Question 5/15 – Characteristics and test methods of optical fibres and cables, and installation guidance

(Continuation of Question 5/15)

1 Motivation

Optical fibre cables have been specified and deployed in telecommunication networks worldwide, finding wide application in access, intra/inter-office, metropolitan, long-haul, and submarine networks. New optical fibre technologies and new applications continue to drive the need for additional specifications. For example, the IoT, advanced mobile services, edge computing, cloud/distributed data management and so on requires new features and/or functions for optical fibre network. Moreover, increased transmission speeds and bandwidth requirements across the optical network supporting a variety of services requires a new class of optical fibre that can substantially expand the transmission capacity of a traditional single-mode fibre.

One important set of issues to be studied is related to the network infrastructure used to connect the customer. The choice of infrastructure type, cables and outside plant components is strictly dependent on the topology chosen as well as the installation conditions (presence of infrastructures or need to construct new ones). For this purpose, optical or optical/electrical cables and new cable constructions and installation techniques for outside plant construction and operation will be required.

Moreover, cable installation in existing buildings without specific available infrastructure for these new elements will be a challenge, and technical solutions for wiring customer premises with minimum disturbance to the customer need to be identified, such as in particular miniaturized cables and devices, pre-assembled solutions etc.

The responsibility under this Question includes the following areas of standardization:

– Description and testing of basic single- and multi-mode fibre types and associated with optical fibre cables, with parameter tables describing the variations within each of the basic types.
– Description of installation technique of cabled optical fibres in the network and user premises.
– Definitions of attributes and associated test methods for environmental, geometrical, transmission, mechanical and reliability characteristics.
– Descriptions of different possible fibres and/or cables solutions for OTN, access network and submarine network.
– Descriptions of relationships between the different attributes with other attributes and with variations in the environment.
– The following major Recommendations and Supplements, in force at the time of approval of this Question, fall under its responsibility:
    - Optical fibres: G.650.1, G.650.2, G.650.3, G.651.1, G.652, G.653, G.654, G.655, G.656, G.657, G Suppl.40, G Suppl.47 and G Suppl.59.
    - Optical fibre cables:
        - L.100/L.10, L.102/L.26, L.101/L.43, L.106/L.58, L.103/L.59, L.109/L.60, L.104/L.67, L.107/L.78, L.108/L.79, L.105/L.87, L.110 for cable structure and characteristics,
        - L.126/L.27 for cable evaluation, and

- L.151/L.34, L.150/L.35, L.152/L.38, L.161/L.46, L.153/L.48, L.154/L.49, L.158/L.56, L.156/L.57, L.157/L.61, L.159/L.77, L.160/L.82, L.155/L.83, L.162, L.163 for guidance and installation technique.

2 Question

Study items to be considered include, but are not limited to:

– What fibre characteristics are needed to:

- Improve performance limits of optical fibres for next generation transmission systems such as beyond 100 Gbit/s per wavelength?
- Support coarse or dense wavelength division multiplexing (CWDM/DWDM) applications in access (including to and in home/building), metropolitan (including intra/inter office), long-haul and submarine networks?
- Support space- and/or mode-division multiplexing (SDM/MDM) applications?
- Open new spectral transmission regions as the additional passband?

NOTE − Some of these aspects are, at present, covered also in Q2/15, Q6/15 and Q8/15 so coordination is necessary.

– What is needed to provide cost-effective optical access (including to and in home/building), mobile front/back-haul, metropolitan (including intra/inter office), long-haul and submarine networks? How can cohesive Recommendations on the optical cabling in these application eras be formulated? These could be divided by the main types of topology and could include aspects such as:

- Optical fibres.
  - Impact of cable construction and cable installation on fibre characteristics.
  - Impact of hardware, such as splicing trays, customer outlets, enclosures, connectors etc, on fibre and cable characteristics.
  - Handleability and mechanical reliability of optical fibres.
  - Testing and maintenance in field.

NOTE − Some of these aspects are, at present, covered also in Q7/15 so coordination is necessary.

– Study items to be considered include, but are not limited to:

- Geometrical, mechanical, and optical properties of the glass, for single- and few-mode fibre applications.
- Mechanical and optical reliability of fibres and cables (lifetime and failure rate) under different installation and environmental conditions.
- Fibre requirements for high density cable structures.
  - Modelling, and measurements of polarization mode dispersion (PMD) under advanced cable structure and/or particular environment.
  - Impact of network deployment conditions on optical characteristics, e.g., multi path interference (MPI), PMD, cut off wavelength, distributed Raman amplification and so on.
- Possible additional fibre types, and additional parameter tables, within the existing Recommendations.
- Other types of single-mode silica fibres optimized for higher bitrates (e.g., beyond 100 Gbit/s) DWDM systems.
- Other types of single-mode silica fibres for opening new spectral transmission regions.

- Other types of single-mode silica fibres for reducing non-linearity effects.
- Fibre damage from high power and small bend radii.
- Fibre and cable requirements for parallel transmissions on either CWDM or SDM on single- or few-mode fibres.
- Fibre and cable requirements for SDM transmission beyond 100 Tbit/s per fibre.
- Fibre and cable requirements for supporting the advanced access and mobile network.
- Define a "degree of compatibility" between the different types of fibres installed in the same link in order to estimate the transmission characteristics.
- Fibre parameters for the monitoring wavelength region.
- Aspects and/or guidance of measurements in the field related to point-to-point and point-to-multipoint topology.
- What are the optimal methods to enter the user premises and for installing optical fibre cables and other network elements in common parts of the buildings?
- What are the desirable optical fibre cable construction types for wireless, indoor and outdoor cabling application?
- What are the desirable hybrid/composite cable construction types?
- What are the suitable techniques to connect the OTN, access network, and customer premises inside a building?
- What are the suitable techniques to construct the fibre network inside an apartment?
- What are the suitable technologies to connect "smart city" physical infrastructure?
- What are the suitable technologies for smart manufacturing?

3 Tasks

Tasks include, but are not limited to:

– Maintenance and enhancements of G.65x-series including modifying parameters in Recommendations G.651.1, G.652, G.653, G.654, G.655, G.656, and G.657.

– Update the text of G Suppl.40, G Suppl.47 and G Suppl.59, as required.

– Develop new Recommendations or parameter tables within existing Recommendations for possible additional fibre and cable types.

– Develop definitions of new parameters, and corresponding factory and field test methods, RTMs and ATMs, for G.650.1, G.650.2, and G.650.3.

– Maintain and enhance L.100 series including modifying parameters in existing Recommendations L.100-L.199.

– Develop guidelines for users of optical fibres and cables.

– Develop cohesive Recommendations on the cabling.

– Optical fibre and cable aspects related to installation of OTN, access and wireless networks.

– Installation of cables inside home/building and intra/inter office.

– Solutions for connection between external and internal networks.

– Characteristics and test methods for vertical cabling in buildings.

– Impact of optical fibre cable installation on the city environment.

An up-to-date status of work under this Question is contained in the SG15 work programme (https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=17&q=5/15).

4 Relationships

Recommendations:

– G.67x-, G.69x-, G.95x-, G.97x-, G.98x-, L.200-series, L.300-series, and L.400-series Recommendations

Questions:

– Q1/15, Q2/15, Q6/15, Q7/15, Q8/15

Study Groups:

– None

Other bodies:

– ISO/IEC JTC1/SC25 on multimedia cabling for customer premises
– IEC SC86A on fibres and cables
– IEC SC86B on connectors and components
– IEC SC86C on system testing and active devices
– IEC SC46C JWG8 on hybrid cables
– CENELEC TC86A on fibres and cables
– CENELEC TC86BXA on connectors and components
– IEEE 802.3