2038Km and Four 50GHz OADM/Filters Transmission Field Trial of 115.2 Gb/s Coherent CoFDM Modem in the Telstra Network

Frank Ruhl[(1)], Luigi Sorbello[(1)], Darwin Evans[(2)], Luca Diaconescu[(2)], Dave Doucet[(2)], David Fasken[(3)], Michael Nimiczeck[(3)], John Sitch[(2)], Maurice O'Sullivan[(2)], Michel Belanger[(2)]

(1) Telstra, 242 Exhibition St, Melbourne, VIC 3000, Australia
(2) Nortel, Ottawa Carling Campus, 3500 Carling Ave., Nepean, ON, K2H 8E9, Canada
(3) Nortel, 4/380 St Kilda Rd, Melbourne, VIC 3004, Australia
Michel Belanger: michelb@nortel.com

Abstract: We present results of a 115.2Gb/s, coherent frequency division multiplexed (CoFDM) transceiver across a 2038km link in the Telstra network. The link had 50GHz channel spacing and the transceiver traversed four (50GHz spaced) OADM sites.

OCIS codes: (060.4510) Optical Communication; (060.0060) Fiber optics and optical communications

1. Introduction

In response to a measured network capacity growth of an approximate factor of three every three years [1] carriers are assessing the viability of deployment of 100 Gb/s transceivers [2]. To be effective such transceivers must demand no more than standard care during installation and tolerate physical plant uncertainties consistent with existing network deployments at lower rates. It is further required that transceivers be compatible with existing line (amplifiers) and flexibility equipment (filters, wavelength switches) in order to afford substantially the same or better static and dynamic network configurability. Finally the reduction in cost of transmission per managed bit compared with lower rates must provide enough incentive for deployment.

In this submission we report the error-free operation of a real time 115.2 Gb/s CoFDM transmission experiment across a 2038 km link in the Telstra network. The link is channelized at 50 GHz spacing and contains four 50Ghz OADM filters, one of which was used as an optical demultiplexer.

Work is presented as follows: first, we review conditions of the test, second we describe the system under test, and finally we present measured transmission performance results.

2. Nortel OME eDC100G and CPL system on Telstra Adelaide to Sydney route

The system was installed on an existing fibre route between Sydney and Adelaide. It contained OME 6500 terminal shelves hosting the prototype eDC100G-LH CoFDM modems as well as the 10X10GE Customer interfaces, and a commercial CPL optical line system.

The fibre link consisted of 27spans of G.652 fibre with an average loss of ~17.1.dB/span. The total system length was 2038 km. The average span length was ~ 75.5 km. The net fibre dispersion of the link was about 31550ps/nm. The link PMD was ~4.6ps. The geographical location of the route is shown in Figure 1.

Figure 1: eDC100G CoFDM trial route.

The eDC100G-LH is equipped with complete chromatic dispersion compensation in the electronic domain as described in [3]. As a result, no optical dispersion compensation was used in this trial. Moreover, with active electronic compensation for PMD, there was no need for an optical PMD compensator.

3. Nortel eDC100G modem description

Nortel's eDC100G-LH modem employs an extension of the technology that Nortel developed for its eDC40G Modem [4]. To achieve the required 115.2Gb/s data rate with a modem that operates at 14.4GBaud, 2 subcarriers spaced by ~ 20GHz are used. Each subcarrier is encoded with a dual polarization QPSK signal. As illustrated in Fig 2, the composite FDM spectrum is sufficiently compact to be very robust to 50GHz OADM concatenation. In commercial deployment, over ten 50GHz selective elements can be traversed by eDC100G-LH signal without significant impairment, making it appropriate for typical core and metro network deployment.

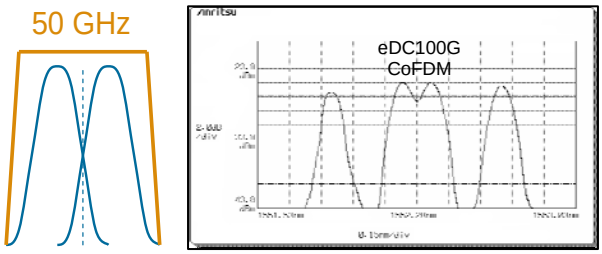

Figure 2: Two modulated carriers spaced 20 GHz apart within a 50-GHz ITU bandwidth.

The separation of the two closely spaced subcarriers is performed in the coherent receiver. As illustrated in Figure 3, the optical signal is mixed with the local oscillator to create electrical beat products after detection. The low-pass electrical filter applied to these beat products determines the portion of optical spectrum around the local oscillator frequency that is received. Much finer control of this optical spectrum shaping can be achieved using the baseband electrical filter than is feasible with optical filters.

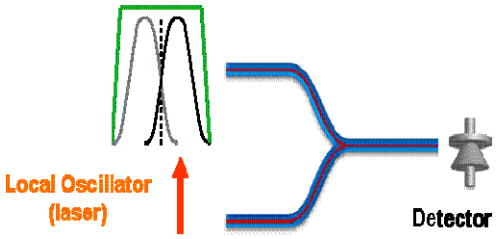

Figure 3: eDC100G Receiver concept

This electronic carrier selection is a much more cost effective and higher performing method than optical filtering.

In Figure 4, a view of the prototype eDC100G-LH Modem in its shelf is presented. The 10x10GE Client interface is located on the right side of the eDC100G Modem.

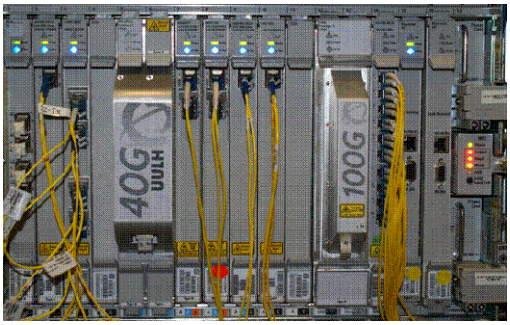

Figure 4: View of the OME 6500 Shelf equipped with eDC100G Modem and 10X10GE Client Interface

The CPL line system of this field trial is a commercially available line system comprising of a suite of EDFA and optical active and passive channelized filtering operating on a 50GHz optical grid in the C-Band. To improve the gain characteristic of the CPL system, Dynamic Gain Flattening Filters are deployed every 6 to 8 spans when long reach is required.

4. Field trial results

After installation of the CPL line system, the eDC100G-LH Modems were installed and their provisioning was optimized automatically by the CPL control system. System performance tests were then initiated.

As shown in Figure 5, in order to load the system with 100GE worth of traffic, the 10GE tributaries of the 10X10GE were looped back on each other (daisy chained). Performance was then measured on a 10GE test set.

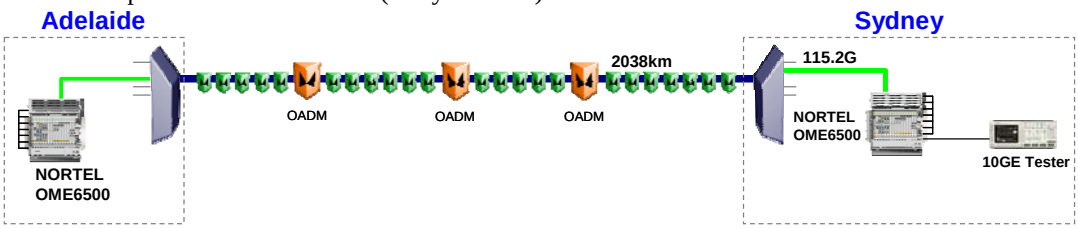

Figure 5: System configuration for testing

The 100 Gb/s transmission test operated error free for more than 68 consecutive hours over the 2038 km link. This verifies the long term stability of the 100 Gb/s link. The pre-FEC BER was better than 9E-04 (the FEC error correction threshold for error free traffic is 3.8E-03). No errors were observed. Thus significant margin was observed in this system.

In Figure 6 a screen view of the 10GE BER test set is presented.

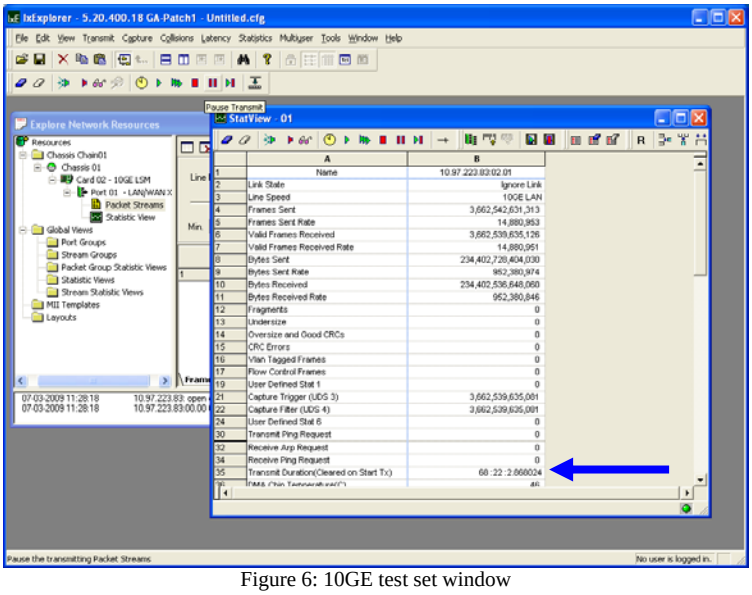

Figure 6: 10GE test set window

5. Summary

A 2038km field trial was successfully conducted on a commercial CPL DWDM line system with prototype 115.2 Gb/s modems in the Telstra network. The system used electronic dispersion and PMD compensation. The system carried test signals emulating 100GE of traffic. Results demonstrate the deployability of this technology on long haul networks.

6. References

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