СТАНДАРТИЗАЦИЯ ТЕЛЕКОММУНИКАЦИОН-НОЙ ИНФРАСТРУКТУРИ

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2018

International Telecommunication Union

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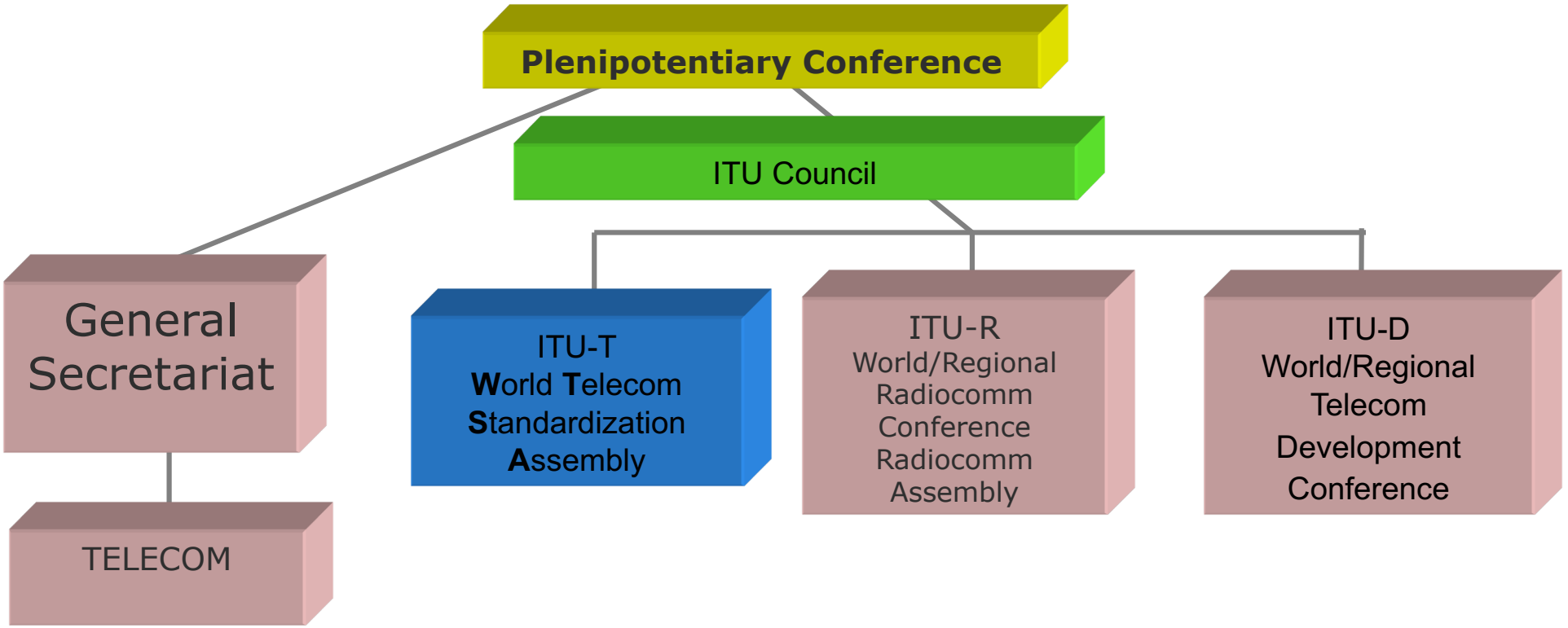
укртелеком

ITU Structure

Oldest UN specialized agency (founded in 1865)



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World Telecommunication Standardization Assembly - 16

The **World Telecommunication Standardization Assembly** is held every four years and defines the next period of study for ITU-T. WTSA-16 was held in Yasmine Hammamet, Tunisia, from **25 October to 3 November 2016** preceded by the Global Standards Symposium on **24 October 2016**

15-я Исследовательская комиссия МСЭ-Т

Сети, технологии и инфраструктура для транспортирования, доступа и жилищ

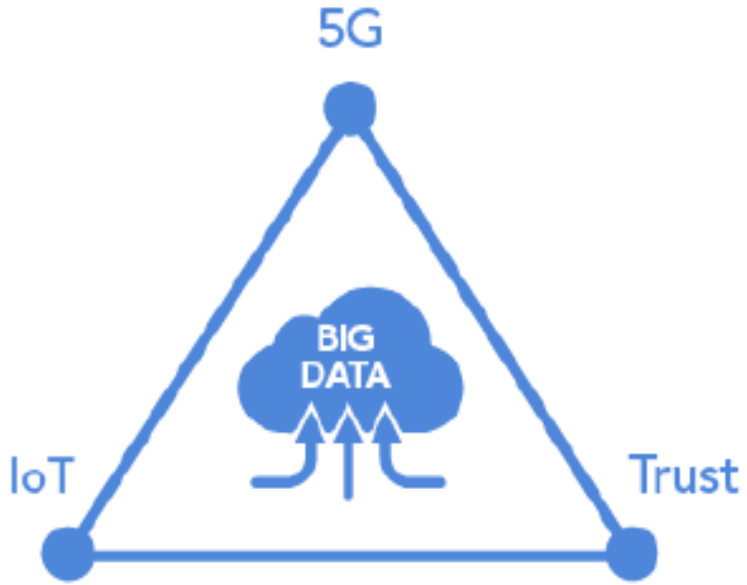
15-я Исследовательская комиссия МСЭ-Т отвечает в МСЭ-Т за разработку стандартов для инфраструктуры оптических транспортных сетей, сетей доступа, домашних сетей и сетей энергосистем общего пользования, систем, оборудования, оптических волокон и кабелей. Это включает связанные с ними прокладку, техническое обслуживание, управление, испытания, измерительное оборудование и методы измерений, а также технологии плоскости управления, позволяющие осуществлять развитие в направлении интеллектуальных транспортных сетей, включая поддержку приложений "умных" электросетей.

The future of our wireless networks depends on the future of our wireline networks

Setting the standard

2020 vision

- The future of standardization will be driven by 5G, IoT and Trust
- WTSA-16 will provide members with a standardization toolkit optimized to assist government and industry in achieving their ambitions for the year 2020 and beyond.



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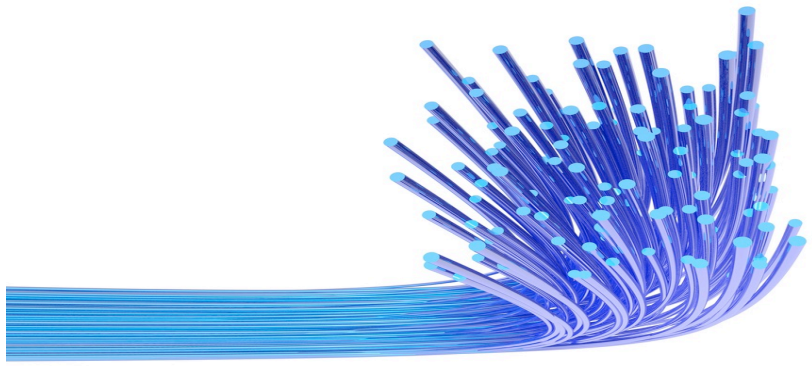
Setting the standard

95%

International traffic carried over fibre networks built using ITU standards

ITU-T continues to provide leadership in the standardization of networks, technologies and infrastructures for transport and access.



ИНТЕРЕС К ВОЛС ВОЗРАСТАЕТ НА ВСЕХ УРОВНЯХ

Cebit 2014: Die Datenkrake zähmen

Bundeskanzlerin Angela Merkel (CDU) und der britische Premierminister David Cameron (l) lassen sich am Stand der Telekom Glasfasern erklären.
Foto: dpa

Data analysis and research reports

ICT FACTS AND FIGURES 2017

Измерение информационного общества (издание за 2017 год)

Table 2.2: IDI rankings and values, 2017 and 2016

Economy	Rank 2017	IDI 2017	Rank 2016	IDI 2016
Iceland	1	8.98	2	8.78
Korea (Rep.)	2	8.85	1	8.80
Switzerland	3	8.74	4	8.66
Denmark	4	8.71	3	8.68
United Kingdom	5	8.65	5	8.53
Hong Kong, China	6	8.61	6	8.47
Netherlands	7	8.49	10	8.40
Norway	8	8.47	7	8.45
Luxembourg	9	8.47	9	8.40
Japan	10	8.43	11	8.32
Sweden	11	8.41	8	8.41
Germany	12	8.39	13	8.20
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jordan	70	6.00	66	5.97
Kuwait	71	5.98	70	5.75
Mauritius	72	5.88	75	5.51
Grenada	73	5.80	77	5.39
Georgia	74	5.79	73	5.59
Armenia	75	5.76	74	5.56
Antigua & Barbuda	76	5.71	76	5.48
Dominica	77	5.69	69	5.76
Thailand	78	5.67	79	5.31
Ukraine	79	5.62	78	5.31

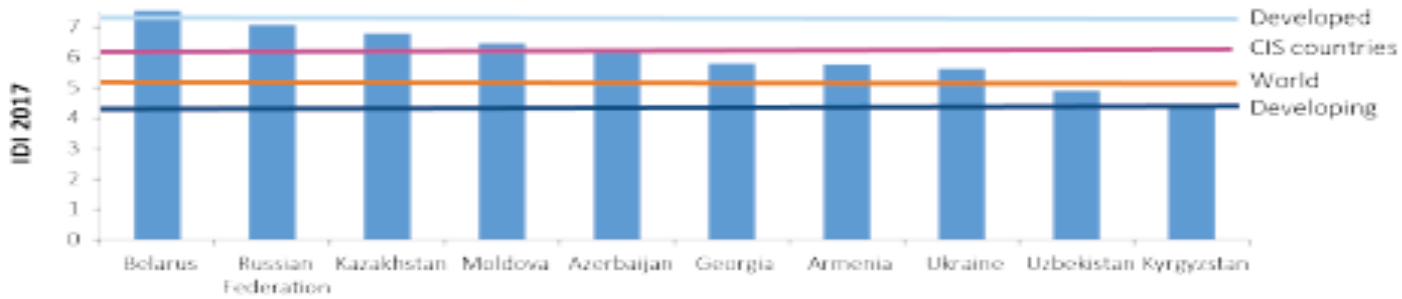
Измерение информационного общества (издание за 2017 год)

Regional IDI rank	Economy	IDI	Global IDI rank
Europe			
1	Iceland	8.98	1
2	Switzerland	8.74	3
3	Denmark	8.71	4
4	United Kingdom	8.65	5
5	Netherlands	8.49	7
36	Montenegro	6.44	61
37	Turkey	6.08	67
38	TFYR Macedonia	6.01	69
39	Bosnia and Herzegovina	5.39	83
40	Albania	5.14	89

CIS			
1	Belarus	7.55	32
2	Russian Federation	7.07	45
3	Kazakhstan	6.79	52
4	Moldova	6.45	59
5	Azerbaijan	6.20	65
6	Georgia	5.79	74
7	Armenia	5.76	75
8	Ukraine	5.62	79
9	Uzbekistan	4.90	95
10	Kyrgyzstan	4.37	109

Измерение информационного общества (издание за 2017 год)

Chart 3.9: IDI values, CIS region, IDI 2017



Note: Georgia exited CIS on 18 August 2009 but is included in the ITU BDT administrative region for the CIS countries.
Source: ITU.

Table 3.10: IDI rankings and values, CIS region, IDI 2017 and IDI 2016

Economy	Regional rank 2017	Global rank 2017	IDI 2017	Regional rank 2016	Global rank 2016	IDI 2016	Global rank change 2017-2016	Regional rank change 2017-2016
Belarus	1	32	7.55	1	32	7.29	0	0
Russian Federation	2	45	7.07	2	43	6.91	-2	0
Kazakhstan	3	52	6.79	3	51	6.72	-1	0
Moldova	4	59	6.45	5	63	6.21	4	1
Azerbaijan	5	65	6.20	4	60	6.25	-5	-1
Georgia	6	74	5.79	6	73	5.59	-1	0
Armenia	7	75	5.76	7	74	5.56	-1	0
Ukraine	8	79	5.62	8	78	5.31	-1	0
Uzbekistan	9	95	4.90	9	103	4.48	8	0
Kyrgyzstan	10	109	4.37	10	110	4.06	1	0
Average			**6.05**			**5.84**		

Note: Georgia exited CIS on 18 August 2009 but is included in the ITU BDT administrative region for the CIS countries.
Source: ITU.

Директива 2014/61/ЄС Європейського Парламенту та Ради від 15 травня 2014 року про заходи, спрямовані на зменшення витрат на розгортання високошвидкісних мереж електронного зв'язку

Визнаючи важливість розгортання високошвидкісної широкосмугової мережі, держави-члени підтримали амбітні цілі щодо широкосмугового зв'язку, визначені в Повідомленні Комісії під назвою "Цифровий порядок денний для Європи - Європейське зростання за допомогою цифрових технологій" ("Цифровий порядок денний"), а саме забезпечення послугами базового широкосмугового зв'язку всіх громадян Європейського Союзу до 2013 року, і забезпечення до 2020 року доступу для всіх європейців до високошвидкісного Інтернету, понад 30 Мбіт/с, а також більш ніж 50% домогосподарств Європейського Союзу доступом до Інтернету зі швидкістю, що перевищує 100 Мбіт/с.

Definition for broadband access

INTERNATIONAL
TELECOMMUNICATION UNION

TELECOMMUNICATION
STANDARDIZATION SECTOR

Standardization Committee for Vocabulary

SCV – LS 13 – E

English only

Original: English

Question(s): Geneva, 19 June 2017

LIAISON STATEMENT

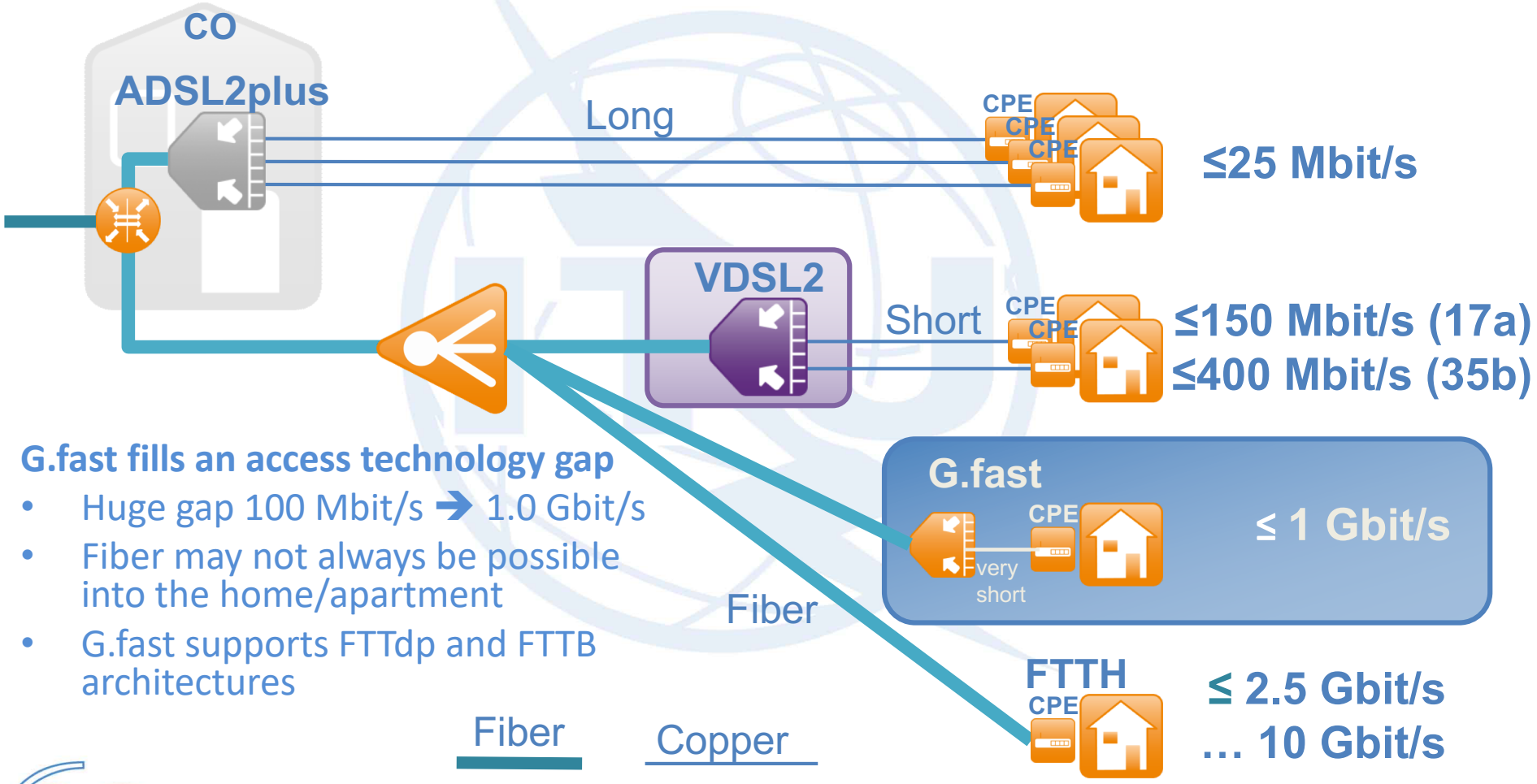
Source: Standardization Committee for Vocabulary (SCV)

Coordination Committee for Vocabulary (CCV)

As the result of a question raised by ITU-D SG1 on the definition for the term "broadband", and considering that the term is too general and is widely used within ITU with several meanings, making it inappropriate to try to provide a single specific definition adapted to all contexts, the SCV and CCV have considered instead the following definition for the term "broadband access", which is more specific and thus more appropriate for a definition:

broadband access: *Access in which the connection(s) capabilities support data rates greater than 2 Mbit/s.*

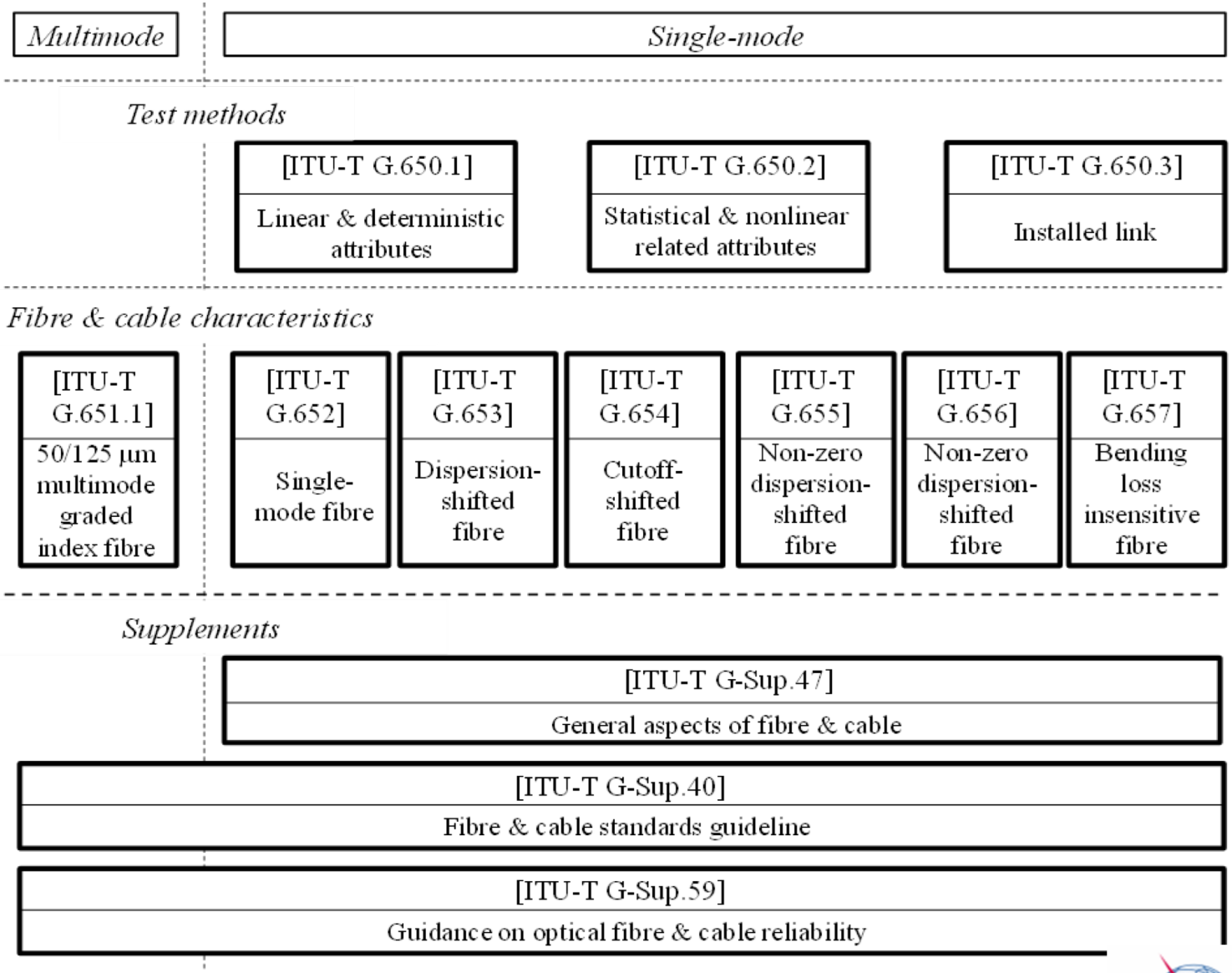
Overview Access Network Solutions



G.fast fills an access technology gap

- Huge gap 100 Mbit/s ➔ 1.0 Gbit/s
- Fiber may not always be possible into the home/apartment
- G.fast supports FTTdp and FTTB architectures

ITU-T G.65x-series Recommendations



Renumbering for new technical classification of ITU-T L-series Recommendations

Technical area		Assigned Questions			
	Sub-category	Q7/15	Q8/15	Q16/15	Q17/15
Optical fibre cables (e.g. L.100 – L.199)	Cable structure and characteristics (L.100 –L.124)			10, 26, 43, 58, 59, 60, 67, 78, 79, 87, L.dsa	
	Cable evaluation (L.125 –L.149)			14, 27	
	Guidance and installation technique (L.150 – L.199)			34, 35, 38, 46, 48, 49, 56, 57, 61, 77, 82, 83, 91 (ex L.coi), L.cci	
Optical infrastructures (e.g. L.200 – L.299)	Infrastructure including node element (except cables) (L.200 – L.249)			11, 13, 44, 50, 51, 70, L.oxcon, L.pneid	
	General aspects and network design (L.250 – L.299)			17, 39, 45, 47, 62, 63, 72, 73, 84, 86, 89, 90, 94	
Maintenance and operation (e.g. L.300 – L.399)	Optical fibre cable maintenance (L.300 – L.329)				25, 40, 41, 53, 66, 68, 85, 93, L.wdc
	Infrastructure maintenance (L.330 – L.349)				74, 88
	Operation support and infrastructure management (L.350 – L.379)				64, 69, 80
	Disaster management (L.380 – L.399)				81, 92, L.nrr-frm, L.dm-nrr-mdru
Passive optical devices (e.g. L.400 – L.429)		12, 31, 36, 37, L.fmc			
Marinized terrestrial cables (e.g. L.430 – L.449)			28, 29, 30, 54, 55		

Optical fibre cable structures

The following ITU-T Recommendations describe the optical fibre cable structures.

Recommendation ITU-T G.978, *Characteristics of optical fibre submarine cables.*

Recommendation ITU-T L.100/10, *Optical fibre cables for duct and tunnel application.*

Recommendation ITU-T L.102/26, *Optical fibre cables for aerial application.*

Recommendation ITU-T L.430/28, *External additional protection for marinized terrestrial cables*.

Recommendation ITU-T L.101/43, *Optical fibre cables for buried application.*

Recommendation ITU-T L.106/58, *Optical fibre cables: Special needs for access network.*

Recommendation ITU-T L.103, *Optical fibre cables for indoor applications.*

Recommendation ITU-T L.109/60, *Construction of optical/metallic hybrid cables.*

Recommendation ITU-T L.104/67, *Small count optical fibre cables for indoor applications.*

Recommendation ITU-T L.105/87, *Optical fibre cables for drop applications*.

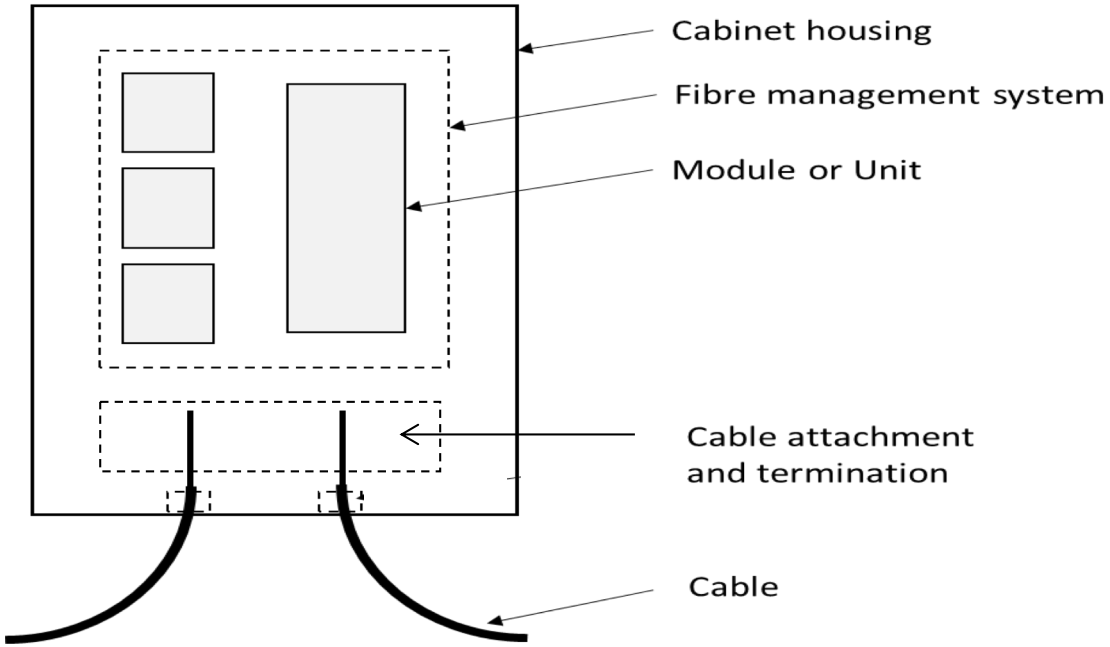
Status of single-mode optical fibre specifications in ITU-T and IEC

Optical fibre specification			
ITU-T		**IEC**	
Fibre category	**Recommendation**	**Fibre category**	**Document**
Single-mode optical fibre	[ITU-T G.652]	B-652(ex.B1.1 / ex.B1.3) single-mode fibre	[IEC 60793-2-50]
Dispersion-shifted single-mode optical fibre	[ITU-T G.653]	B-653 (ex. B2) single-mode fibre	
Cut-off shifted single-mode optical fibre	[ITU-T G.654]	B-654 (ex. B1.2) single-mode fibre	
Non-zero dispersion shifted single-mode optical fibre	[ITU-T G.655]	B-655 (ex. B4) single-mode fibre	
Non-zero dispersion shifted single-mode optical fibre for wideband optical transport	[ITU-T G.656]	B-656 (ex. B5) single-mode fibre	
Bending loss insensitive single-mode optical fibre	[ITU-T G.657]	B-657 (ex. B6) single-mode fibre	

NOTE – New fibre designations, e.g. "B-652", have been agreed at 2016 IEC SC86A meeting. Designation found in bracket "(ex. Bx.x)" corresponds to the description found in [IEC 60793-2-50] published in 2015th or before.

Направления стандартизации

- **L.404 Field mountable single-mode optical fibre connectors**
- **G.663 Application-related aspects of optical amplifier devices and subsystems**
- **G.672 Characteristics of multi-degree reconfigurable optical add/drop multiplexers**
- **L.206 Requirements for Passive Optical Nodes: Outdoor Optical Cross-Connect Cabinet**
- **L.110 Optical Fibre Cables for Direct Surface Application**
- **L.109 (L.60) Construction of optical/metallic hybrid cables**
- ***L.fdb Requirements for Passive Optical Nodes: Fiber Distribution Box***
- **G.650.3 Test methods for installed single-mode optical fibre cable links**



Направления стандартизации

Recommendations	N=new R=rev.	Title
G.650.1	R	Definitions and test methods for linear, deterministic attributes of single-mode fibre and cable
G.698.4 **(ex G.metro)**	N	Multichannel bi-directional DWDM applications with port agnostic single-channel optical interfaces
G.695	R	Optical interfaces for coarse wavelength division multiplexing (CWDM) applications
G.959.1	R	Optical transport networks physical layer interfaces
L.108 (ex L.79)	R	Optical fibre cable elements for microduct blowing-installation application
L.156 (ex L.57)	R	Air-assisted installation of optical fibre cable
L.207 (ex L.pneid)	N	Passive node elements with automated ID tag detection
L.315 (ex L.wdc)	N	Water detection in undergoptical monitoring systemround closures for the maintenance of optical fibre cable networks with

New Supplements to ITU-T G-series Recommendations

Supplement 41 Design guidelines for optical fibre submarine cable systems

Supplement 41 to ITU-T G-series Recommendations describes design considerations for repeatered, repeaterless and optically amplified systems supporting SDH and OTN signals in optical submarine cable systems.

Supplement 58 Optical transport network module framer interfaces

Supplement 58 to ITU-T G-series Recommendations describes several interoperable component-to-component multilane interfaces (across different vendors) to connect an optical module (with or without digital signal processor (DSP)) to a framer device in a vendor's equipment supporting 40G, 100G or beyond 100G optical transport network (OTN) interfaces.

Supplement 59 Guidance on optical fibre and cable reliability

Supplement 59 to ITU-T G-series Recommendations provides guidance regarding the long term reliability of cabled optical fibres. This Supplement uses currently accepted models combined with current experience to describe items that can impact the performance of an optical fibre over time. The document describes "optical reliability" for fibres, "mechanical reliability" for fibres and describes how optical cables impact these properties.

Supplement 59 to ITU-T G-series Recommendations
Guidance on optical fibre and cable reliability

Optical cables were first deployed commercially in 1977. Thus, our knowledge of their performance in the field is less than 40 years and much information provided in this Supplement is speculative, although today significant spontaneous fibre breakage in these old fibres is not known. Detailed analysis of attenuation characteristics and mechanical attributes for cabled fibre that have been installed for 25 years indicate that the optical properties are very stable over time. With this background we can use our accumulated field knowledge combined with accelerated aging to estimate the reliability of optical cables.

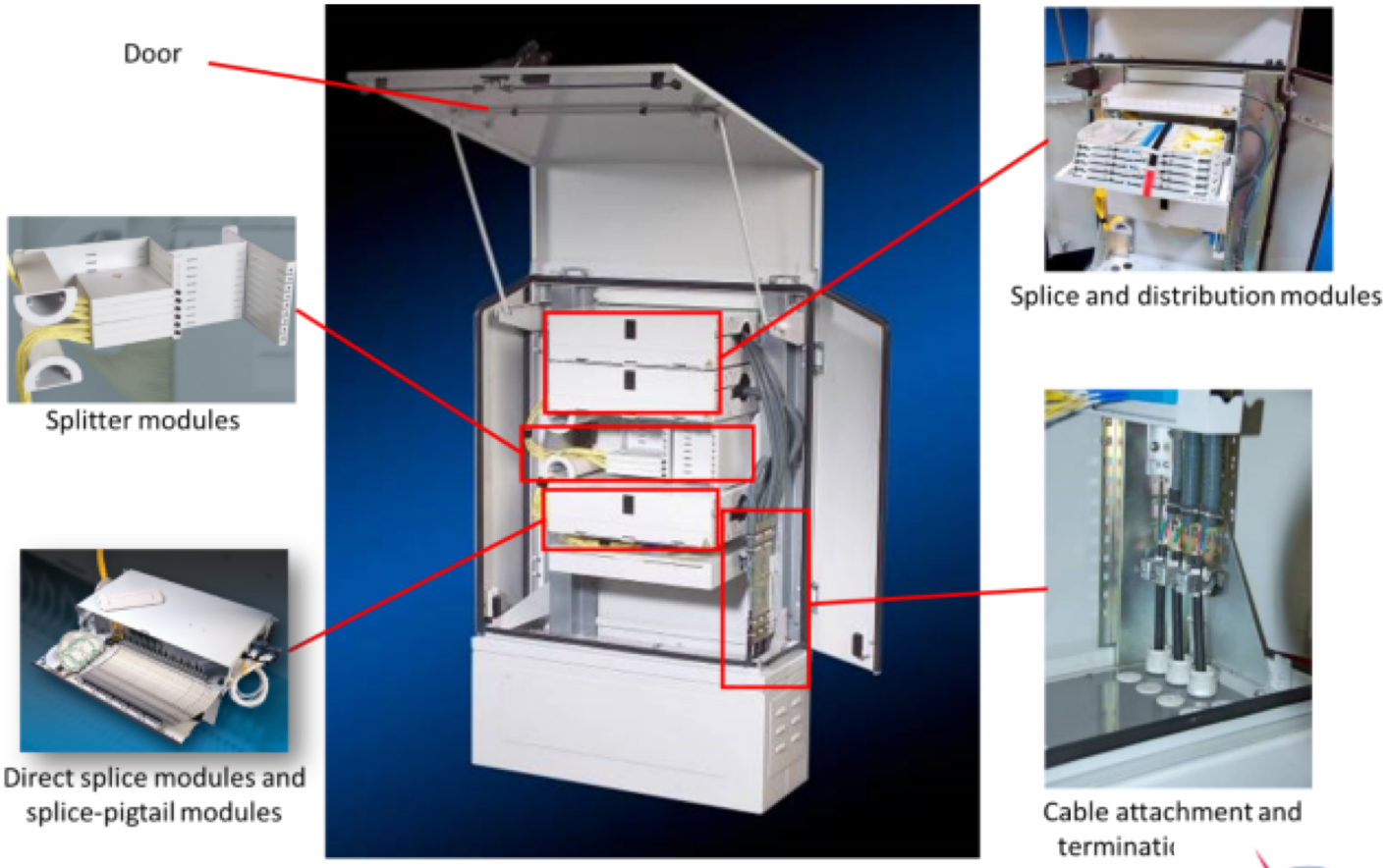
Reliability falls into two major categories:

- **Mechanical reliability (will the fibre break over the cable lifetime)**
- **Optical reliability (will optical transmission be maintained over the cable lifetime)**

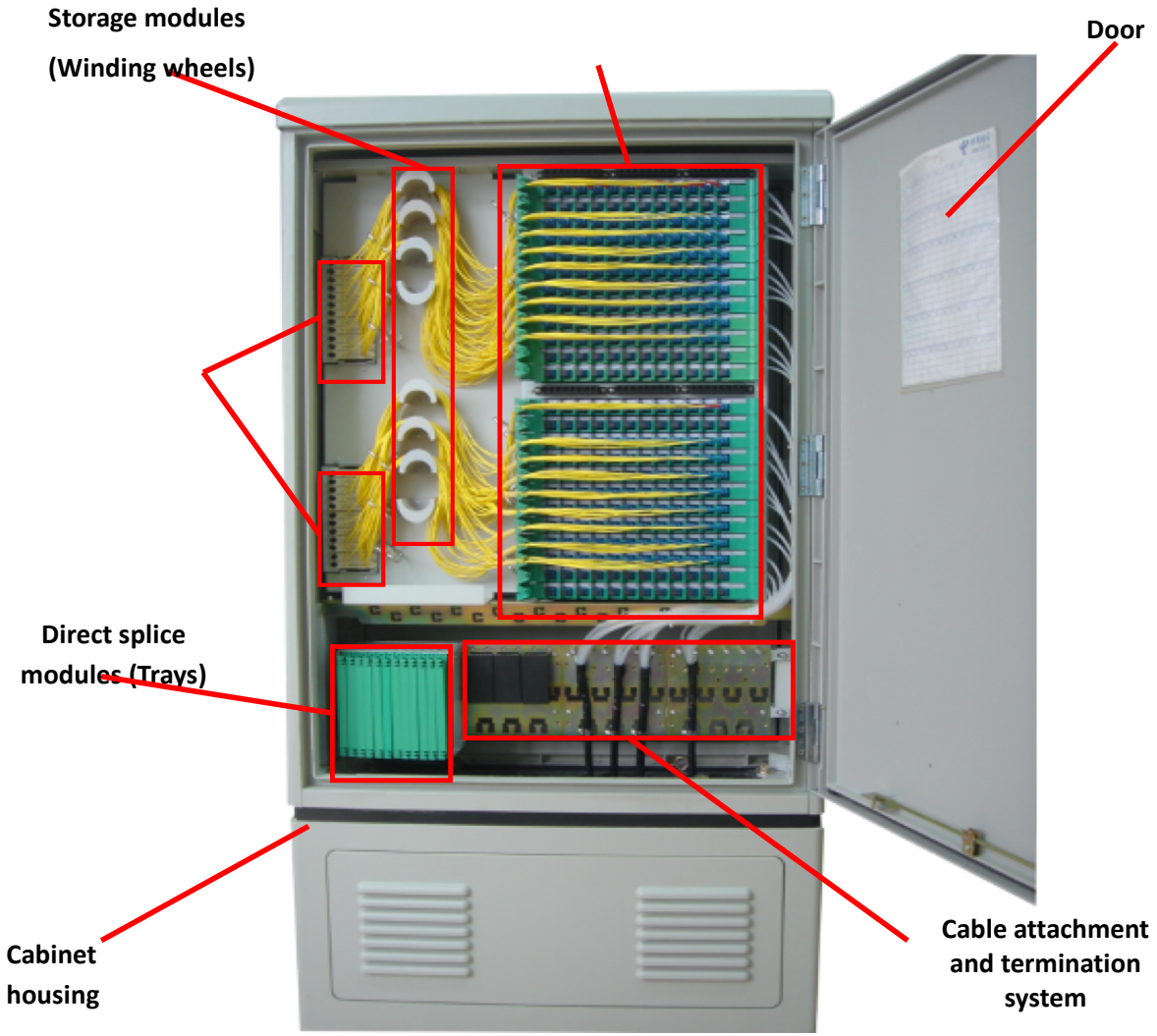
It is hard to separate optical fibre reliability from optical cable reliability as the two are intimately related, but in this Supplement we will focus primarily on the fibre attributes and how they relate to cabled optical fibre.

Outdoor Optical Cross-Connect Cabinet

optical cross-connect cabinet: The term "optical cross-connect cabinet" refers to a cabinet with an integrated fibre management system to protect the cross connections of optical fibre cables.



Outdoor Optical Cross-Connect Cabinet



Высокая загрузка смотровых устройств кабельной канализаци

L.404 Field mountable single-mode optical fibre connectors

patch cord: Optical fibre cable with connectors on both ends.

Figure – Patch cord

pigtail: Buffered or cabled fibre terminated with a connector on one end.

Figure – Pigtail

While no complete international standard is approved at this time, the general trend is to colour code the plastic body connectors to distinguish the PC type from the APC type independently of the attenuation and return loss performance.

The blue colour is used for the single-mode FMC (PC type).

The green colour is used for single-mode FMC (APC type).

As an alternative means, labels may be applied for connector type/class/grade identification, as it is independent on regional differences in colour code conventions. Especially for metallic body connectors, this may be a good alternative.

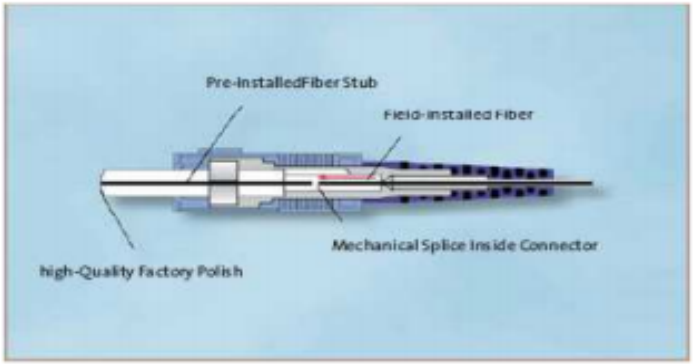
L.404 Field mountable single-mode optical fibre connectors

The operating temperature ranges in which the connector performance should be guaranteed are from –25°C to +70°C for outdoor applications ("Outdoor Protected environment ") and –10°C to +60°C for indoor applications ("Controlled environment").

Although an FMC can be installed on any kind of fibre, in this document the performance requirements for the single-mode FMC are stated for single-mode fibres, having a mode field diameter in the range from 8.2 µm to 9.6 µm at 1 310 nm.

Unless otherwise stated in the individual test details, all single mode measurements are done at room temperature and should be performed at 1 310 nm ± 30 nm, 1 550 nm ± 30 nm and 1 625 nm ± 25 nm.

Outside plant and related indoor installation



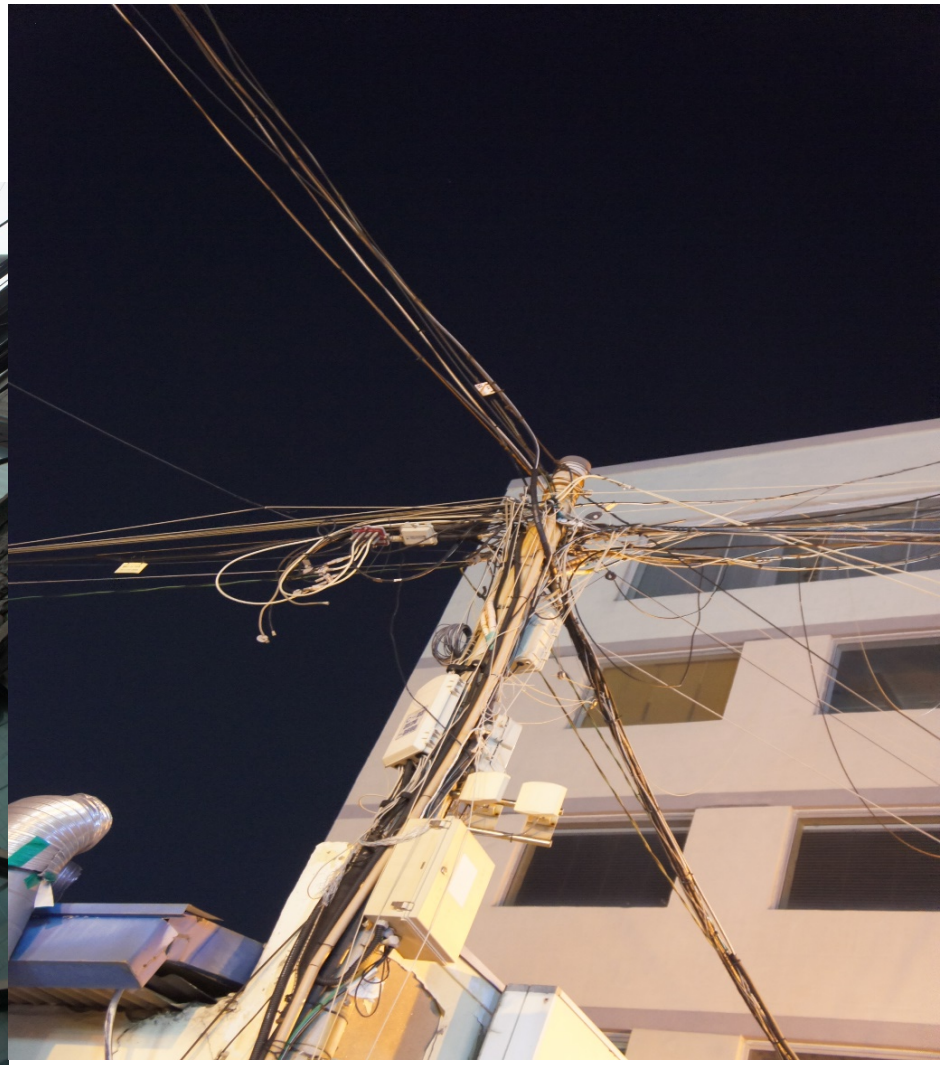
Need of new Recommendation on field mountable connector technologies

- Use of low environmental impact trenching machines

MINIATURIZED

Diameter 10/14 mm (inner/outer)

Outside plant and related indoor installation



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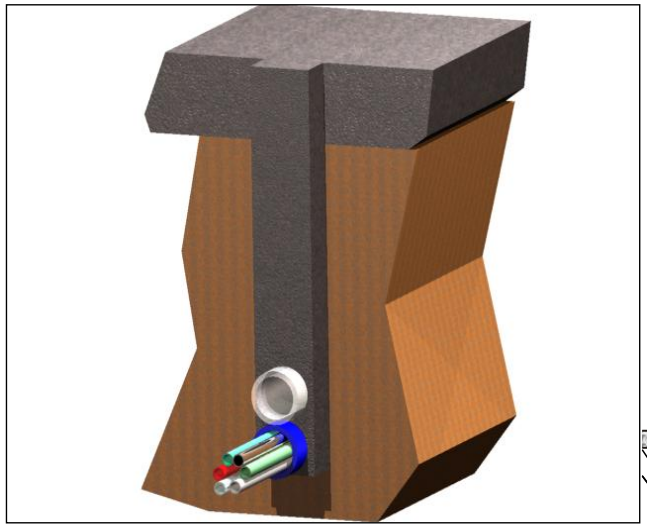
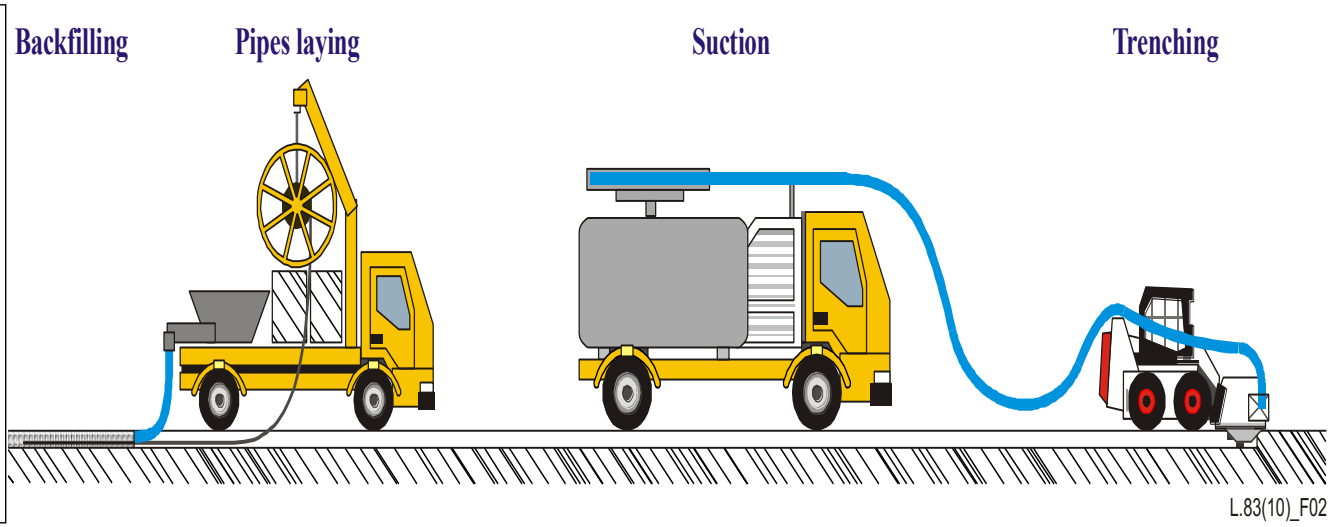
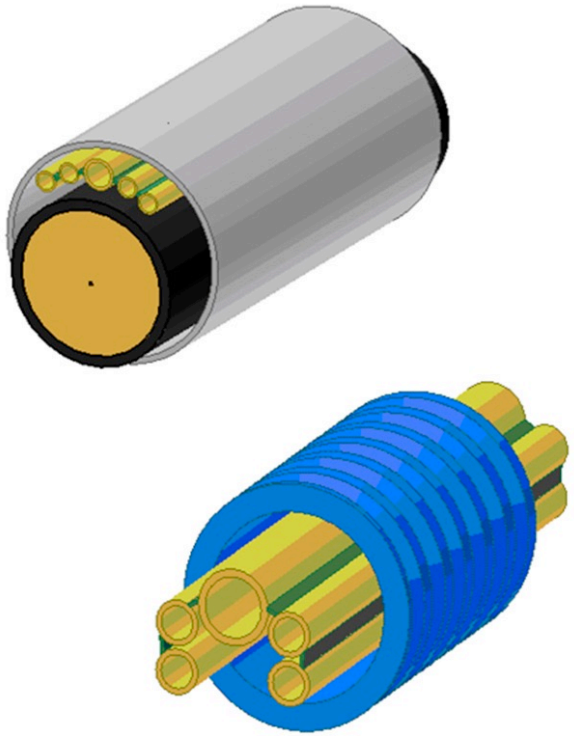
Новые рекомендации серии L





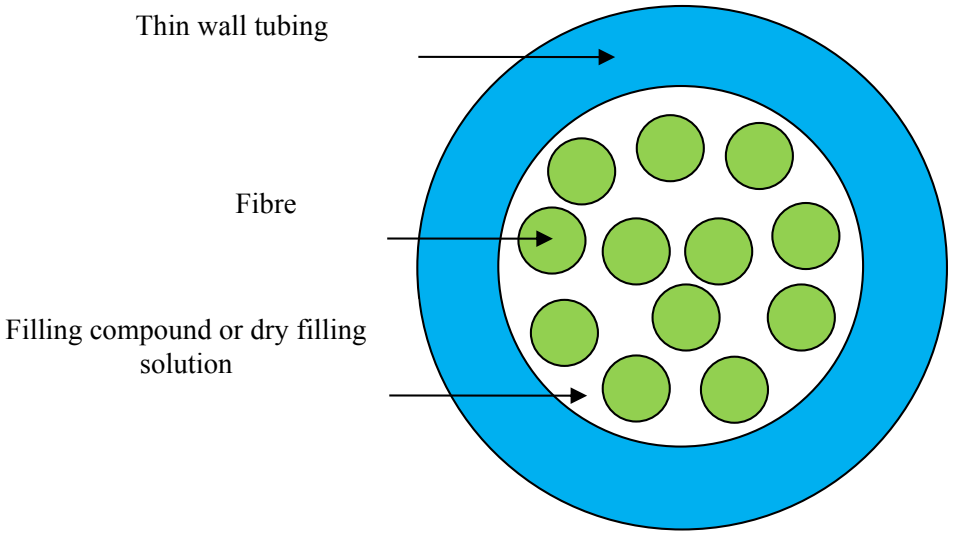
L.155 (ex L.83)Low-impact trenching technique for FTTx networks

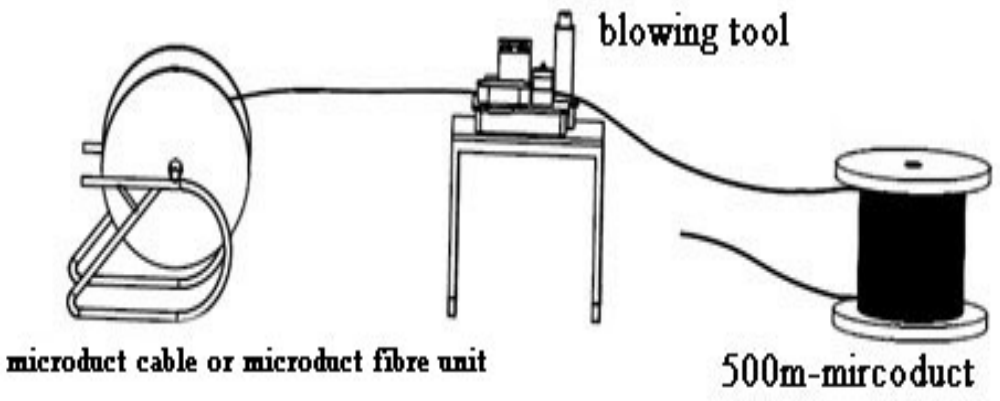
Новые рекомендации серии L



L.162 Microducts technology and its applications

L.108 Optical fibre cable elements for microduct blowing-installation application





L.108 Optical fibre cable elements for microduct blowing-installation application

Microduct cable

Microduct cables, often called microcables, may consist of fibres, groupings of fibres, strength members, water blocking materials, sheaths and other appropriate materials. Microduct cable construction and performance is described by [IEC 60794-5-10].

Microduct cables typically have fibre counts ranging from 4 to 288 or more, with a typical outside diameter of 1.5 mm to 10.0 mm or even larger diameters. The units within may consist of single fibres, fibre groupings such as tubes, micromodules or ribbons.

Microduct fibre unit

These units differ from microduct optical fibre cables in that they provide less protection to the fibres that they contain. Microduct fibre unit construction and performance is described by [IEC 60794-5-20].

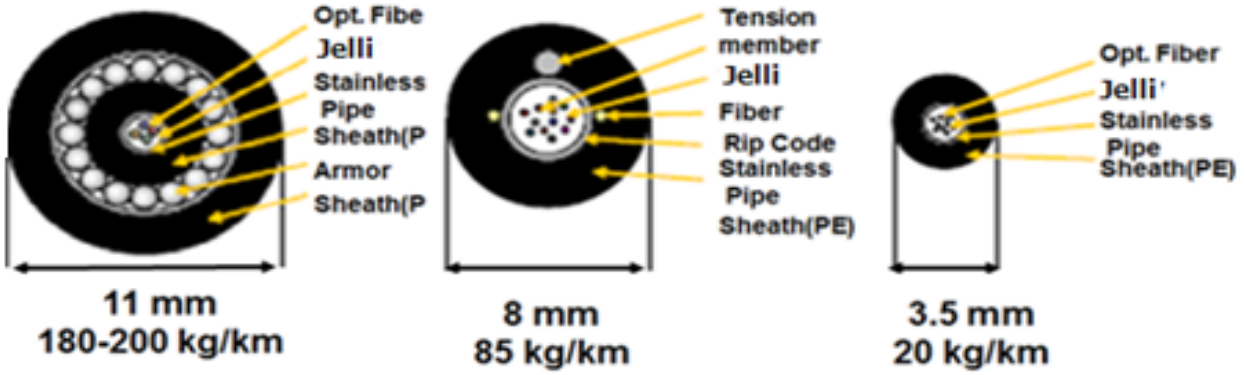
Microducts

The microducts should be able to resist the pressure differences needed during installation with a blowing technique. They should be circular and uniform in cross-section throughout their length and the inner surface should have a low friction coefficient either by the material used (silicone, etc.) or having profiled ribbing. The inner and outer diameters should be specified.

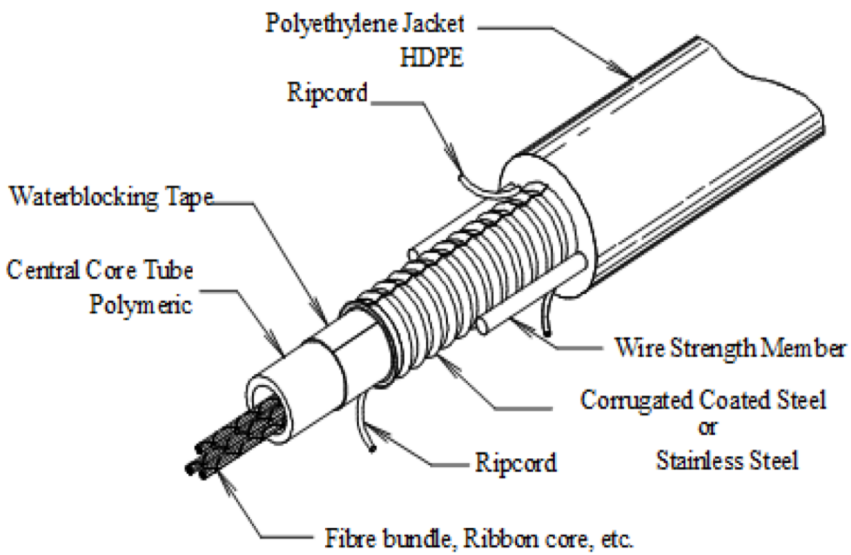
In all cases, it should be possible to identify each individual microduct throughout its length. Colour coding or marking are common methods for identification.

Microducts can also be put into the interstices of ducts containing other cables.

Optical Fibre Cables for Direct Surface Application



Optical Fibre Cables for Direct Surface Application



Опыт NTT

ОПЫТ УКРАИНЫ

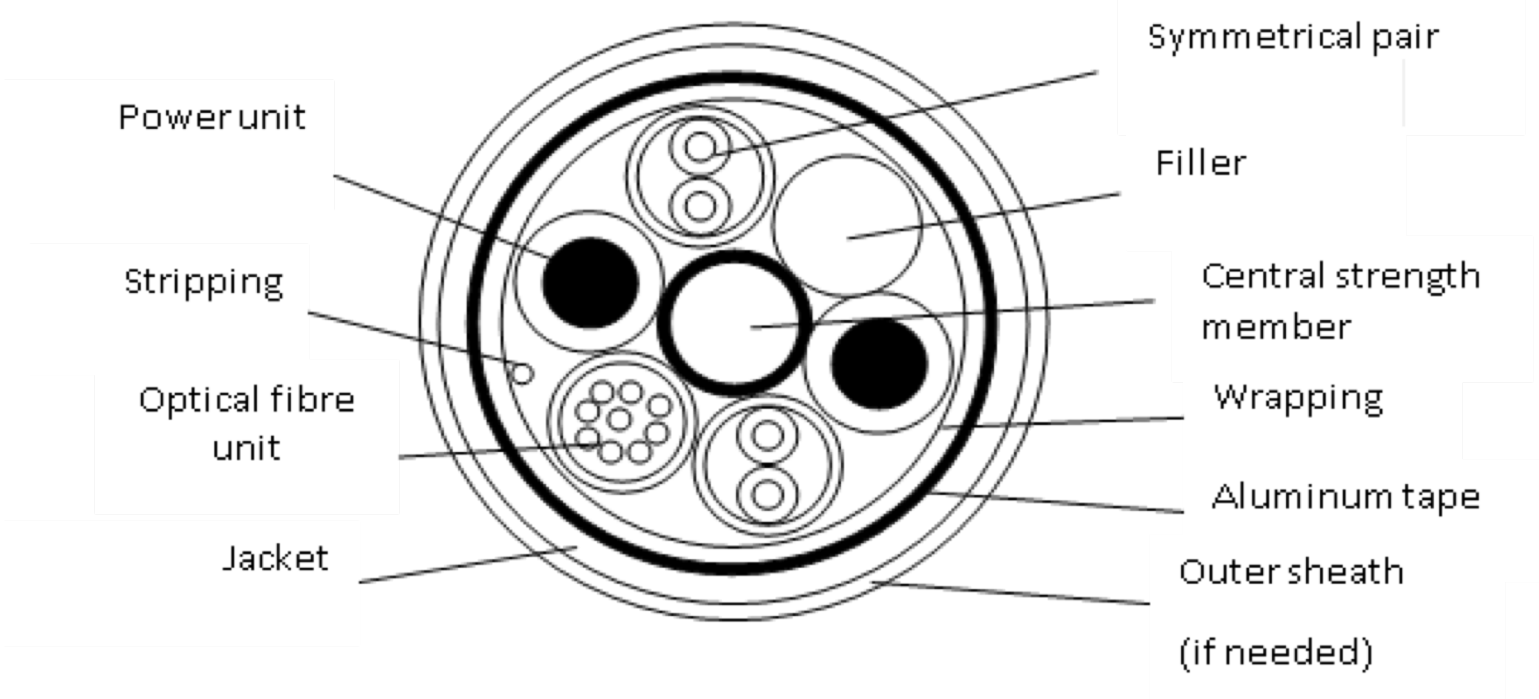
L.207 Passive node elements with automated ID tag detection

Scope

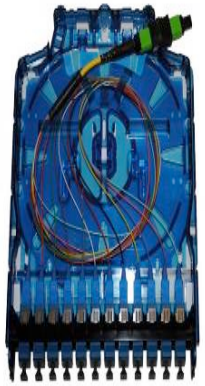
This Recommendation addresses the general features, characterization and performance requirements for passive node elements with ID tag detection which supports automatic information collection on fibre connectivity. This Recommendation focuses on both indoor and outside plant deployment conditions and includes the following:

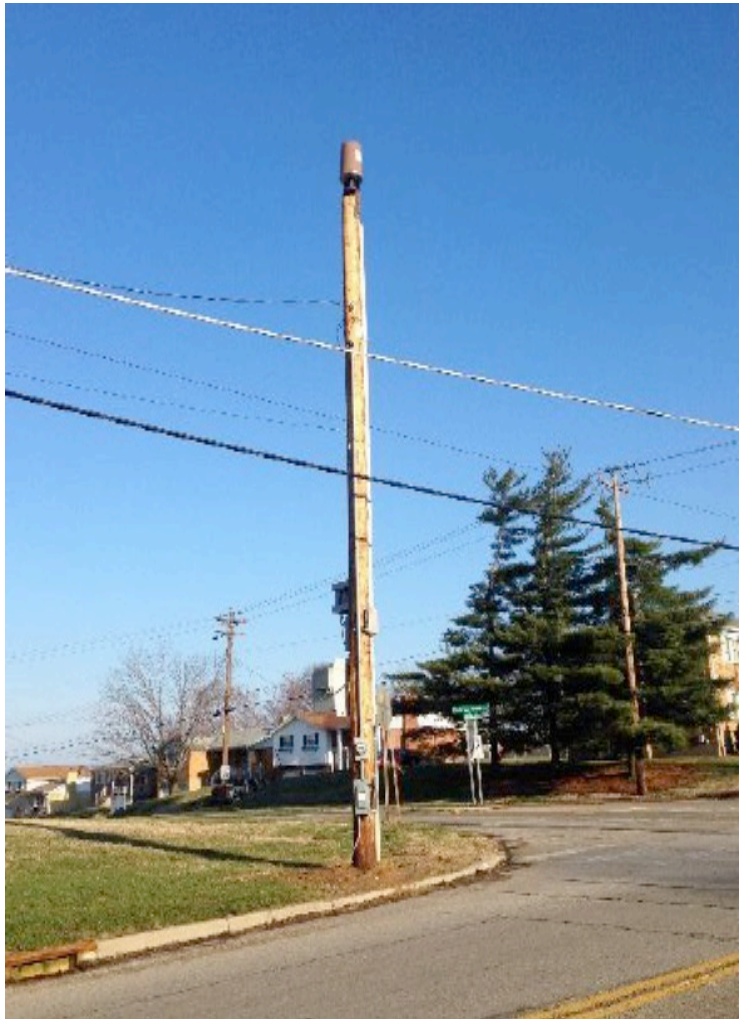
- Functional requirements
- Automated ID tag detection performance requirements
- Mechanical and electrical/optical interface requirements

Construction of optical/metallic hybrid cables



Modular Technology /Plug-N-Play / Fixed Wireless

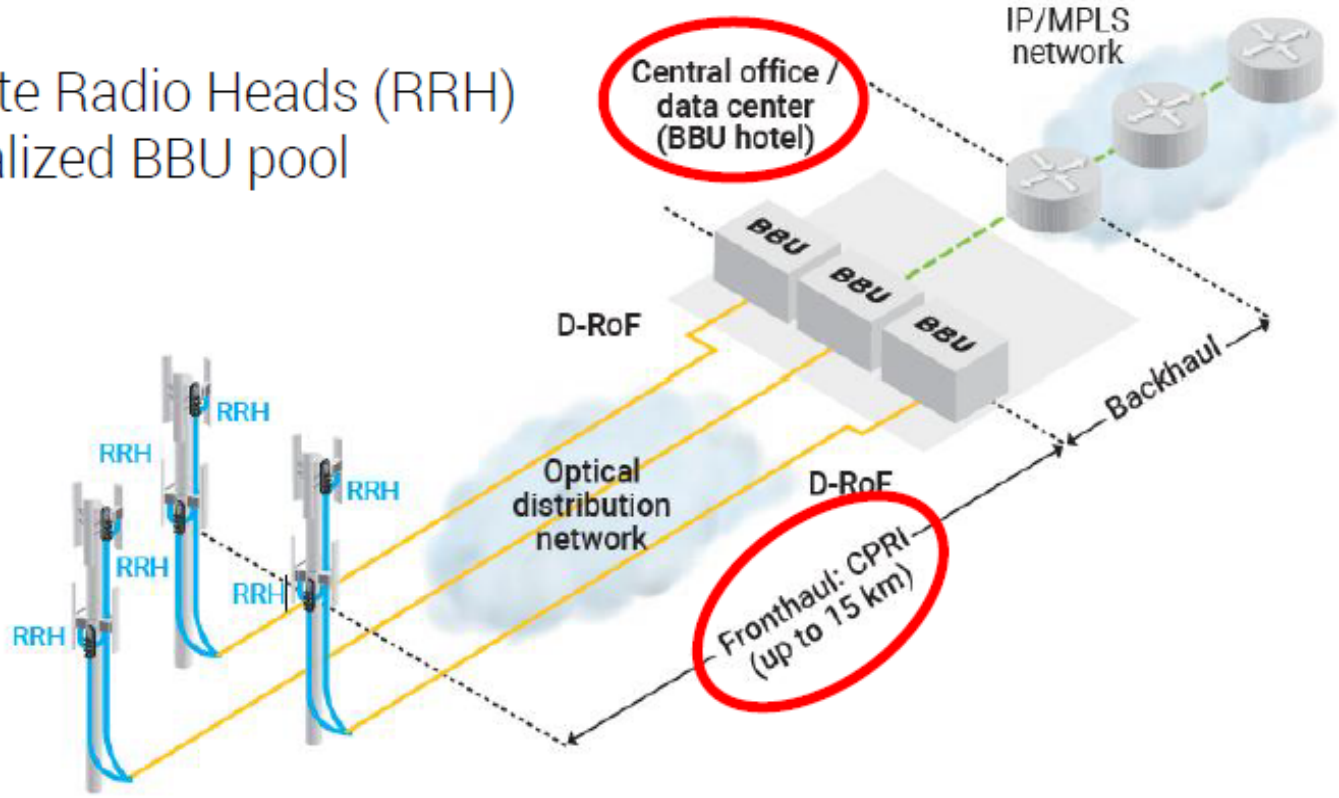


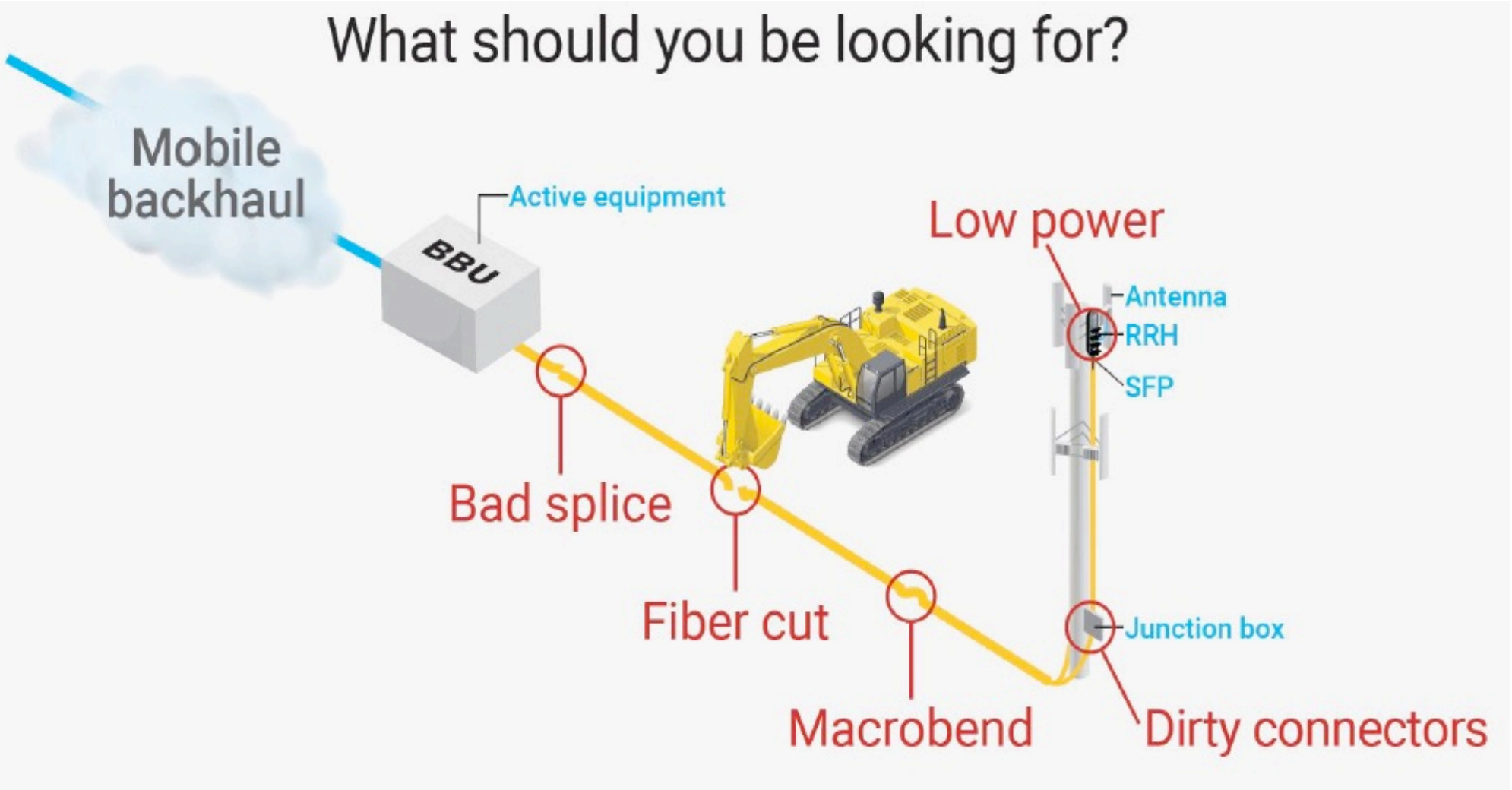


FTTA/C-RAN Overview

C-RAN : Centralized Radio Access Network

- Hundreds of Remote Radio Heads (RRH) connect to a centralized BBU pool
- Up to 15 km

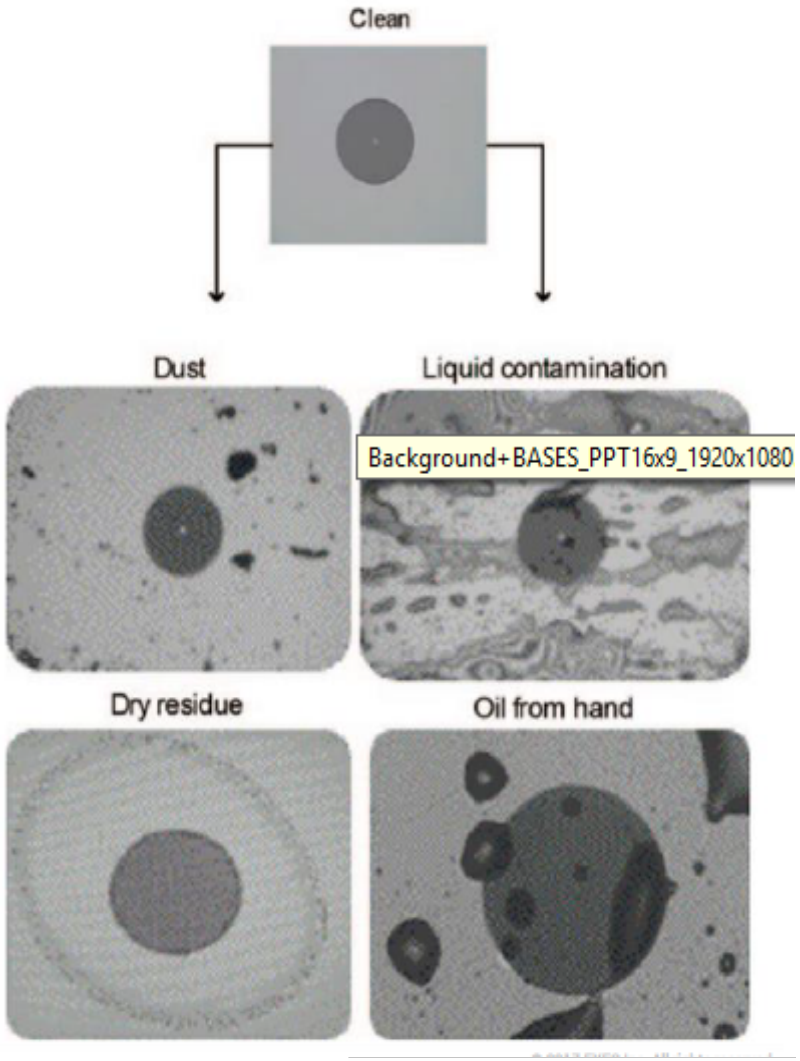




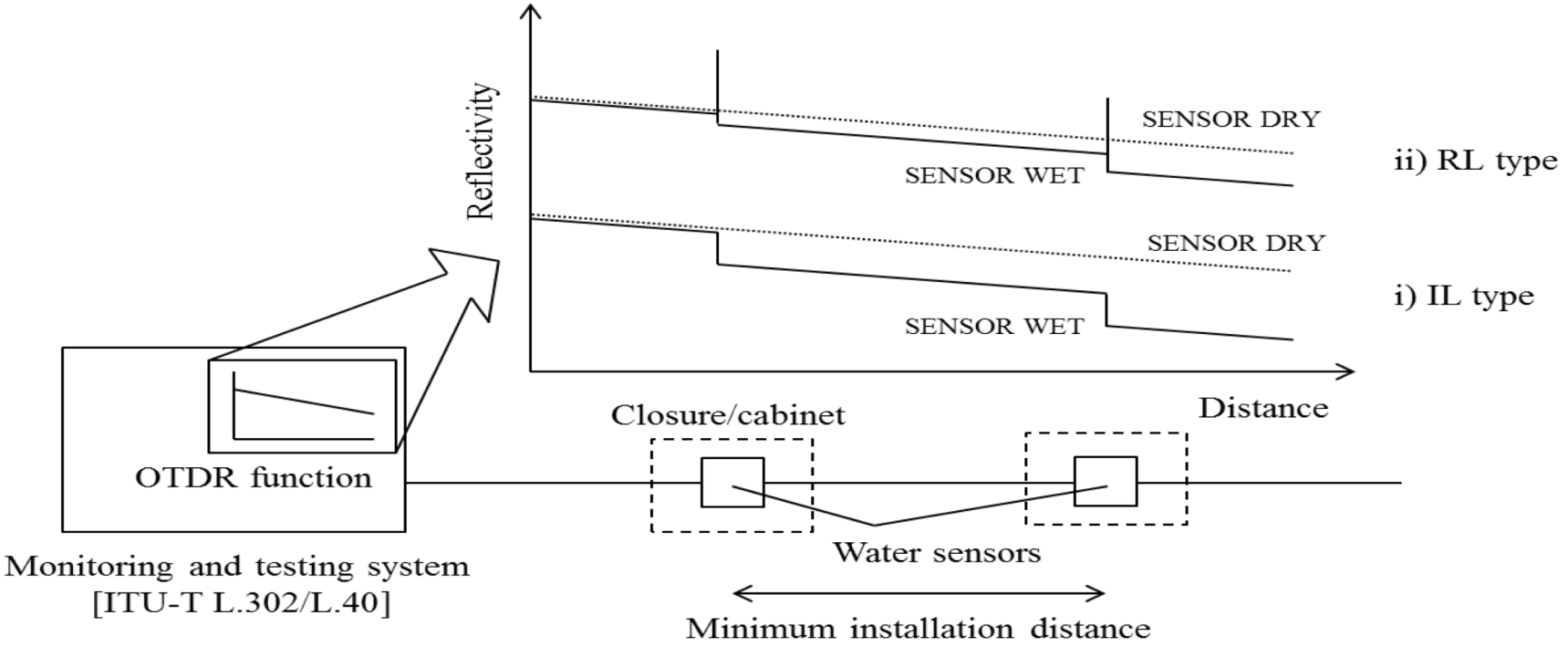
Загрязнения в оптических соединителях

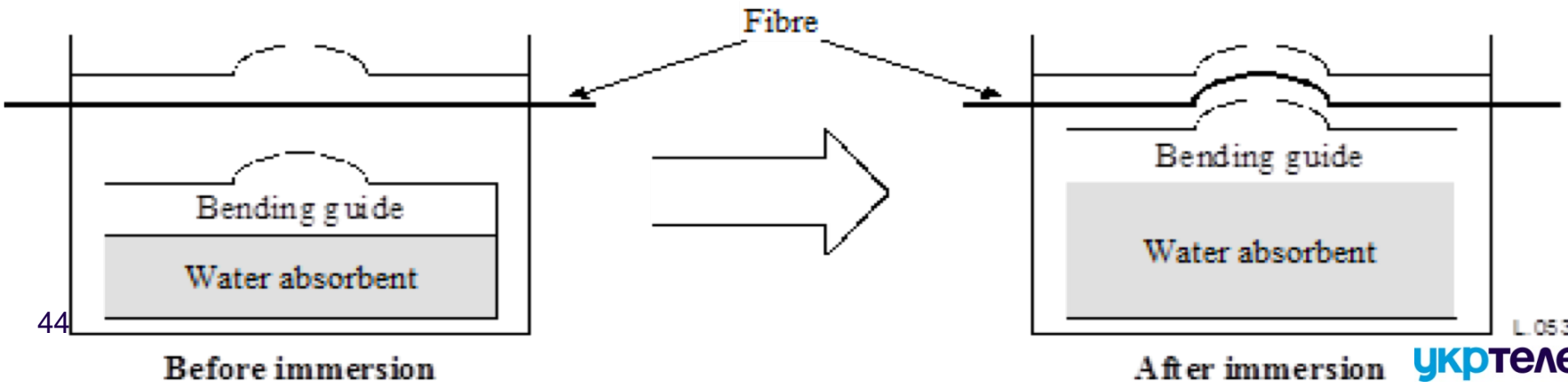
- One of the most common problem found in FTTA and C-RAN installations
- Create communication issues such as bit errors or even complete optical loss of signal
- Could require a repeat truck roll with a cell tower crew

- **Fiber Inspection probe should be used to inspect the fiber tip**
- **Power meter will help detect excess loss**
- **OTDR / iOLM will detect the exact location of issue**



L.315 Water detection in underground closures/cabinets for the maintenance of optical fibre cable networks





Functional requirements of water sensor

Type	IL	RL
Operational temperature (NOTE 1)	0 ° C to 60 ° C	
Threshold (NOTE 2)	≥ 2 dB	≥ 25 dB
Response time (NOTE 3)	≤ 24 hours	
Hold after detection (NOTE 4)	Latching	

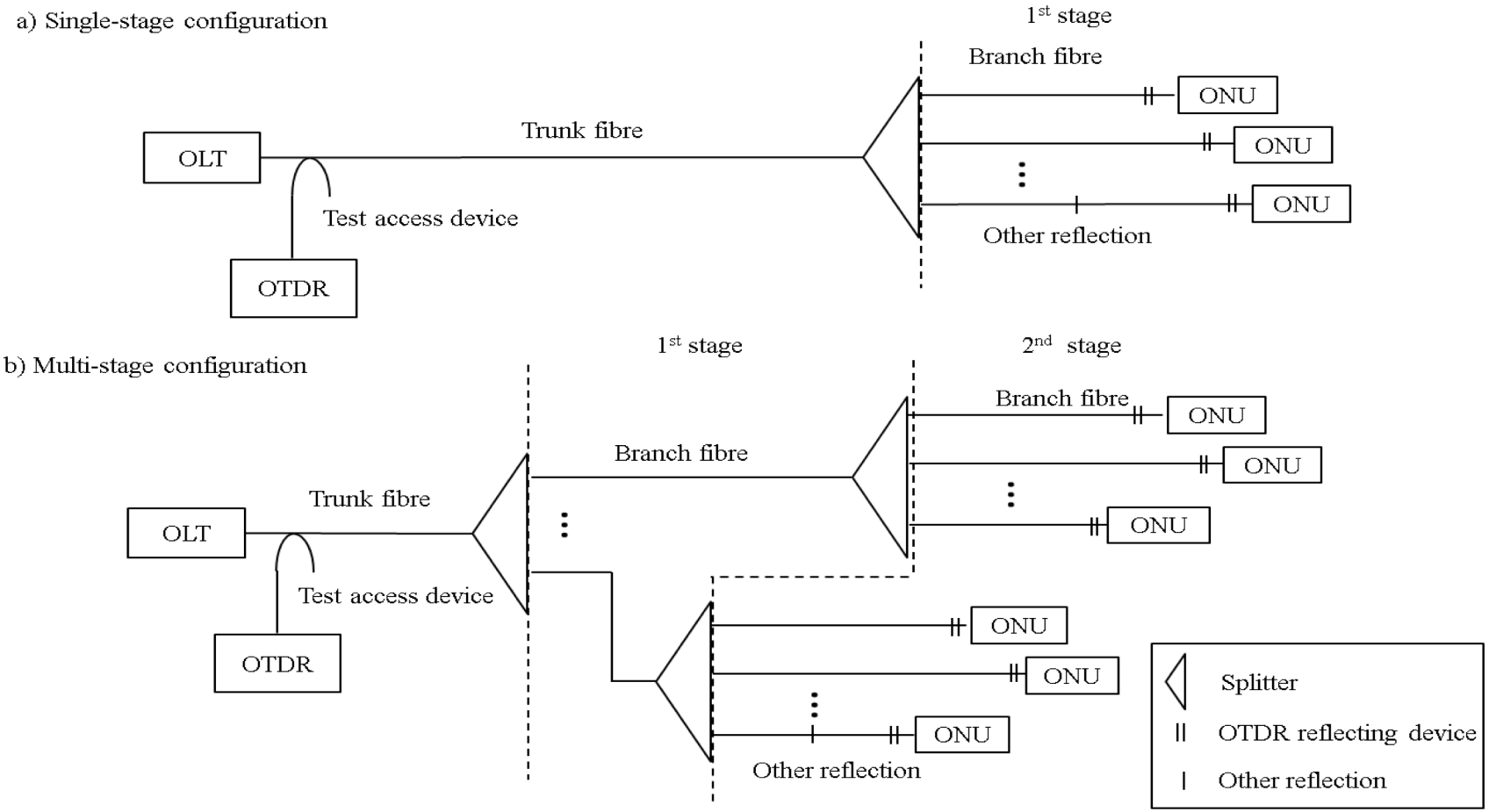
NOTE 1 – Water with contamination may not freeze exactly at 0 C. Lower operational temperature is possible.

NOTE 2 – For wavelengths of 1550 nm ± 20 nm.

NOTE 3 – Time taken to reach the threshold value after sufficient amount of water surrounds the sensor.

NOTE 4 – Function that maintains the state over thresholds after detection. The hold time should be determined by operator's maintenance policy.

Optical fibre maintenance criteria for access networks depending on topologies of access networks



Network configurations for in-service testing with OTDR reflecting devices

Новые направления стандартизации

Draft new Recommendation ITU-T L.osp

Optical fibre cables for general outdoor application in buried, duct, and lashed/connected aerial cable plant

Recommendation ITU-T L.osp coordinates with the cable ITU-T Recommendations L.100, L.101, and L.102. It defines a cable, which may be used in all of the application spaces of these Recommendations—general buried plant, underground plant in ducts, and aerial plant where the cable is lashed or connected to a messenger wire.

Draft new Recommendation ITU-T L.fdb

Requirements for passive optical nodes: Fibre distribution boxes

Recommendation ITU-T L.fdb refers to fibre distribution boxes (FDB) deployed as passive optical nodes in indoor or outdoor environments. It deals with the box housing, fibre management system, cable attachment and termination system, and specifies the mechanical and environmental characteristics as well.

Draft new Recommendation ITU-T L.oha

Optical fibre cables for in-home applications

This Recommendation aims to provide the requirements of optical fibre cables for in-home applications. Compared to requirements of optical fibre cables in tradition "indoor" applications, the requirements of cables in "in-home" applications have their own specialized characteristics. This new recommendation describes characteristics, cable construction and test methods of optical fibres and cables for in-home applications.

L.59 Optical fibre cables for indoor applications

5.2 Mechanical characteristics

5.2.1 Tensile strength

5.2.2 Bending

5.2.3 Crush

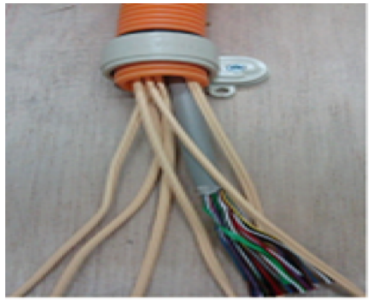
5.2.4 Bending under tension (flexing)

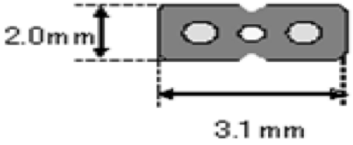
5.2.5 Torsion

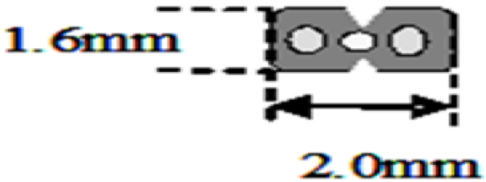
5.2.6 Impact

5.2.7 Kink

5.2.8 Repeated bending







Draft New Recommendation ITU-T L.oha «*Optical fibre cables for in-home applications*»

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Application Case I

- project in China

new Recommendation “Optical fibre cables for in-home directly wall surface applications”

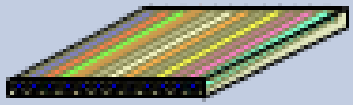
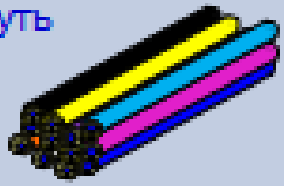
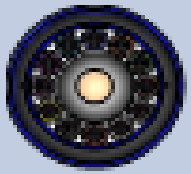
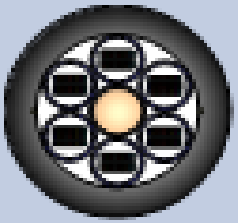
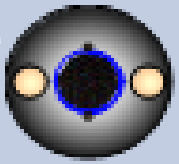
Application Case II

- project in China

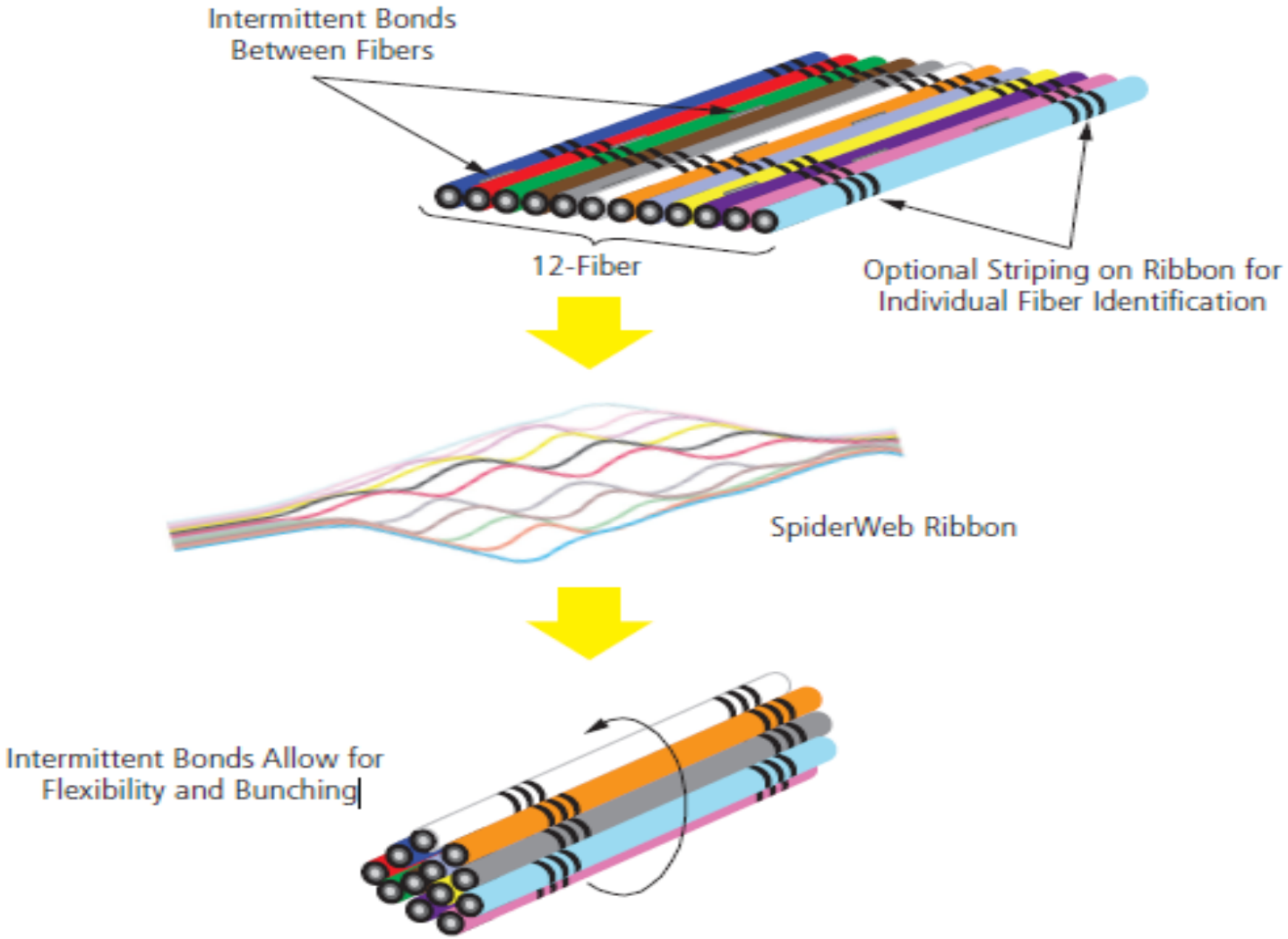
Новые типы кабелей

Spider Web Ribbon & Wrapping Tube Cables

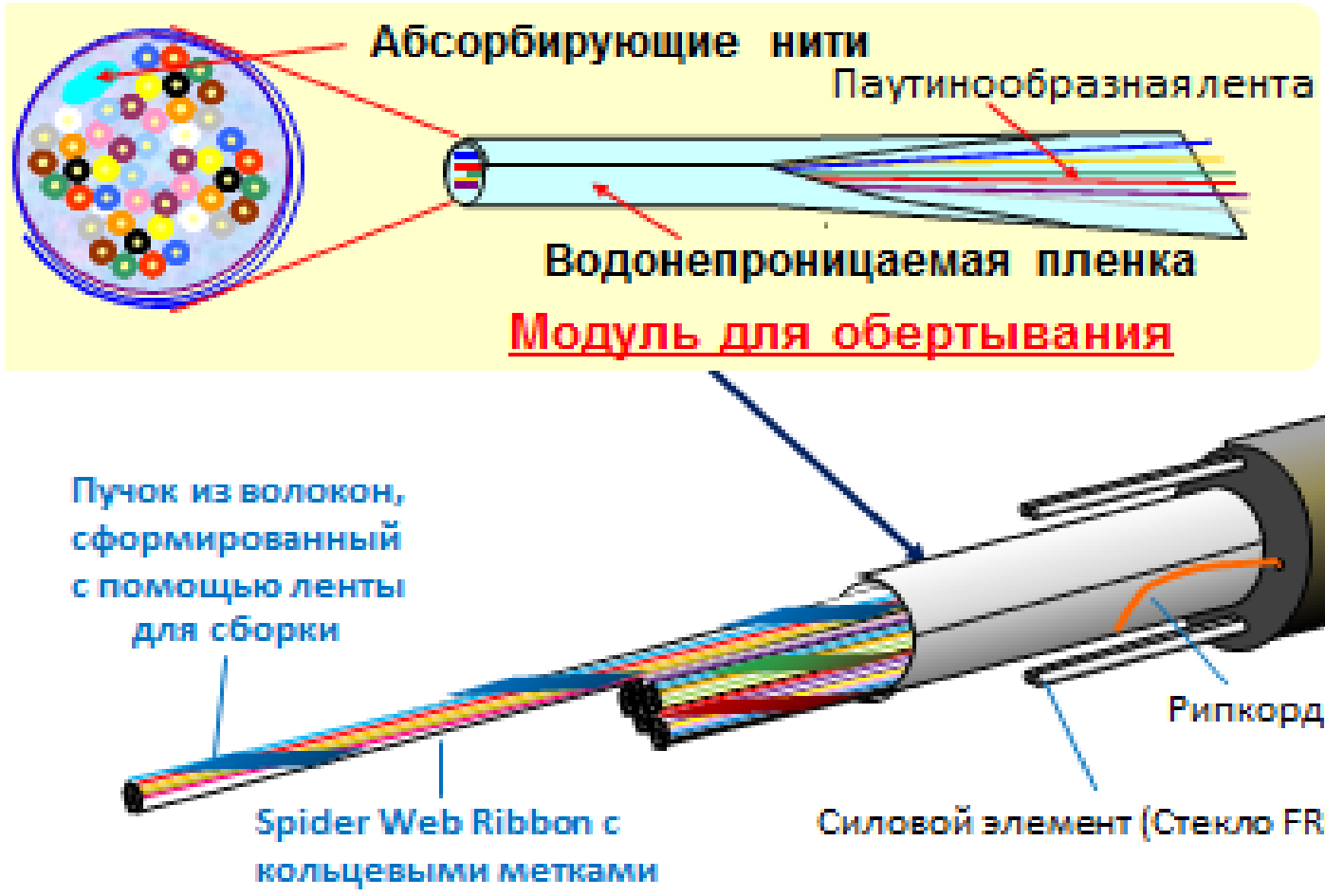
Мы объединили лучшее от кабелей со свободной укладкой и с ленточным волокном и добавили ещё привлекательных характеристик.

Кабель со свободной укладкой	Ленточные кабели	Кабель с паутинообразной лентой
Свободные одиночные волокна	Волокна в ленте	Паутинообразное волокно
Легко свернуть	Нельзя свернуть	Легко свернуть
		
Сложная многоволоконная сварка	Простая многоволоконная сварка	Простая многоволоконная сварка
		
Заполнен гидрофобом	Заполнен гидрофобом	Абсолютно сухой

SpiderWeb Ribbon Design and Functionality



Структура Wrapping Tube Cable



Buffer Tube High Density Cable: Traditional versus New

New 200µm Micro Cable versus Traditional Loose Tube

- Construction
  - ✓ Glass remains the same (125 microns)
  - ✓ Telcordia GR-20 and IEC 60794-5-10 compliant
  - ✓ Dry-blocked core made up of six buffer tubes SZ-stranded around central strength member
  - ✓ Kink-resistant gel-filled buffer tubes contain multiple 12-fiber sets of color-coded fibers.
  - ✓ Fibers are arranged in 12-fiber sets with each being identified by dual color-coded binder threads

288-F with 200µm SM
8.0mm (O.D.) in
10 mm (I.D.) micro-duct

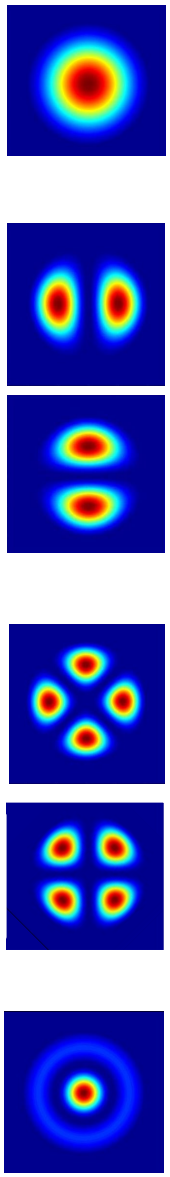
SDM: Transmission media

Degrees of freedom:

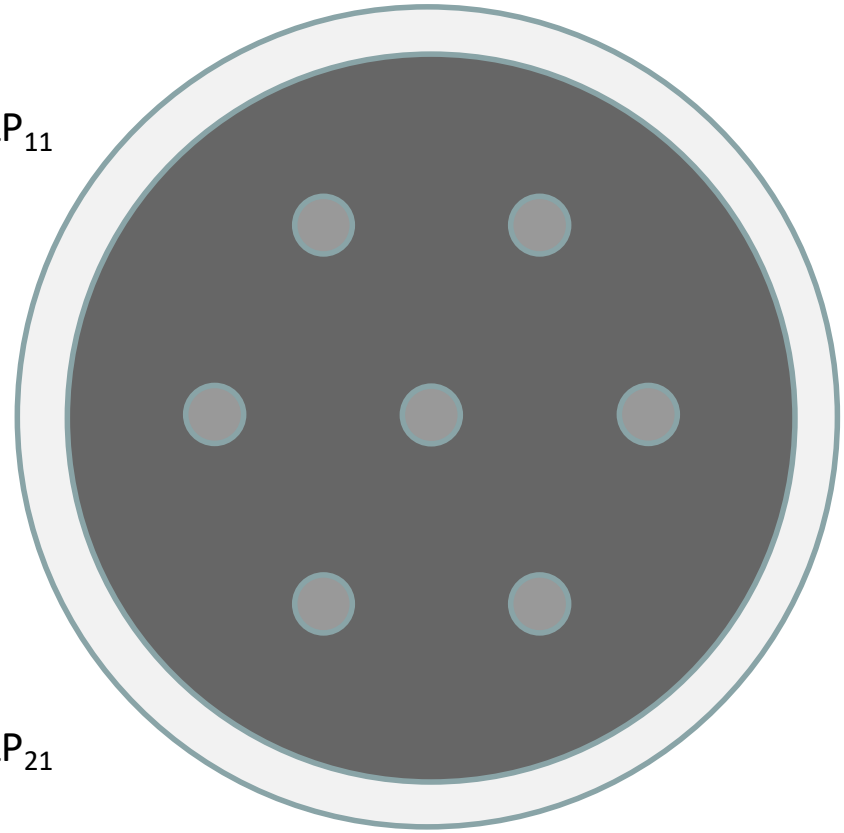
- Core count
- Mode count
- Cladding diameter
- Core layout
- Refractive-index profile
  - Graded-index
  - Step-index
  - Trench-assisted

Parameters affecting transmission performance:

- Inter-core crosstalk
- Inter-mode crosstalk
- Differential mode group delay (DMGD)
- Bend loss
- Nonlinearity
- Process variability



(C) Coupled spatial subgroups



FM-MCF

Благодарю за внимание!

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