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(Part B)

DWDM Interconnect Between UK Licensed Operators

TECHNICAL RECOMMENDATION

Issue 1

Network Interoperability Consultative Committee
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Normative Information

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1 INTRODUCTION

1.1 History

July 2000	Draft 0.1	
September 2000	Draft 0.2	Document updated to include reference diagram and updates based on G.959.1
September 2000	Issue 1.0	As agreed by correspondence

1.2 References

ITU-T Recommendations

Recommendation	Title (year published)
G.652	Characteristics of a single-mode optical fibre cable (04/97)
G.655	Characteristics of a non-zero dispersion-shifted single-mode optical fibre cable (10/96)
G.664	Optical safety procedures and requirements for optical transport systems (06/99)
G.707	Network Node Interface for the synchronous digital hierarchy (SDH) (1996)
G.783	Characteristics of SDH Multiplexing Equipment Functional Blocks (04/97)
G.784	Synchronous Digital Hierarchy (SDH) Management (06/99)
G.872	Architecture of optical transport networks (02/99)
G.957	Optical interfaces for equipments and systems relating to the Synchronous Digital Hierarchy (06/99)
G.959.1	Optical transport network physical layer interfaces

British Standards

BS EN 60825: Radiation safety of Laser Products

Part 1: Equipment Classification Requirements and User Guide (1994).

Part 2: Safety of Optical Fibre Communication Systems (1995)

1.3 Definitions and Abbreviations

For terms and definitions refer to Recommendation G.959.1.

ABBREVIATIONS

For the purposes of this Technical Recommendation the following abbreviations apply:

ALS	Automatic Laser Shutdown
BS	British Standard
dB	Decibel
dBm	Decibel relative to 1 milliwatt
GHz	Gigahertz
ITU-T	International Telecommunications Union – Telecommunications Standardisation Sector
MPI	Main path interface
MPI –R _M	Multichannel receive main path interface reference point

MPI –S _M	Multichannel source main path interface reference point
NA	Not applicable
nm	Nanometres
NRZ	Non-return to zero
OD	Optical Demultiplexer
OM	Optical Multiplexer
POI	Point of Interconnect
ps	Picoseconds
SDH	Synchronous Digital Hierarchy
STM-16	Synchronous Transport Module, level 16
STM-N	Synchronous Transport Module, Level N
THz	Terahertz

1.4 Scope

This document addresses DWDM interconnect between UK licensed operators at the optical level to support interconnection of digital data streams. It specifies characteristics at the Point of Interconnect (POI) based on published versions of ITU-T Recommendations as detailed in section 1.2.

In areas where the standards are non-explicit or still under development, specific options for the UK are identified that are consistent with available equipment practice. Where details of DWDM-related interfaces are not covered in this recommendation, reference shall be made to ITU-T Recommendations.

Revisions to this recommendation are likely to be required to reflect developments in the relevant standards.

This recommendation assumes that the recommendations on the principles of DWDM interconnect which includes Topologies and Protection mechanisms given in the Overview document section 4, have been followed.

2 BASIC SIGNAL STRUCTURE at POI

The reference model for DWDM interconnect is shown in figure 1. This indicates the reference points where physical parameters are assigned.

2.1 Physical interface at POI

The POI shall be optical comprising one fibre for each direction of transmission. Requirements for single fibre working are not included in this document.

2.2 Reference Points

The reference points shall be as described in G.959.1. For the application described the reference points are

- MPI –S_M is a multichannel reference point on the optical fibre just after the optical network element transport interface output optical connector;
- MPI –R_M is a multichannel reference point on the optical fibre just after the optical network element transport interface input optical connector.

2.3 Main Optical Path

The main optical path is the optical fibre between the MPI – S_M and the MPI – R_M reference points.

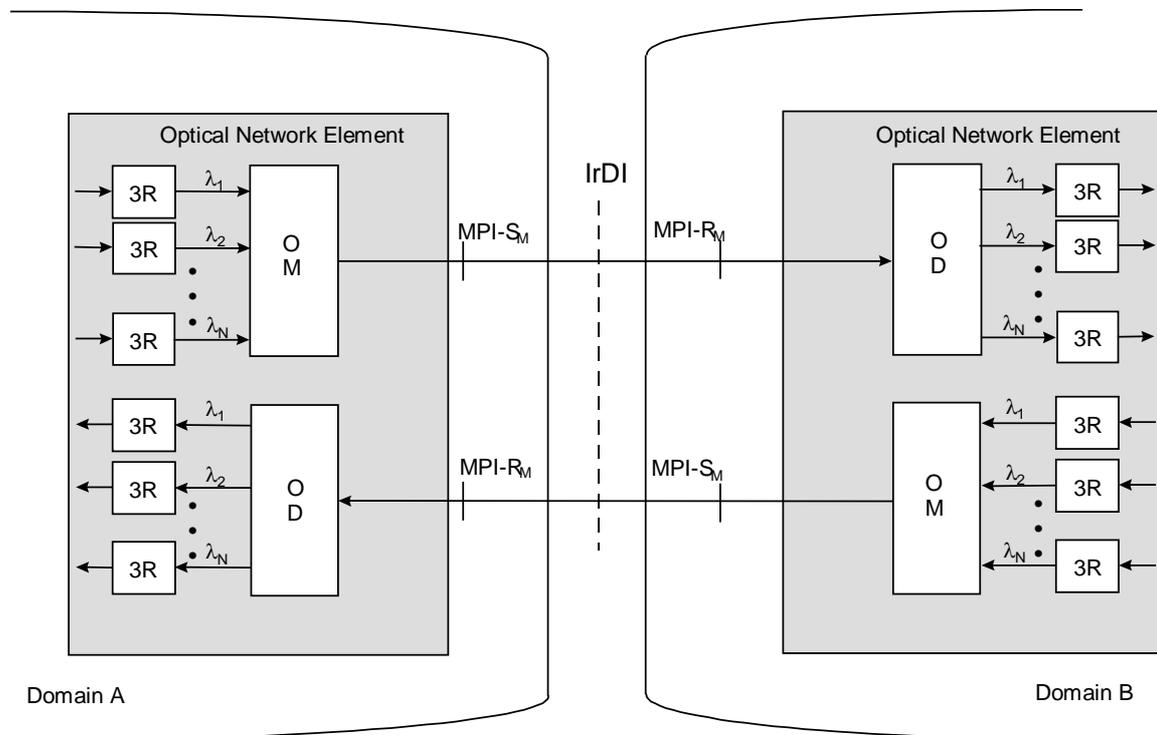


FIGURE 1 DWDM INTERCONNECT REFERENCE MODEL

2.4 Interface Parameters

The application code that is to be used in the UK is P16S1-1D2. Other application codes are for further study. The application code notation is constructed as follows:

$$PnW_x-ytz$$

- where
- P**, when present, indicates a pre-OTN application code applying to an IrDI
 - n** is the maximum number of channels supported by the application code
 - W** is a letter indicating the span distance/attenuation, such as:
 - **VSR** indicating very short reach (span attenuation for further study)
 - **I** indicating intra-office (up to 7 dB span attenuation)
 - **S** indicating short-haul (11 dB span attenuation)
 - **L** indicating long-haul (22 dB span attenuation)
 - **V** indicating very long-haul (33 dB span attenuation)
 - x** is the maximum number of spans allowed within the application code
 - y** indicates the highest class of optical tributary signal supported.
 - **1** indicating NRZ 2.5G
 - **2** indicating NRZ 10G
 - t** is a letter indicating configuration supported by the application code, such as:
 - **A** indicating one OA used as a booster amplifier in the originating ONE and a second OA used as a preamplifier in the terminating ONE
 - **B** indicating only the booster amplifier is used
 - **C** indicating only the pre-amplifier is used
 - **D** indicating neither amplifier is used
 - z** is the source and fibre type, as follows:
 - **1** indicating nominally 1310 nm sources on G.652 fibre
 - **2** indicating nominally 1550 nm sources on G.652 fibre
 - **3** indicating nominally 1550 nm sources on G.653 fibre
 - **5** indicating nominally 1550 nm sources on G.655 fibre

All parameters shall be as defined in G.959.1.

The physical layer parameters and values for a multi-channel DWDM POI are given below in table 1. The parameters shall be as in table 7-1/G.959.1, Physical layer parameters and values for multichannel IrDI applications.

Parameter	Units	P16S1-1D2
General information		
Maximum number of channels	-	16
Bit rate/line coding of client signals	-	NRZ 2.5 G
Maximum bit error ratio	-	10 ⁻¹²
Fibre type	-	G.652/G.655
Interface at point MPI-S_M		
Maximum mean channel output power	dBm	-4
Minimum mean channel output power	dBm	-10
Maximum mean total output power	dBm	+8
Central frequency	THz	192.1 + 0.2m, m= 0 to 15
Channel Spacing	GHz	200
Maximum central frequency deviation	GHz	40
Minimum channel extinction ratio	dB	8.2
Eye mask	-	STM-16 per G.957
Optical path (single span) from point MPI-S_M to MPI-R_M		
Maximum attenuation	dB	11
Minimum attenuation	dB	2
Maximum chromatic dispersion	ps/nm	800
Minimum optical return loss	dB	24
Maximum discrete reflectance	dB	-27
Maximum differential group delay	ps	120
Interface at point MPI-R_M		
Maximum mean channel input power	dBm	-6
Minimum mean channel input power	dBm	-21
Maximum mean total input power	dBm	+6
Maximum channel power difference	dB	NA
Maximum optical path penalty	dB	1
Maximum reflectance of optical network element	dB	-27

Table 1 Physical Layer Parameters

3 ALARMS AND PERFORMANCE MONITORING

Network Elements used for interconnect should provide local and remote alarm and performance monitoring functions.

Where the digital client supported on DWDM is SDH the provision of such functions will be in accordance with ITU-T Recommendations G.783 and G.784.

4 PROTECTION

The preferred protection mechanisms for DWDM interconnects are described in the Overview Recommendation. This section details the specific technical features associated with protection.

This is not available at present, and its use is for wider study.

5 OPTICAL SAFETY

All optical interconnections should be designed, installed and operated in accordance with the safety requirements detailed in BS EN 60825.

The use of “Automatic Laser Shutdown” (ALS) mechanisms is not specifically recommended in this document. However, operators should be aware that an ALS mechanism may be necessary to meet manufacturer’s recommendations and/or operator-specific safety standards.

The use of ALS is therefore for bi-lateral agreement. Where used, it is recommended that the mechanism should meet ITU-T recommendation G.664, provided this meets the requirements for safety.

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