TEMPLATE FOR THE TERMS OF REFERENCE FOR THE R&D PROJECTS

(*Refer to the Guidelines on R&D Projects issued vide note SCMD/R&D dated xx-09-23*)

1. Title of the Project: Requirements for the Optical fibres - Part 2-50: Product specifications - Sectional specification for class B single-mode fibres

2. Background:

Sectional Committee: of Fibre Optics, Fibres, Cables and Devices, LITD 11

Division Council: Electronics and Information Technology Division Council (LITDC)

Optical Fibres Cable can broadly classified into multimode and singlemode optical fibres.

Multimode fibre : optical fibre in the core of which the radiation of two or more bound modes can propagate at the wavelength of interest

Single-mode fibre: optical fibre in which the radiation of only one bound mode can propagate at the wavelength of interest

Multimode fibres has four categories of multimode fibres: A1, A2, A3, and A4 (part of the multimode fibre class A) having different requirements specific to each category.

World over class B single-mode fibres categories such as B-652, B-653, B-654, B-655, B-656 and B-657 are widely used by Industry.

Unlike multi-mode optical fiber, single-mode fiber does not exhibit modal dispersion. This is due to the fiber having such a small cross section that only the first mode is transported. Single-mode fibers are therefore better at retaining the fidelity of each light pulse over longer distances than multi-mode fibers. For these reasons, single-mode fibers can have a higher bandwidth than multi-mode fibers.

The Categories of Single Mode fibre along with their desctiption is given in next page.

Category	Type	Description
B-652	Dispersion unshifted	Dispersion unshifted single-mode fibre. Two sub-categories are recognized: B-652.B is optimised for use in the 1 310 nm region but can be used in the 1 550 nm and 1 625 nm regions. Depending on link length and bit rates, dispersion may need accommodation in the 1 550 nm region. B-652.D can be used over the extended wavelength range from 1 260 nm up to 1 625 nm. Chromatic dispersion in this band may impose requirements either on the maximum link length or the need for accommodation.
B-653	Dispersion shifted	This dispersion-shifted single-mode fibre is optimised for single-channel transmission in the 1 550 nm region. Multiple channels can only be transmitted if care is taken to avoid the effects of four-wave mixing by, for example, moderating the power levels or appropriate spacing or placement of the channels. Two sub-categories are recognized (B-653.A and B-653.B) differing in chromatic dispersion characteristics.
B-654	Cut-off shifted	This category of dispersion unshifted single-mode fibre is optimised for low loss in the 1 550 nm region. Five sub-categories are recognized (B-654.A, B-654.B, B-654.C, B-654.D and B-654.E) differing in chromatic dispersion and mode field characteristics.
B-655	Non-zero dispersion-shifted	This dispersion-shifted single-mode fibre is optimised for multiple channel transmission in the 1 550 nm region. The dispersion coefficient is required to be non-zero throughout the band from 1 530 nm to 1 565 nm, but may be either positive or negative. Depending on the dispersion characteristics, multiple channel transmission may be possible at bands either above or below the normal 1 550 nm region. Three sub-categories are recognized (B-655.C, B-655.D and B-655.E), differing in chromatic dispersion characteristics.
B-656	Wideband non-zero dispersion-shifted	This wideband non-zero dispersion-shifted single-mode fibre is optimised for multiple channel transmission in the wavelength range of 1 460 nm to 1 625 nm with the positive value of the chromatic dispersion coefficient that is greater than some non-zero value. This fibre can be used for both CWDM and DWDM systems throughout the wavelength region between 1 460 nm and 1 625 nm.
B-657	Bending loss insensitive	This category of single-mode fibre is optimised for improved bending performance. Four sub-categories are recognized: B-657.A1 and B-657.A2 fibres are a subset of category B-652.D fibres and therefore are compliant with B-652.D fibres and have the same transmission properties. Sub-category B-657.A1 fibres are appropriate for a minimum bend radius of 10 mm; sub-category B-657.A2 fibres for a minimum bend radius of 7,5 mm. B-657.B2 and B-657.B3 fibres are intended to be used for restricted distances (less than 1 000 m) at the end of access networks, in particular inside buildings or near buildings (e.g. outside building riser cabling). Application length of B-657.B fibre, however, depends on the deployment strategy of each network operator. Sub-category B-657.B fibres are not necessarily compliant with category B-652.D fibres in terms of chromatic dispersion coefficient specifications. These fibres, however, are system compatible with B-657.A (and B-652.D) fibres in access networks. Sub-category B-657.B2 fibres are appropriate for a minimum bend radius of 7,5 mm; sub category B-657.B3 fibres for a minimum bend radius of 5 mm.

3. Scope: The Research and Development project will Study of class B single-mode fibres categories B-652, B-653, B-654, B-655, B-656 and B-657 and its applicability in sub-tropical Indian Conditions.

These fibres are used or can be incorporated in information transmission equipment and optical fibre cables.

Three types of requirements apply to these fibres:

- general requirements, as defined in IEC 60793-2;
- specific requirements common to the class B single-mode fibres
- particular requirements applicable to individual fibre categories or specific applications,

For some fibre categories (shown in the relevant family specifications), there are sub-categories that are distinguished on the basis of difference in transmission attribute specifications. The designations for these sub-categories are documented in the individual family specifications.

In some cases, as for Recommendation G.652, a given IEC designation maps to multiple categories in the ITU-T because the ITU-T categories are distinguished by cabled fibre attribute (PMDQ) performance which are not distinguished in the IEC fibre specifications.

4. Expected Deliverables:

The Research and development project will study the detailed Specifications of Single mode Fibre, which includes (the requirements may extended)

a) General requirement

b) Dimensional requirements common to all category B fibres

c) Mechanical requirements common to all class B fibres

d) Transmission attributes and measurement methods

Besides common Requirements, R&D project will also study different categories of optical fibres cables as per Indian Requirement condition for following cables:

- Family specification for category B-652 Dispersion unshifted single-mode fibres
- Family specification for category B-653 Dispersion unshifted single-mode fibres
- Family specification for category B-654 cut-off shifted single-mode fibres
- Family specification for category B-655 non-zero dispersion shifted single-mode fibres
- Family specification for category B-656 Wideband non-zero dispersion shifted single-mode fibres

5. Research Methodology:

The entire project shall consist of detail study and research of different types of single-mode fibres categories used in India.

Experts who are in the design and development of optical fibre in general, including technical contributors, shall be part of the studies and research. Along with other Indian Manufactures, experts and Laboratories testing shall be invited to be part of the research and discussions, through various meetings, workshops etc.

Research may Focus group discussions, visits to the relevant Manufacturing Units and Labs.

6. Requirement for the CVs:

Person should be working in optical fibre industry for at least 10 years at Senior level looking after both testing and selling the project

7. Timeline and Method of Progress Review:

Time line for the Project 6 months

Study, and gap analysis	One month
Brainstorming, Discussions	One month
Drafting	One Month
Testing	Two Month
Final Document preparation	One Month

8. Support BIS will Provide:

BIS will provide budgetary support for

a) Meetings: Monthly meetings with the experts

b) Manufacturing and Laboratory visits

c) Testing of Different variety

d) Consumables and Stationary