Certified Fibre Characterisation Engineer (CFCE)

5 days

Test course

As data rates increase and systems become more complex there are more factors that can impair system performance. This course is designed to help you master the fibre optic tests that are required to prove that advanced fibre infrastructures are of a good quality and can support direct detection and coherent systems for high data rate applications from 10Gb/s to 400Gb/s and beyond. You will also be able to assess support for Raman amplification as well as extended wavelength range operation for DWDM and CWDM systems. Typically it is necessary to characterise fibres when dark fibre contracts are signed, to prove that the fibres will operate satisfactorily for the duration of the contract period.

You will learn to apply the full power of multi-purpose test platforms with their powerful array of measurement capabilities to carry out these tests including insertion and return loss measurements, bi-directional OTDR testing, chromatic dispersion, Polarisation Mode Dispersion (PMD) and spectral attenuation. You will learn how to check the validity of the measurements, to avoid costly mistakes and time consuming re-tests. You'll be able to process the results swiftly and efficiently, using test report software, to provide full system documentation. By appreciating the issues behind the tests you will be able to assess link performance intelligently against application support criteria.

Features

- ❑ hands-on experience using specially constructed fibre test systems
- ❑ comprehensive course manual
- ❑ supporting online resources
- ❑ pass the assessment to gain Certified Fibre Characterisation Engineer (CFCE) status

Key outcomes

- ✓ explain the significance of fibre specifications and performance grades, including all G.65n.x fibre types
- ✓ identify the characteristics of the infrastructure that can impair system performance
- ✓ design and plan test programmes to meet customer and operational requirements
- ✓ interpret test specifications
- ✓ inspect connector end faces and assess against criteria of IEC61300-3-35
- ✓ perform accurate and reliable insertion loss and return loss measurements
- ✓ describe the purpose of OTDR testing
- ✓ analyse OTDR traces, event tables and link maps
- ✓ explain what chromatic dispersion is and be able to measure it accurately
- ✓ describe PMD and be able to measure it accurately
- ✓ perform full fibre characterisation on installed fibre systems
- ✓ interpret the results of fibre characterisation to report on infrastructure quality and map against application support criteria

This is an advanced course and assumes that you have some previous experience of ILM and OTDR testing.

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BECOMING A CFCE
- ❑ What are optical networks?
- ❑ What is fibre characterisation?
- ❑ Why & when is it necessary?
- ❑ How is it done?
- ❑ Standards

CHARACTERISTICS OF LIGHT
- ❑ Electromagnetic spectrum
- ❑ Wavelengths & frequencies used in fibre optics
- ❑ Singlemode fibre as a waveguide
- ❑ Speed of light
- ❑ Dispersion

LIGHT IN OPTICAL FIBRES
- ❑ How fibres work
- ❑ Singlemode fibre
- ❑ Launch conditions
- ❑ Attenuation
- ❑ Dispersion
- ❑ Bend loss performance

OPTICAL FIBRES
- ❑ Optical fibres for telecoms
- ❑ Fibre standards

PREPARATION

PREPARING FOR FIBRE CHARACTERISATION
- ❑ Specification of parameters
- ❑ FC characterisation systems & resources checklists
- ❑ Management of test results
- ❑ Reference procedures
- ❑ Measurement procedures

INSPECT+CLEAN CONNECTORS
- ❑ Why do we inspect & clean?
- ❑ Inspection standards
- ❑ Inspection equipment
- ❑ Cleaning equipment
- ❑ Connector care

ILM & SPECTRAL ATTENUATION
- ❑ Continuity checking
- ❑ Power & loss budgets
- ❑ Insertion loss measurements
- ❑ Spectral attenuation
- ❑ Live fibre identifiers

RETURN LOSS MEASUREMENT
- ❑ Definitions
- ❑ Performance requirements
- ❑ How is it measured?

OTDR TESTING

OTDR INTRODUCTION
- ❑ What is OTDR testing?
- ❑ What can it do for us?
- ❑ How does it work?

OTDR CAPABILITIES
- ❑ Distance measurements
- ❑ Fibre loss measurements
- ❑ Bending losses
- ❑ Splice loss measurement
- ❑ Connector losses
- ❑ Link return loss (ORL)

OTDR LIMITATIONS
- ❑ Dynamic range
- ❑ Dead zone
- ❑ Resolution

TEST CONFIGURATIONS
- ❑ Cable on a drum
- ❑ Installed cable before termination
- ❑ Connectorised systems
- ❑ Bi-directional testing

USING THE OTDR
- ❑ Step by step guide
- ❑ Manipulating the trace
- ❑ Measurement parameters

OTDR ISSUES
- ❑ Poor launch conditions
- ❑ Interfacing with bare fibres
- ❑ Ghosts
- ❑ Fibre mismatches

OTDR TRACE ANALYSIS
- ❑ What info do we want?
- ❑ Event tables and link maps
- ❑ Analysis of a single trace
- ❑ Multiple wavelength traces
- ❑ Analysis of multiple fibres
- ❑ Bi-directional analysis
- ❑ OTDR trace comparison

USING OTDR SOFTWARE
- ❑ OTDR viewer software
- ❑ Automatic event detection
- ❑ Comparing OTDR traces

DISPERSION

INTRO TO DISPERSION
- ❑ When do we need dispersion measurements?

CHROMATIC DISPERSION
- ❑ What is it?
- ❑ What causes it?
- ❑ CD characteristics of common fibre types

CD MEASUREMENT METHODS
- ❑ Standards
- ❑ Group delay and dispersion
- ❑ Time of flight techniques
- ❑ Phase Shift Techniques

PRACTICAL EXERCISES
- ❑ G.652 & G.655 systems
- ❑ DCMs
- ❑ Compensated links
- ❑ Amplified links

POLARISATION MODE DISPERSION
- ❑ Polarisation in fibres
- ❑ Polarisation in other system components
- ❑ PMD & system performance
- ❑ Second order PMD
- ❑ Dynamics of PMD

MEASUREMENT TECHNIQUES
- ❑ Interferometric technique
- ❑ Polarimetric technique
- ❑ Fixed analyser technique
- ❑ Wavelength scanning
- ❑ Interpreting test results

PMD MEASUREMENT ISSUES
- ❑ What are we testing & why?
- ❑ Factors affecting choice of technique

PMD MEASUREMENT EXERCISES
- ❑ Low PMD fibre link
- ❑ High PMD fibre link
- ❑ Concatenated links
- ❑ Amplified links

REPORTING
- ❑ Measurement validation checklist
- ❑ OTDR measurement presentation
- ❑ Fibre characterisation reports
- ❑ Web based documentation

LINK ACCEPTANCE CRITERIA
- ❑ Fibre distances
- ❑ Cabling losses
- ❑ Reflections
- ❑ Chromatic dispersion
- ❑ PMD
- ❑ Extended wavelength requirements
- ❑ Support for Raman amplifiers
- ❑ Application support:
- ✓ ITU OTN applications
- ✓ Ethernet LR, ER and ZR
- ✓ 128G Fibre Channel
- ✓ OIF IA for 400ZR
- ✓ OpenROADM MSA for OpenZR+
- ✓ Coherent 100G-400G+

CFCE ASSESSMENT
- ❑ Fibre characterisation practical assignment
- ❑ Theory assessment