect product performance 	<ul style="list-style-type: none"> IEC 61300-3-1

Performance	Conditions	Requirements	Reference
4.3.2 Fiber/cable retention	<ul style="list-style-type: none"> ● Force: 5 N per fiber or 70 N per reinforced cable ● Rate: 0-full load in 15 sec. ● Point of application: 300 mm from device ● Duration: 1 minute 	<ul style="list-style-type: none"> ● Appearance ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-4
4.3.3 Static side load 90°	<ul style="list-style-type: none"> ● Force: 0.5 N per fiber or 10 N per reinforced cable ● Angle of load: 90° ● Rate: from 0 to full load in 15 s. ● Application of force: 300 mm from device ● Duration: 1 minute 	<ul style="list-style-type: none"> ● Appearance ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-42
4.3.4 Torsion	<ul style="list-style-type: none"> ● Cable clamp distance: 300 mm from device ● Load: 2 N per fiber or 15 N per reinforced cable ● Torsion: +180°/-180° ● Cycles: 25 	<ul style="list-style-type: none"> ● Appearance ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-5
4.3.5 Vibration	<ul style="list-style-type: none"> ● Sweep range: 10-500 Hz at 1 octave/minute ● Crossover frequency: 41 Hz - below 41 Hz: 	<ul style="list-style-type: none"> ● Appearance ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-1

Performance	Conditions	Requirements	Reference
	Amplitude 0.75 mm - above 41 Hz: 50 m/s ² (~ 5 g) ● Axes:3 mutually perpendicular ● Duration: 10 cycles/axis		

4.4 Environmental Requirements

Performance	Conditions	Requirements	Reference
4.4.1 Damp heat (steady state)	<ul style="list-style-type: none"> ● Temperature: (+85±2)°C ● Relative humidity:(85±2)%RH ● Duration: 14 days 	<ul style="list-style-type: none"> ● Appearance ● Change in attenuation and Return loss ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-19
4.4.2 Temperature cycling with condensation (Z/AD)	<ul style="list-style-type: none"> ● Precondition: 24 hrs at 55°C and max 20%RH ● Cycle A: <ul style="list-style-type: none"> - Lowest temperature: (+25±2)°C - Highest temperature: (+65±2)°C - Relative humidity:(93±3)%RH - Duration time: 24hrs 	<ul style="list-style-type: none"> ● Appearance ● Change in attenuation and Return loss ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-21



Performance	Conditions	Requirements	Reference
	<ul style="list-style-type: none"> ● Cycle B: <ul style="list-style-type: none"> - Lowest temperature: (-10±2)°C - Highest temperature: (+65±2)°C - Relative humidity:(93±3)%RH - Duration time: 24hrs ● Total cycles: 10 cycles, alternating cycle B and A 		
4.4.3 Water immersion	<ul style="list-style-type: none"> ● Waterhead: 150 mm ● Duration: 7 days 	<ul style="list-style-type: none"> ● Appearance ● No water ingress ● Change in attenuation and Return loss ● IL and RL after test (Section 4.1) 	<ul style="list-style-type: none"> ● IEC 61300-2-45

5 MARKING

- 5.1 The splitter shall be identifiable by the manufacturer’s name or trademark, splitter ratios, serial number, month and year of manufacture shall be clearly located and firmly marked on the splitter to provide traceability.
- 5.2 The fiber number identification and group/unit identification in all type shall be provided clearly durable and easy to use.
- 5.3 The splitter shall show a permanent customer’s trademark or logo, if required.

6 ORDERING INFORMATION*

TOT CODE	Splitter type	Split ratio	Connectorized (Both sides)	Fiber length (m) (Each side)	Packing Set/Bx.
10058984	A1	1:2	None	2	1
10058985	A1	1:4	None	2	1
10058986	A1	1:8	None	2	1
10058987	A1	1:16	None	2	1
10058988	A1	1:32	None	2	1
10062482	A1	1:64	None	2	1
10062483	A1	2:2	None	2	1
10062484	A1	2:4	None	2	1
10062485	A1	2:8	None	2	1
10062486	A1	2:16	None	2	1
10062487	A1	2:32	None	2	1
10062488	A1	2:64	None	2	1
10062489	A2	1:2	SC/APC	1	1
10062490	A2	1:4	SC/APC	1	1
10062491	A2	1:8	SC/APC	1	1
10062492	A2	1:16	SC/APC	1	1
10062493	A2	1:32	SC/APC	1	1
10062494	A2	1:64	SC/APC	1	1
10062495	A2	2:2	SC/APC	1	1
10062496	A2	2:4	SC/APC	1	1
10062497	A2	2:8	SC/APC	1	1
10062498	A2	2:16	SC/APC	1	1
10062499	A2	2:32	SC/APC	1	1



TOT CODE	Splitter type	Split ratio	Connectorized (Both sides)	Fiber length (m) (Each side)	Packing Set/Bx.
10062500	A2	2:64	SC/APC	1	1
10062501	A2	1:2	LC/APC	1	1
10062502	A2	1:4	LC/APC	1	1
10062503	A2	1:8	LC/APC	1	1
10062504	A2	1:16	LC/APC	1	1
10062505	A2	1:32	LC/APC	1	1
10062506	A2	1:64	LC/APC	1	1
10062507	A2	2:2	LC/APC	1	1
10062508	A2	2:4	LC/APC	1	1
10062509	A2	2:8	LC/APC	1	1
10062510	A2	2:16	LC/APC	1	1
10062511	A2	2:32	LC/APC	1	1
10062512	A2	2:64	LC/APC	1	1
10058989	B	1:2	SC/APC	2	1
10058990	B	1:4	SC/APC	2	1
10058991	B	1:8	SC/APC	2	1
10058992	B	1:16	SC/APC	2	1
10058993	B	1:32	SC/APC	2	1
10062513	B	1:64	SC/APC	2	1
10062514	B	2:2	SC/APC	2	1
10062515	B	2:4	SC/APC	2	1
10062516	B	2:8	SC/APC	2	1
10062517	B	2:16	SC/APC	2	1
10062518	B	2:32	SC/APC	2	1

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TOT CODE	Splitter type	Split ratio	Connectorized (Both sides)	Fiber length (m) (Each side)	Packing Set/Bx.
10062519	B	2:64	SC/APC	2	1
10058994	B	1:2	LC/APC	2	1
10058995	B	1:4	LC/APC	2	1
10058996	B	1:8	LC/APC	2	1
10058997	B	1:16	LC/APC	2	1
10058998	B	1:32	LC/APC	2	1
10062520	B	1:64	LC/APC	2	1
10062521	B	2:2	LC/APC	2	1
10062522	B	2:4	LC/APC	2	1
10062523	B	2:8	LC/APC	2	1
10062524	B	2:16	LC/APC	2	1
10062525	B	2:32	LC/APC	2	1
10062526	B	2:64	LC/APC	2	1

* The other fiber length shall be specified on order.

7 PACKING

Each fiber optic splitter shall be packed in a box and clearly labeled to show “Fiber Optic Splitter”, splitter type, the description, TOT code, contract number, the name of manufacturer and supplier (if any).

End of Specification

