

FIBER OPTIC ATTENUATOR (FC/UPC, SC/UPC, LC/UPC)

1. GENERAL

This specification covers the requirements of the standard attenuator for single mode optical fiber to be supplied to TOT Public Company Limited (TOT). The attenuator shall be used for Metro LAN, TOT passive optical network (PON) such as FTTx namely Fiber To The Home (FTTH), Fiber To the Curb (FTTC), etc. which installed in the exchange, access node, building or equivalents.

All types of attenuator specified shall be compatible and be able to apply for TOT standard equipments and shall be designed to reduce or balance the power in TOT network. The primary design consideration of the attenuator shall operate within its range to ensure proper performance and to maximize the life of TOT optical receiver devices.

Abbreviation ; FC/UPC : Fiber connector /Ultra polished Physical Contact



FC

SC/UPC : Subscription channel connector / Ultra polished Physical Contact.



SC

LC/UPC : Lucent connector /Ultra polished Physical Contact.



LC

Full details of this following information shall be provided in technical bidding proposal by bidder, Failure in this section (1.4) the proposal shall be

disqualified.

- Product specification issued by manufacturer.
- The material used and grade (or composite material) in detail for all components of product proposed.
- Test method and test data of all requirements of sections 2, 3 and 4 according to this specification.

2. General Requirements

Each attenuator types of the specified attenuator shall have the attenuation value of 1, 2, 3, 4, 5, 10, 15 and 20 dB according to Table 2.

The dimensions of each attenuator types shall be able to be equipped or installed in TOT equipments without any deformation, crack, scratch, flaw, stain, looseness and burr.

The attenuator specified in this specification shall not have any problems occurred or disturb TOT systems after installation.

This attenuator in this specification shall have 2 dust caps provided on both ends. The attenuator shall be able to use with a standard fiber which specified in ITU-T recommendation G.652.D, TOT specification OES-004-030-XX (latest issue) Single Mode Optical Fiber Cable.

This attenuator shall be able to operate in range from 1285 nm-1625 nm standard wavelengths. The attenuator required as this specification shall be in accordance with Fig. 2 to 4.

3. Material Requirements

Materials

Metallic materials

All metallic parts of attenuator shall be resistant to the corrosive influences they may encounter in normal use. No signs of corrosion shall be visible after 7 days exposure to non-acidic salt fog spray (5% NaCl, 35° C) according to IEC 61300-2-26. If stainless steel used, it shall be made of 300 series stainless steel or better corrosion resistance material. The metallic part of galvanized steel or other steel materials that have corrosion resistance property lower than 300 series stainless steel are not allowable.

Plastic materials

All plastic parts of attenuator shall be made of flame retardant material with flammability rating of V-0 according to UL 94 standard.

4. Performance Requirements

The proposed attenuator shall meet the requirements in the table below.

Attenuation Value	Attenuation Tolerance (AT)	Return Loss (RL)	References
1 dB	± 0.75 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
2 dB	± 0.75 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
3 dB	± 0.75 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
4 dB	± 0.75 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
5 dB	± 0.75 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
10 dB	± 1.50 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
15 dB	± 2.25 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1
20 dB	± 3.00 dB	≥ 50 dB	AT : IEC 61300-3-5 RL : IEC 61300-3-6 Method 1

Polarization Dependent Loss

Polarization Dependent Loss, $PDL \leq 0.5$ dB by using a fiber coupled polarization controller (PC) per Figure 1 according to GR-910 CORE.

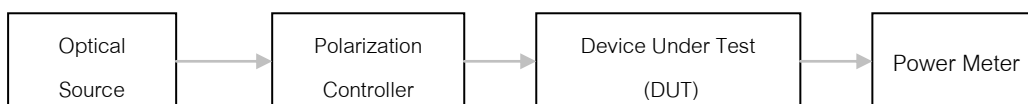


Figure 1 An example of PDL Configuration

Maximum optical input power of the attenuator shall be 250 mW.

5. Mechanical and Environmental Requirements

The propose attenuator in this specification shall be in accordance with Table 1 below which all tests in Table 1 Shall be run in sequence and meet the following references. Unless otherwise specified, the measurement of the change in attenuation and return (RL) shall be measured at 1310 ± 10 nm and 1550 ± 10 nm wavelengths.

Test item	Conditions	Requirements	References
5.1 Appearance	exam the product with the naked eyes	<ul style="list-style-type: none"> The attenuator shall be no deformation, crack, scratch, flaw, stain, looseness and burr. 	-
5.2 Endurance	Mating and Remating 500 times	<ul style="list-style-type: none"> Return loss (RL) ≥ 50 dB Change in Attenuation ≤ 0.5 dB for 1, 2, 3, 4, 5 dB Attenuator ≤ 1.0 dB for 10 dB Attenuator ≤ 1.5 dB for 15 dB Attenuator ≤ 2.0 dB for 20 dB Attenuator This attenuator shall comply with item 5.1 after this test. 	Endurance : IEC 61200-2-2 RL : IEC 61300-3-6 Method 1 Change in Attenuation : IEC 61300-3-3
5.3 Strength of coupling mechanism	Force : 40 N Rate : 0-full load in 15 sec Point of application : 300 mm Duration : 1 minute	<ul style="list-style-type: none"> Return loss (RL) ≥ 50 dB Change in Attenuation ≤ 0.5 dB for 1, 2, 3, 4, 5 dB Attenuator ≤ 1.0 dB for 10 dB Attenuator ≤ 1.5 dB for 15 dB Attenuator ≤ 2.0 dB for 20 dB Attenuator This attenuator shall comply with item 5.1 after this test. 	Strength of coupling mechanism : IEC 61300-2-6 RL : IEC 61300-3-6 Method 1 Change in Attenuation : IEC 61300-3-3

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Test item	Conditions	Requirements	References
5.4 Vibration	Sweep range : 10-500 Hz at 1 octave/minute Crossover frequency: 41 Hz - below 41 Hz Amplitude 0.75 mm - above 41 Hz : 50 m/s ² (~5g) Axes : 3 mutually perpendicular Duration : 10 cycles/axis	<ul style="list-style-type: none"> ● Return loss (RL) ≥ 50 dB ● Change in Attenuation ≤ 0.5 dB for 1, 2, 3, 4, 5 dB Attenuator ≤ 1.0 dB for 10 dB Attenuator ≤ 1.5 dB for 15 dB Attenuator ≤ 2.0 dB for 20 dB Attenuator ● This attenuator shall comply with item 5.1 after this test. 	Vibration: IEC 61300-2-1 RL : IEC 61300-3-6 Method 1 Change in Attenuation : IEC 61300-3-3
5.5 Temperature cycling with condensation (Z/AD)	Precondition: 24 hrs at 55° C and max 20% RH Cycle A: Lowest temperature: (+25±2) °C Highest temperature: (+65±2) °C Relative humidity: (93±3)% RH Duration time: 24 hrs Cycle B: Lowest temperature: (+10±2) °C Highest temperature: (+65±2) °C Relative humidity: (93±3)% RH Duration time: 24 hrs Total cycles : 10 cycles, alternating cycle B and A	<ul style="list-style-type: none"> ● Return loss (RL) ≥ 50 dB ● Change in Attenuation ≤ 0.5 dB for 1, 2, 3, 4, 5 dB Attenuator ≤ 1.0 dB for 10 dB Attenuator ≤ 1.5 dB for 15 dB Attenuator ≤ 2.0 dB for 20 dB Attenuator ● This attenuator shall comply with item 5.1 after this test. 	Temperature cycling with condensation (Z/AD) : IEC 61300-2-1 RL : IEC 61300-3-6 Method 1 Change in Attenuation : IEC 61300-3-3

Table 1 The attenuator mechanical and environmental requirements

6. Marking

The attenuator shall be marked on the body with manufacturer's name or trademark.

The attenuator identification marking shall be permanently identified as the followings:

- Manufacturer name or trade mark
- Date month and year (C.E) of attenuator manufacture or finished product manufacture.
- Type of attenuator, attenuation value. such as SC/UPC 2 dB, etc.

7. Packing and ordering information

The attenuator shall be packed securely in a box or equivalent which adequate protection. The package shall be labeled to show the description, TOT Code, contract number, batch number and name of supplier. The ordering information shall be as following in Table 2 below.

TOT CODE	Product Type	Packing
10059325	Attenuator FC/UPC 1 dB	10 Pcs./ Box
10059326	Attenuator FC/UPC 2 dB	10 Pcs./ Box
10059327	Attenuator FC/UPC 3 dB	10 Pcs./ Box
10059328	Attenuator FC/UPC 4 dB	10 Pcs./ Box
10059329	Attenuator FC/UPC 5 dB	10 Pcs./ Box
10059330	Attenuator FC/UPC 10 dB	10 Pcs./ Box
10059331	Attenuator FC/UPC 15 dB	10 Pcs./ Box
10059332	Attenuator FC/UPC 20dB	10 Pcs./ Box
10059333	Attenuator SC/UPC 1 dB	10 Pcs./ Box
10059334	Attenuator SC/UPC 2 dB	10 Pcs./ Box
10059335	Attenuator SC/UPC 3 dB	10 Pcs./ Box
10059336	Attenuator SC/UPC 4 dB	10 Pcs./ Box
10058659	Attenuator SC/UPC 5 dB	10 Pcs./ Box
10058660	Attenuator SC/UPC 10 dB	10 Pcs./ Box
10059337	Attenuator SC/UPC 15 dB	10 Pcs./ Box
10059338	Attenuator SC/UPC 20dB	10 Pcs./ Box

TOT CODE	Product Type	Packing
10059339	Attenuator LC/UPC 1 dB	10 Pcs./ Box
10059340	Attenuator LC/UPC 2 dB	10 Pcs./ Box
10059341	Attenuator LC/UPC 3 dB	10 Pcs./ Box
10059342	Attenuator LC/UPC 4 dB	10 Pcs./ Box
10058661	Attenuator LC/UPC 5 dB	10 Pcs./ Box
10058662	Attenuator LC/UPC 10 dB	10 Pcs./ Box
10059343	Attenuator LC/UPC 15 dB	10 Pcs./ Box
10059344	Attenuator LC/UPC 20dB	10 Pcs./ Box

Note : The other attenuation value of attenuator shall be specified on order.

Table 2 The ordering information

Figure 2 An example design of FC/UPC attenuator



Figure 3 An example design of SC/UPC attenuator

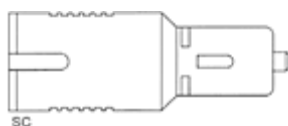


Figure 4 An example design of LC/UPC attenuator

