

# Certified Fibre Characterisation Engineer (CFCE)

**Course Duration** 5 Days



## Course Summary

Understand the fibre optic tests that are required to prove that advanced fibre infrastructures can support high data rate applications (10Gb/s, 40Gb/s, 100Gb/s) as well as extended wavelength range operation for DWDM and CWDM systems. Apply the full power of modern multi-purpose test platforms to carry out these tests including bi-directional OTDR testing, chromatic dispersion, Polarisation Mode Dispersion (PMD) and spectral attenuation. Process the results swiftly and efficiently using test report software to provide full system documentation. Assess link performance against application support criteria. Pass the exam to gain Certified Fibre Characterisation Engineer (CFCE) status.



## Course Objectives

At the end of this course you will be able to:

- ⦿ explain the significance of modern fibre specifications including G.652.A, B, C & D, G.655.x and G.656
- ⦿ appreciate the characteristics of the infrastructure that can impair system performance
- ⦿ design and plan test programmes to meet customer and operational requirements
- ⦿ understand test specifications and describe the purpose of OTDR & OSA testing
- ⦿ analyse OTDR traces and event tables
- ⦿ analyse OSA scans and tables
- ⦿ understand what chromatic dispersion is and how it is measured
- ⦿ understand what PMD is and how it can be measured
- ⦿ perform full fibre characterisation on installed fibre systems
- ⦿ interpret the results of fibre characterisation and map against application support criteria



## Why train with OTT?

- ⦿ gain hands-on experience of testing fibres using specially constructed test boxes
- ⦿ learn directly from Richard Ednay, UK Principal Expert on IEC fibre optic systems working group and contributor to ITU-T Study Group 15 on fibre optic systems

## COURSE CONTENTS

*continued overleaf*

### FIBRE CHARACTERISATION

#### What are optical networks?

What is fibre characterisation?  
Why is fibre characterisation necessary?  
When is fibre characterisation needed?  
How is fibre characterisation done?  
Standards

### CHARACTERISTICS OF LIGHT

What is light?  
Electromagnetic spectrum  
Wavelengths & frequencies  
Wave properties of light  
Interferometry  
Singlemode fibre as a waveguide  
Speed of light  
Chromatic dispersion  
Polarisation mode dispersion

## Why does this course exist?

As data rates increase and systems become more complex then there are many factors that can impair system performance. When dark fibre contracts are signed for long contract periods, then it is usually necessary to characterise the fibres to prove that they will operate satisfactorily for the duration of the contract period. This course helps you to use the modern multi-purpose test platforms with their powerful array of measurement capabilities to ensure that the fibre is up to the job.

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# Certified Fibre Characterisation Engineer

## INTRODUCTION

### OPTICAL FIBRES UPDATE

Optical fibres for telecoms  
Evolution of fibre standards

### PREPARING FOR FIBRE CHARACTERISATION

Specification of parameters  
Resources checklist  
Management of test results  
Using scripts  
Reference procedures  
Measurement procedures

### INSPECTING & CLEANING CONNECTORS

Why do we inspect and clean?  
Inspection standards  
Connector inspection equipment  
Cleaning equipment & technology  
Connector care: do's and don'ts

## LOSS & POWER MEASUREMENTS

### INSERTION LOSS AND SPECTRAL ATTENUATION MEASUREMENTS

Continuity checking  
Optical power and loss budgets  
Insertion loss measurements  
Spectral attenuation  
Live fibre identifiers  
Fault locators

### RETURN LOSS MEASUREMENT TESTING

Definitions  
Performance requirements  
How is return loss measured?

### OPTICAL SPECTRUM ANALYSIS

What is an OSA?  
OSA applications  
OSAs and DWDM systems  
OSAs and amplified performance  
OSAs and optical components  
OSAs and fibre non-linear effects  
OSAs and fibre characterisation

## OTDR TESTING

### WHY USE AN OTDR?

What is OTDR testing?  
Why do it?

### OTDR INTRODUCTION

What can an OTDR do for us?  
How does an OTDR work?  
Inside the OTDR

### OTDR CAPABILITIES

Distance measurements  
Fibre loss measurements  
Splice loss measurements  
Connector losses  
Link return loss

### OTDR LIMITATIONS

Dynamic range  
Dead zone  
Resolution

### OTDR MEASUREMENT CONFIGURATIONS

Cable on a drum  
Installed cable before termination  
Connectorised systems

### OTDR ISSUES

Poor launch conditions  
Interfacing with bare fibres  
Ghosts  
Fibre mismatches

### USING THE OTDR

Step by step guide  
Manipulating the trace  
Measurement parameters

### OTDR TRACE ANALYSIS

What information do we want?  
Analysis of a single trace  
Multiple wavelength traces  
Analysis of multiple fibres  
Bi-directional analysis

### OTDR trace comparison

### USING OTDR SOFTWARE

OTDR emulation software  
Automatic detection of events  
Comparing OTDR traces

## DISPERSION

### DISPERSION MEASUREMENTS

When do need to measure?

### CHROMATIC DISPERSION INTRO

What is chromatic dispersion?  
What causes it?

### CHROMATIC DISPERSION MEASUREMENT METHODS

Standards: ITU, IEC, EIA/TIA  
Group delay and dispersion  
OTDR based time of flight

Photon Counting Time of Flight  
Phase Shift Techniques  
Differential Phase Shift Technique  
Future developments

### PRACTICAL EXERCISES

G.652 & G.655 systems  
Time of flight (OTDR)  
DCMs

### POLARISATION MODE DISPERSION

Polarisation in fibres  
Polarisation in other system components  
PMD and system performance  
Second order PMD  
Dynamics of PMD

### PMD MEASUREMENT TECHNIQUES

Interferometric technique  
Polarimetric technique  
Fixed analyser technique  
WSOSOPA  
Interpreting test results

### PMD MEASUREMENT ISSUES

What are we testing and why?  
Factors affecting choice of technique  
PMD summary

### PMD MEASUREMENT EXERCISES

Low PMD fibre mode coupling  
PMD fibre no mode coupling  
High PMD fibre system

## REPORTING

### REPORTING

Measurement validation checklist  
OTDR measurement presentation  
Fibre characterisation reports  
Generating a fibre characterisation report with JDSU FiberCable  
Web based documentation

### LINK ACCEPTANCE CRITERIA

Fibre distances  
Cabling losses  
Reflections  
Chromatic dispersion  
Polarisation mode dispersion  
Extended wavelength requirements

### CFCE EXAM AND ASSESSMENT