

# Fiber Characterization Report Generation

by Gregory Lietaert

## Fiber Characterization

Both high-speed and high-quality transmission systems require performance verification of the network's fiber infrastructure to ensure that the equipment can operate reliably and meet rigorous performance standards. Line rates at 10 Gbit/s and 40 Gbit/s and technologies such as Dense Wavelength Division Multiplexing (DWDM) and Optical Transport Network (OTN) require a detailed suite of conventional measurements, as well as additional tests such as dispersion measurements.

The number of optical tests required to perform a comprehensive fiber characterization generates a large quantity of data to be delivered to the network operator. Here comes the problem of compiling and formatting of the test results into a comprehensive and professional report using minimum working time and minimum risk of manipulation errors.

## Why Fiber Characterization Report is Essential?

If the fiber is not characterized before the installation of system components, substantial delays in service provisioning or an increase in the time to repair can occur, leading to project postponements and missed turn-up commitments. Detailed records must be generated for any test parameter that can affect the transmission quality, and system limits must be taken into consideration for future provisioning. The fiber characterization report, a contractual document, must be provided to the service provider by the fiber installer or a third-party fiber characterization service company.

If the network fails to perform as contracted and reported, the network provider requires the ability to test the network and pinpoint the trouble source. Comprehensive and complete fiber characterization report is the key information in this troubleshooting scenario: It allows to quick comparing measurements recorded during the fiber installation with current test results. This can be used to isolate and sectionalize problems as well as assign responsibility to restore the issue, if required.

Furthermore, the verification of fiber performance and the comparison with commissioning/acceptance test values is useful for ongoing network analysis and trending. A complete and comprehensive fiber characterization report allows for the investigation of the fiber's behavior and degradation.

## Professional and optimized test report document

The use of such a fiber characterization report is critical at any steps of the network life cycle. This pushes the report quality further ahead. It shall be generated in a professional format and shall include all of the relevant information related to the link as well as detailed measurement results. But furthermore, it shall fulfill the end customer's requirements in terms of information content and document format.

**Multiple test results management**

As transmission system performance increases, the number of test parameters is more and more important. Conventional tests, the core of the fiber characterization report, include Insertion Loss (IL), Optical Return Loss (ORL), and bi-directional OTDR measurements at specific wavelengths (1310/1550/1625 nm). The OTDR provides loss, distance, and reflectance values for each of the in-line components of the link such as splices and connectors. The resulting report of conventional measurements is already a complex and massive report.

In addition, dispersion tests have to be included in the final report since these results ensure the capability of the link to run at a very high bit rate or DWDM transmission systems. Dispersion testing consists of Polarization Mode Dispersion (PMD) and Chromatic Dispersion (CD). Both measurements are origin-to-end tests, but the wavelength-dependent characteristic of CD measurements can result in the generation of a massive table of data when considering the entire wavelength band, from 1250 to 1650 nm, in a CWDM transmission system for example.

When working with DWDM systems, another parameter, Attenuation Profile (AP), must be taken into account. The AP provides the fiber attenuation according to the wavelength and over the entire link. This results in an additional source for an increased number of test results and an additional table in the final acceptance report.

Current softwares, available on the market, enable to compile partial report with some of these individual parameters. But, none of them offers the entire capabilities except the JDSU OFS-200 Optical FiberCable Software. This software manages all of the test results simultaneously so that the technician can generate professional cable acceptance test reports using OTDR, PMD, AP, IL, and ORL results simultaneously.

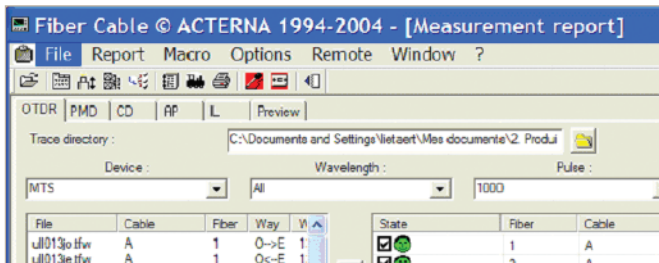


Figure 1: Complete set of test results managed by JDSU's FiberCable software.



### Improve productivity with fast report generation

Nowadays, none of the fiber installers or test contractors, characterizing fiber, can afford spending hours and hours of technician’s workload in generating reports. It is also not acceptable to postpone the job’s completion due to a delay in the acceptance report document. That’s why “time to report” is entirely part of the fiber characterization workload: Contract is over when the final report is provided to the end contractor!

Using JDSU’s Fiber Cable software, technicians eliminate the need to bridge all of the independent reports and information into one single document. The software considerably cuts down the reporting procedure compared to any standard solutions with independent results management.

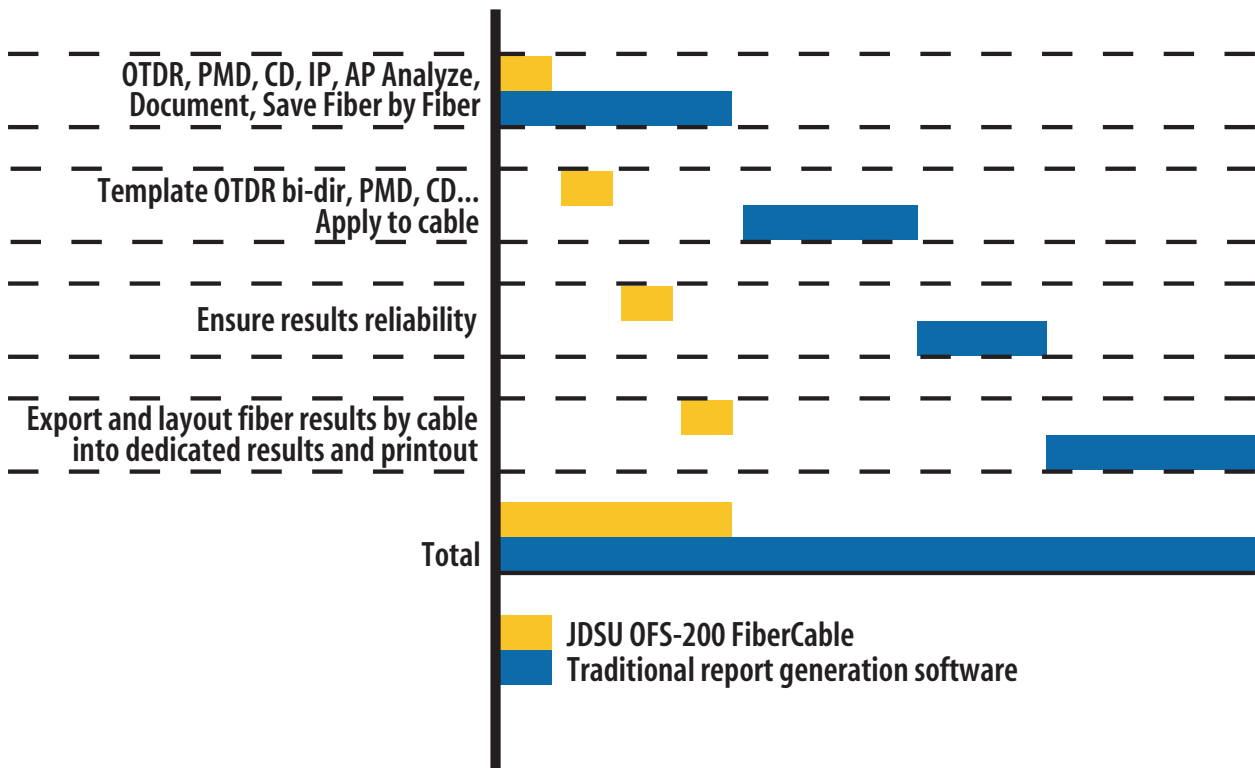


Figure 3: Realize significant time savings in fiber characterization report generation with JDSU's FiberCable software.

### Error-free fiber characterization report

It is not only important to reduce report generation time, but it is also to generate an error-free report. Therefore, the automation process of the software has to be monitored by a step-by-step checking method. Dialog boxes and pop-up windows warn the technician of any potential problems during the report generation process.

In addition to the different check points, a set of thresholds and other criteria can be defined, offering additional information about the report quality. Corresponding pass/fail information is provided throughout the result tables, displaying different types of warnings, if applicable.

ID Cable	ID Fibre	Wavelength	Average	2 : O-->E	2 : E-->O	2 : Average	3 : O-->E	3 : E-->O	3 : Average	4 : O-->E	4 : E-->O	4 : Average	5 : O-->E	5 : E
30	1	1310	0.018	0.126	-0.090	0.018	-0.063	0.088	0.012	0.018	0.022	0.020	0.018	0.02
30	2	1310	0.290	0.028		0.065			0.012	-0.051	0.632	0.290	0.247	0.13
30	3	1310	0.046	0.203	-0.063	0.070	-0.098	0.141	0.021	0.129	0.019	0.074		
30	4	1310	0.016	0.156	-0.140	0.008	-0.040	0.090	0.025	0.021	0.021	0.021	0.021	0.00
30	5	1310	0.030	0.107	-0.087	0.010	-0.032	0.113	0.040	0.013	-0.003	0.005	0.059	0.06

Figure 4: Different alarms enable technicians to locate errors in the report.

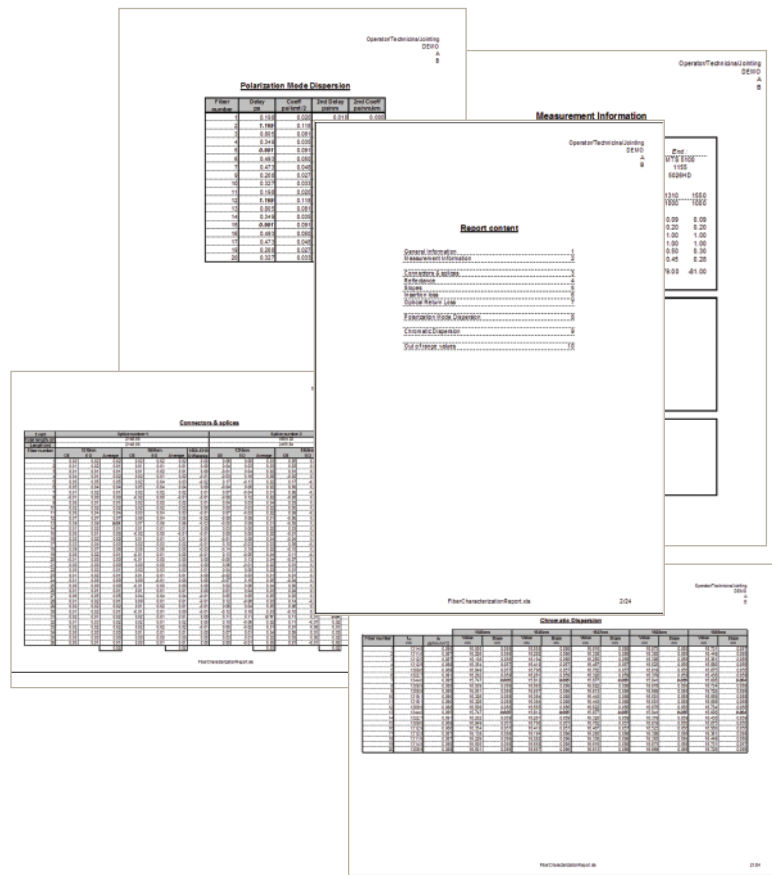
As compiling the data into a spreadsheet is a tedious task, the technician should prefer to review all the results before starting the final stage. That’s why FiberCable offers a complete preview of the report where missing information and inconsistencies are pointed out . This step in the report generation process enables to avoid multiple result compilations increasing dramatically the time to final report generation.

ID Cable	ID Fibre	Wavelength	Average	1 : O-->	1 : E-->	1 : Average	2 : O-->	2 : E-->	2 : Average	3 : O-->	3 : E-->	3 : Average
A	1	1310	0.034	0.262	-0.041	0.110	0.016	0.019	0.018	0.057	-0.003	0.027
A	2	1310	0.023	0.265	0.029	0.147	0.013	0.015	0.014	0.035	0.032	0.034
A	3	1310	0.026	0.332	-0.012	0.160	0.010	0.013	0.012	-0.009	0.038	0.015
A	4	1310	0.031	0.367	-0.059	0.154	0.041	0.007	0.024	-0.026	0.176	0.075
A	5	1310	0.038	0.193	0.104	0.148	0.050	0.053	0.051	0.163	-0.128	0.018
A	6	1310	0.041	0.381	-0.157	0.112	0.050	0.038	0.044	-0.040	0.076	0.018
A	7	1310	0.037	0.141	-0.010	0.065	0.010	0.018	0.014	0.069	-0.041	0.014
A	8	1310	0.028	0.479	-0.004	0.237	-0.007	0.003	-0.002	-0.081	0.118	0.018
A	9	1310	0.021	0.215	-0.016	0.099	0.004	0.013	0.009	0.044	0.025	0.035
A	10	1310	0.023	0.473	0.228	0.351	0.018	0.024	0.021	0.004	0.026	0.015
A	11	1310	0.031	0.385	0.122	0.254	0.046	0.040	0.043	0.069	-0.032	0.018
A	12	1310	0.031	0.376	-0.049	0.164	0.069	0.068	0.068	-0.079	0.091	0.006
A	13	1310	0.030	0.322	0.034	0.178	0.090	0.087	0.088	-0.053	0.079	0.013
A	14	1310	0.030	0.373	0.101	0.237	0.010	0.016	0.013	0.035	0.004	0.020
A	15	1310	0.029	0.560	0.169	0.365	-0.004	0.009	0.002	-0.001	0.050	0.024
A	16	1310	0.026	0.404	-0.025	0.190	0.019	0.019	0.019	-0.013	0.082	0.035
A	17	1310	0.029	0.141	0.069	0.105	0.026	0.038	0.032	0.098	-0.031	0.034
A	18	1310	0.037	0.410	-0.153	0.129	0.085	0.069	0.077	-0.137	0.181	0.022
A	19	1310	0.037	0.384	0.237	0.310	-0.001	0.019	0.009	0.129	-0.054	0.037

Figure 5: Complete fiber characterization report preview

### Conclusion

Professional fiber characterization report format with good legibility has to combine all the tests results, alarms and information, providing the end user the complete information about the fibers laid down. The aim of such a report is to be the conclusion of the installation job, as well as to be regularly and easily consulted by any managers or technicians when fiber manipulations or system upgrade have to be carried out. JDSU has early understood the increased demand for reporting efficiency and documenting quality. The FiberCable software meets technicians and managers requirements when dealing with fiber characterization.



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