Question 8/15 – Characteristics of optical fibre submarine cable systems

(Continuation of Question 8/15)

1 Motivation

The transmission capacity within each country and/or between countries has been rapidly growing due to the evolution of Internet services on a global scale. Optical fibre submarine cable systems at the heart of global networks are affected by such an increase in transmission capacity. In such a seamless global network, connectivity also becomes more important than ever for telecommunication carriers and providers. Multi-vendor operability has also become important to realize cost-effective system construction and upgrade. Optical fibre submarine cable systems include two types of system, repeaterless systems and repeatered systems. Repeaterless submarine cable systems are used for network extensions (e.g., for linking to islands just offshore) because of lower cost for installation and OAM. Repeatered systems are used for long haul transmission (e.g., for linking different continents through the oceans) by introducing line optical amplifiers.

This Question has responsibility for the following areas of standardization related to:

– Specifications of terminal equipment and optical fibre submarine cables in optical fibre repeatered submarine cable systems with various optical amplifiers such as erbium-doped fibre amplifiers (EDFAs) and Raman amplifiers.

– Specifications of terminal equipment and optical fibre submarine cables in optical fibre repeaterless submarine cable systems, including systems with power amplifiers, pre-amplifiers and/or remotely pumped optical amplifiers.

– Specifications of optical interface and interface parameters to support longitudinal/transverse compatibility of the repeatered/repeaterless submarine system.

– Specifications of test methods concerning the terminal equipment, optical fibre submarine cables (including marinized terrestrial cables) and other equipment relevant to the submarine cable systems.

– Specifications of forward error correction (FEC) for optical fibre submarine cable systems.

– Specifications of monitoring systems for optical fibre submarine cable systems.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility: G.971, G.972, G.973, G.973.1, G.973.2, G.974, G.975, G.975.1, G.976, G.977, G.978, G.979, L.430, L.431, L.432, L.433 and L.434. The following Supplement also falls under its responsibility: G Suppl.41.

2 Question

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

- How should Recommendations G.971, G.972, G.973, G.973.1, G.973.2, G.975.1, G.976, G.977, G.978 and G.979 be amended from a viewpoint of techno-economics?
- What new transmission techniques should be recommended to increase transmission capabilities of optical fibre submarine cable systems?
- What new components and subsystems (fibre, component, etc.) should be utilized to improve system capacity and reliability?
- What new test methods are necessary for the submarine cable systems?
- What mechanical protection and system protection mechanisms should be recommended for high-capacity submarine cable systems to improve systems reliability/availability?

- What terrestrial and submarine integration should be recommended for the effective network systems?
- What kind of optical submarine system should be standardized to support longitudinal/transversal compatibility?
- What kind of optical fibre and/or cable is needed as a transmission line for optical fibre submarine cable systems to support the increasing transmission capacity and distance?
- What kind of optical submarine system should be recommended for cable with increased fibre count while satisfying the power supply limit through the cable for the repeaters.
- What kind of optical fibre and/or cable is needed for optical fibre submarine cable systems to improve the space multiplicity within the cable to support the increasing transmission capacity or cost-effective cable system deployment?
- What enhancement can be made to existing published Recommendations to further reduce power consumption of optical fibre submarine cable systems?
- What kind of technologies should be recommended to support the effective network maintenance and operation of submarine cable systems?
- What new Recommendations are needed to support interoperability of submarine aspects of software defined networks in terms of standard system parameters and acceptance criteria?
- What new Recommendation are needed to support the use of submarine cables and systems for ocean and climate monitoring and disaster warning?
- What new Recommendations are necessary?

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

- Transmission characteristics of optical fibre submarine cable systems.
- Interface characteristics of optical fibre submarine cable systems.
- Mechanical characteristics of the submarine portion of optical fibre submarine cable systems.
- Test methods.
- Evolution of submarine systems to higher bit rates, including the effects of chromatic dispersion, polarization mode dispersion, and optical fibre nonlinearities.
- Adoption of wavelength-division multiplexing/demultiplexing techniques.
- Introduction of other types of fibre amplifiers, Raman amplifiers, distributed Raman amplifiers or semiconductor optical amplifiers operating at different wavelengths.
- Flexibility for partial network upgrades.
- Repeaters with optical amplifiers.
- Use of branching devices in submarine networks.
- New specifications and test methods for submarine systems in accordance with the objective of longitudinal / transversal compatibility.
- Submarine systems with higher bit rates of beyond 100 Gbit/s, including the effects of chromatic dispersion, polarization mode dispersion, and optical fibre nonlinearities.
- New dispersion accommodation techniques including dispersion management transmission lines, unmanaged dispersion transmission lines and/or hybrid transmission lines for high-speed optical fibre submarine cable systems.
- Advanced FECs for high bit rate DWDM submarine systems.

- New types of amplifiers operating at different wavelength bands.
- Availability and reliability.
- Engineering, Operations and Maintenance.
- Interface compatibility of submarine and terrestrial systems.
- Terrestrial and submarine integrated networks.
- Mechanical and systems level protection mechanisms.
- System and cable repair procedures.
- Use of submarine systems for marine supervision.
- Terminal independent submarine cable commissioning parameters.

3 Tasks

Tasks include, but are not limited to:

– Revisions to Recommendations G. 971, G. 972, G.973, G.973.1, G.973.2, G. 975.1, G. 976, G.977, G.978, G.979, L.430, L.431, L.432, L.433 and L.434, as required

– Update the text of G Suppl.41, as required

– Update the data on cable ships and submersible equipment (as required)

– Develop additional Recommendations from progress on the above study items

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=8/15).

4 Relationships

Recommendations:

– G.65x series, G.66x series, G.69x series and G.95x series

Questions:

– Q5/15, Q6/15, Q11/15

Study Groups:

– None

Other bodies:

– ITU/WMO/UNESCO IOC JTF

– IEC SC86A

– IEC SC86C