Assignment-2

WDM System Model

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Sec:D

Semester:3-1

Submitted To:

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UAP,CSE

Introduction

Wavelength Division Multiplexing (WDM) is a fiber-optic transmission technique that enables the use of multiple light wavelengths (or colors) to send data over the same medium. Two or more colors of light can travel on one fiber, and several signals can be transmitted in an optical waveguide at differing wavelengths or frequencies on the optical spectrum.

Early fiber-optic transmission systems put information onto strands of glass through simple pulses of light. A light was flashed on and off to represent digital ones and zeros. The actual light could be of almost any wavelength—from roughly 670 nanometers to 1550 nanometers. Wavelength Division Multiplexing, or WDM, is a technique in fiber-optic transmission that uses multiple light wavelengths to send data over the same medium.

During the 1980s, fiber-optic data communications modems used low-cost LEDs to put near-infrared pulses onto low-cost fiber. As the need for information increased, so did the need for bandwidth. Early SONET systems used 1310 nanometer lasers to deliver 155 Mb/s data streams over very long distances.

But this capacity was quickly exhausted. Over time, advances in optoelectronic components allowed the design of systems that simultaneously transmitted multiple wavelengths of light over a single fiber, significantly increasing fiber capacity. Thus, WDM was born. Multiple high-bit-rate data streams of 10 Gb/s, 40 Gb/s, 100 Gb/s, 200 Gb/s and more recently, 400 Gb/s and 800 Gb/s, each carrying distinct throughputs, can be multiplexed over a single fiber.

Related literature

Reference:

Author:

Ling Li

Nortel Networks Limited, Billerica, MA, USA

A.K. Somani

Department of Electrical and Computer Engineering, Iowa State University, Ames, IA, USA

They study the effect of multiple fibers in circuit-switched all-optical wavelength-routing networks. A new analytical model-the multifiber link-load correlation (MLLC) model-is developed to evaluate the blocking performance of such networks. To our knowledge, the MLLC model is the first model that takes the link-load correlation into account in multifiber WDM networks. We show that the MLLC model is accurate for a variety of network topologies by comparing the analytical results to simulation results. We observed that a small number of fibers are sufficient to guarantee high network performance in multifiber WDM networks.

WDM System Model

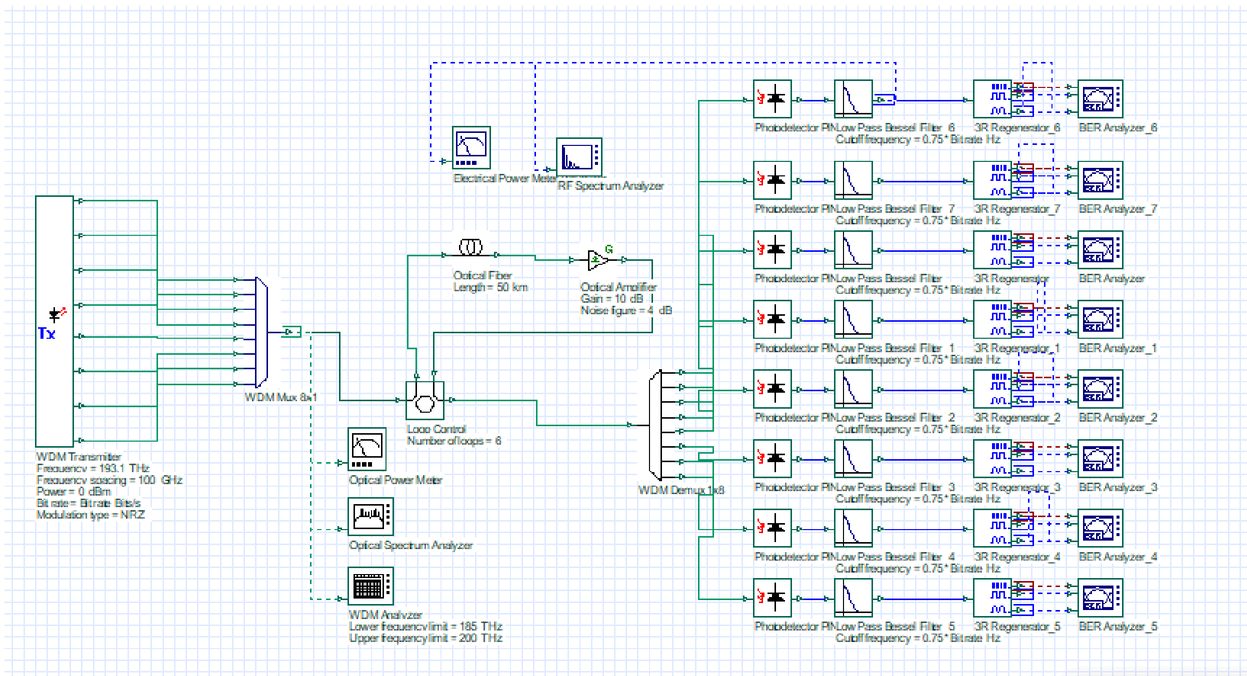


Fig -1

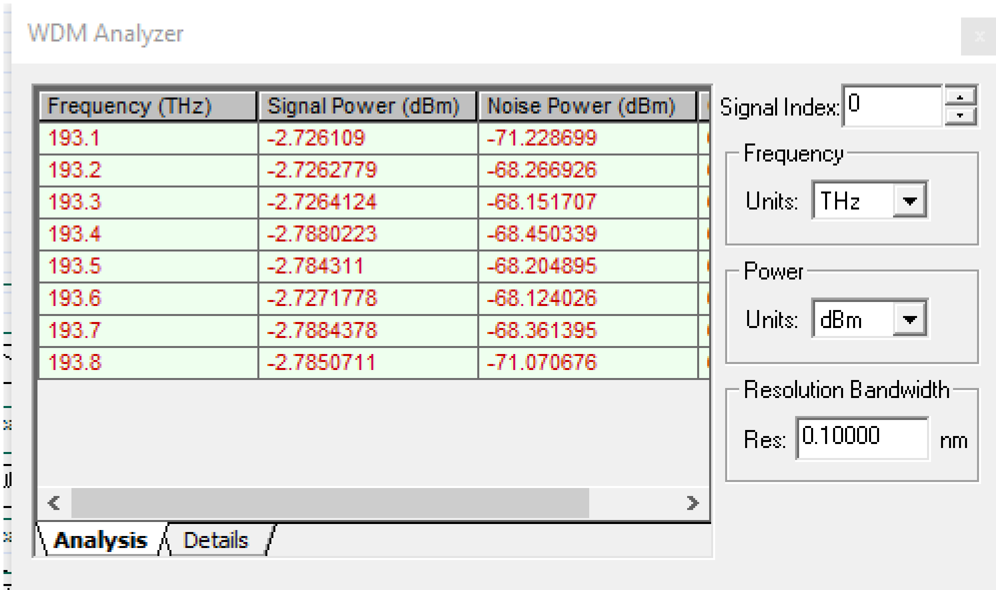
Methodology

As is seen in Fig -1, the WDM transmitter of 8 channels is connected to a WDM Mux (8x1). The WDM Mux is attached to an Optical Power Meter, an Optical Spectrum Analyzer, and a WDM Analyzer to figure out necessary findings. A loop control has been used and joined to an Optical Fiber and Optical Amplifier. This is then directed to WDM Demux (1x8) with 8 channels, each of them consisting of a Photodetector PIN, a Low Pass Bessel Filter, a 3R Generator, and a BER Analyzer. Additionally, an RF Spectrum

Parameters

Device	Parameters
WDM transmitter	Frequency- 193.1 THz to 193.8THz
Optical fiber	80 km
Optical amplifier	Gain, 10 dB
WDM MUX 8x1	8x1
WDM DeMUX	8x1
Photodetector pin	Dark current, 10
Low pass bessel filter	Cut off frequency, 0.75 bit rate Hz
Loop control	3 loops
Bits/s	5000000000
channels	8

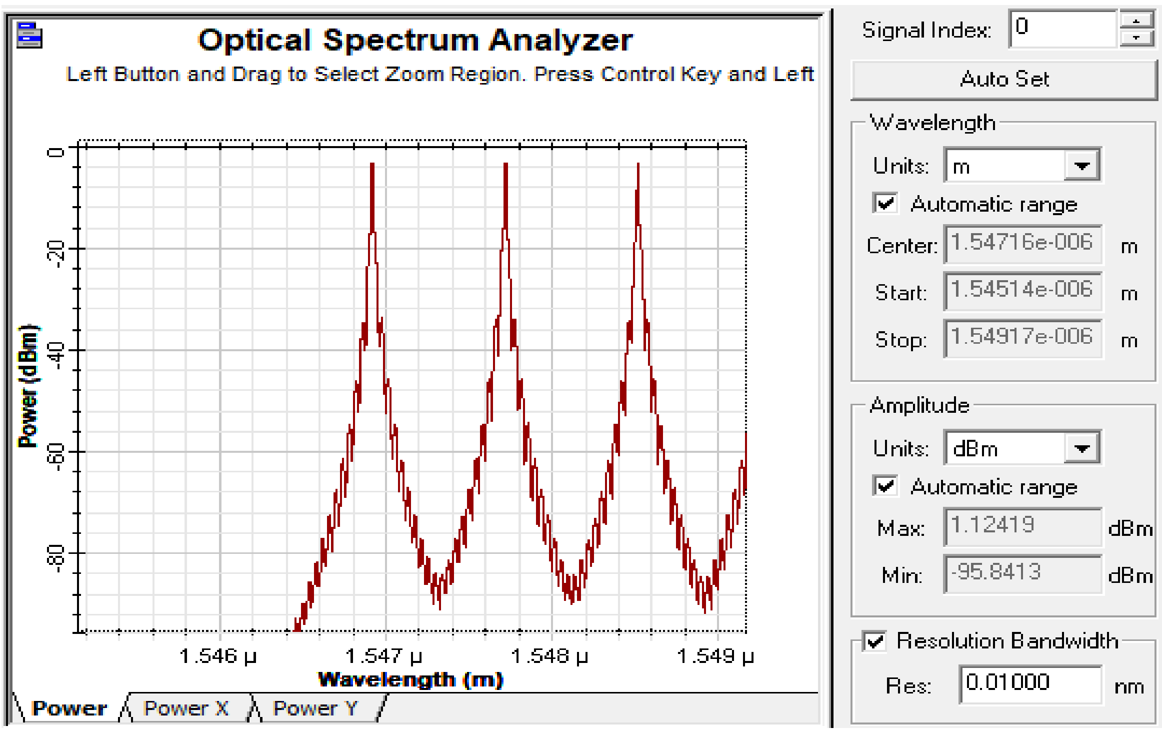
WDM Analyzer



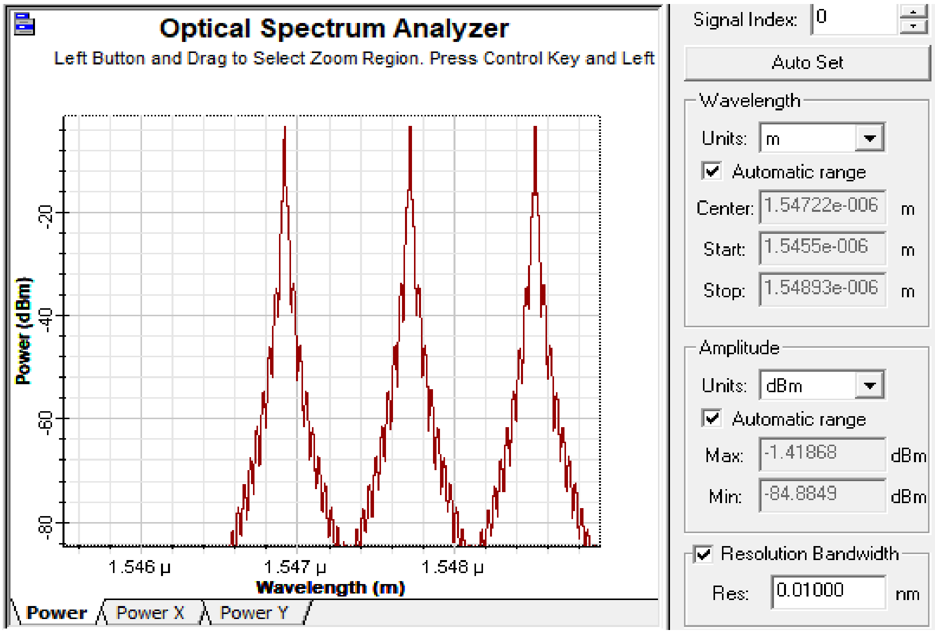
Frequency (THz)	Signal Power (dBm)	Noise Power (dBm)
193.1	-2.726109	-71.228699
193.2	-2.7262779	-68.266926
193.3	-2.7264124	-68.151707
193.4	-2.7880223	-68.450339
193.5	-2.784311	-68.204895
193.6	-2.7271778	-68.124026
193.7	-2.7884378	-68.361395
193.8	-2.7850711	-71.070676

Optical spectrum analyser graphs for 10 different iterations at Tx-

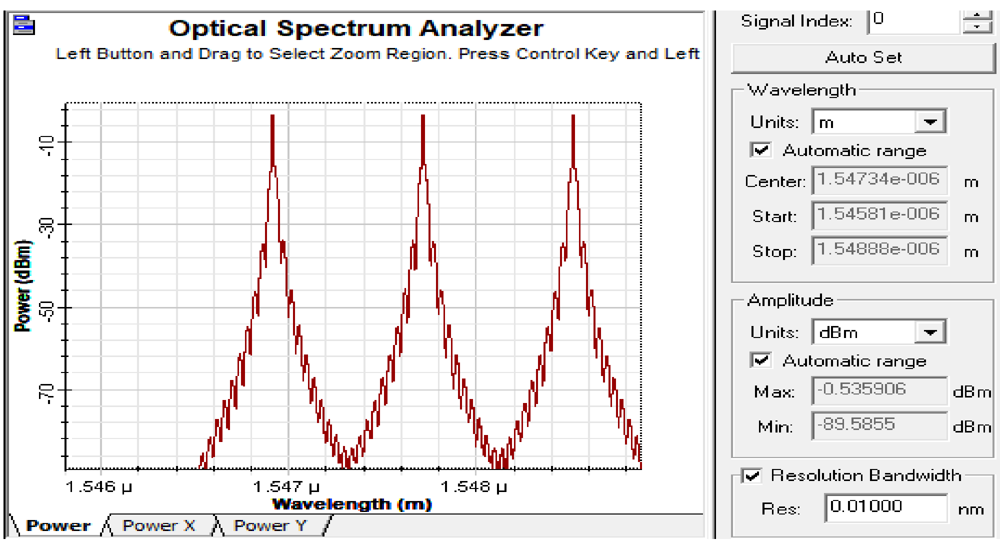
Iteration-1



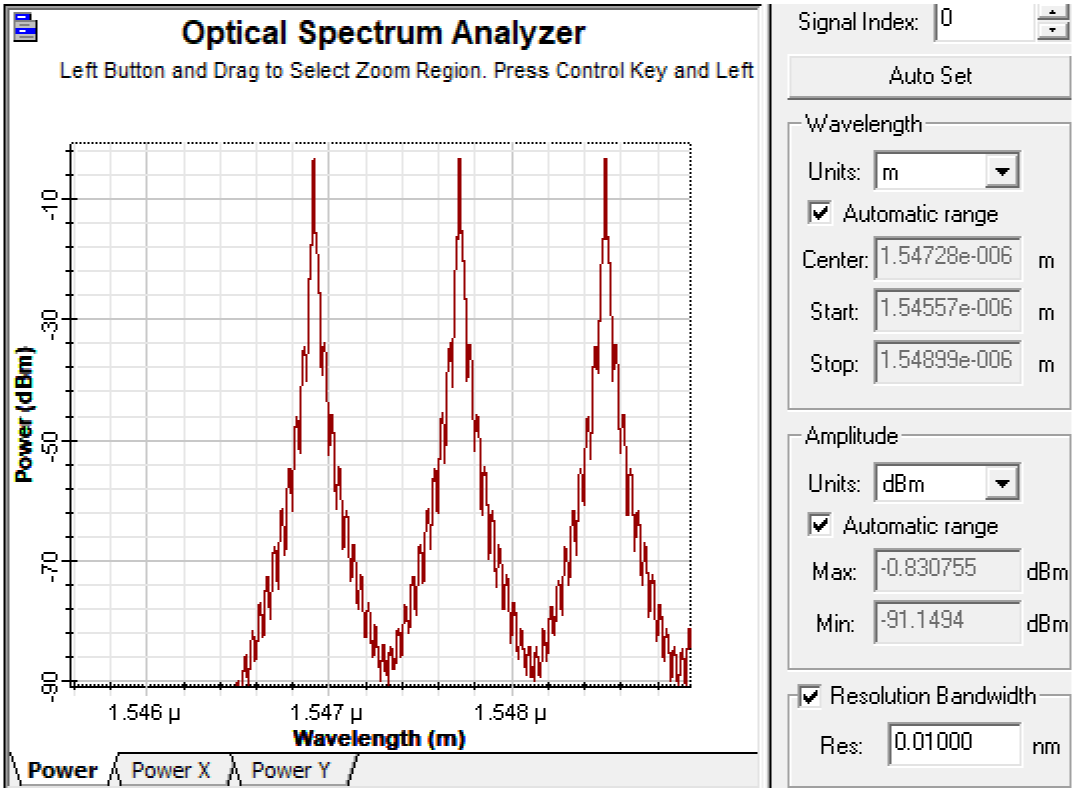
Iteration-2



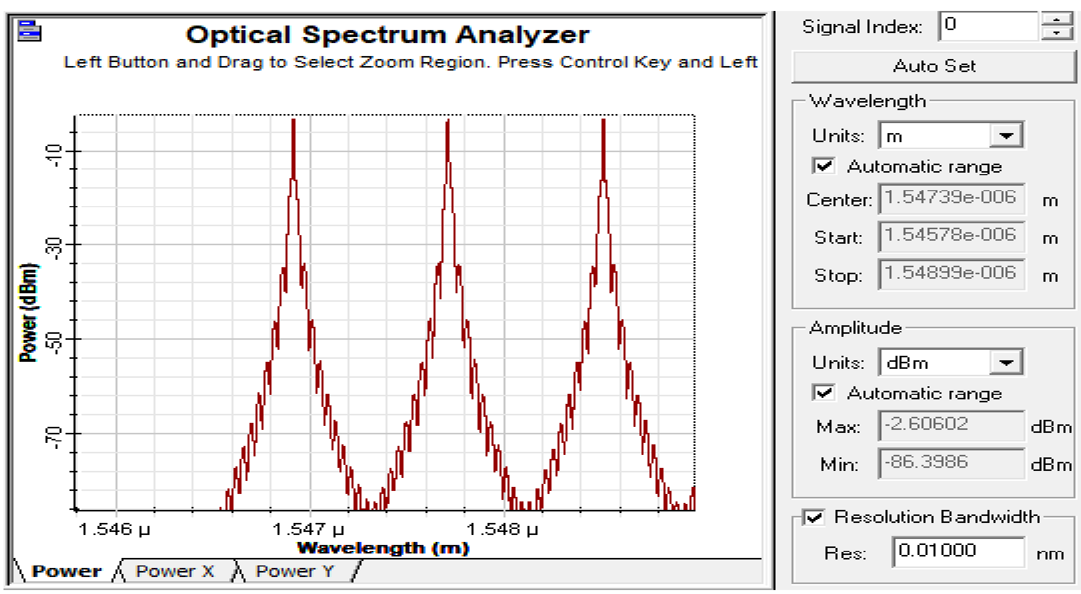
Iteration-3



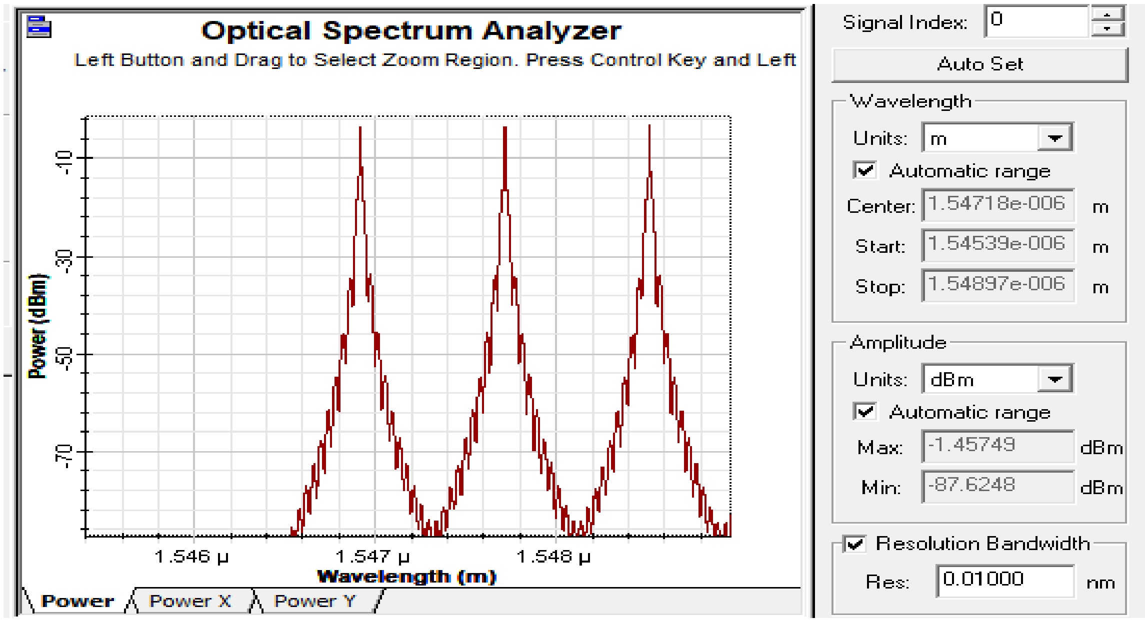
Iteration-4



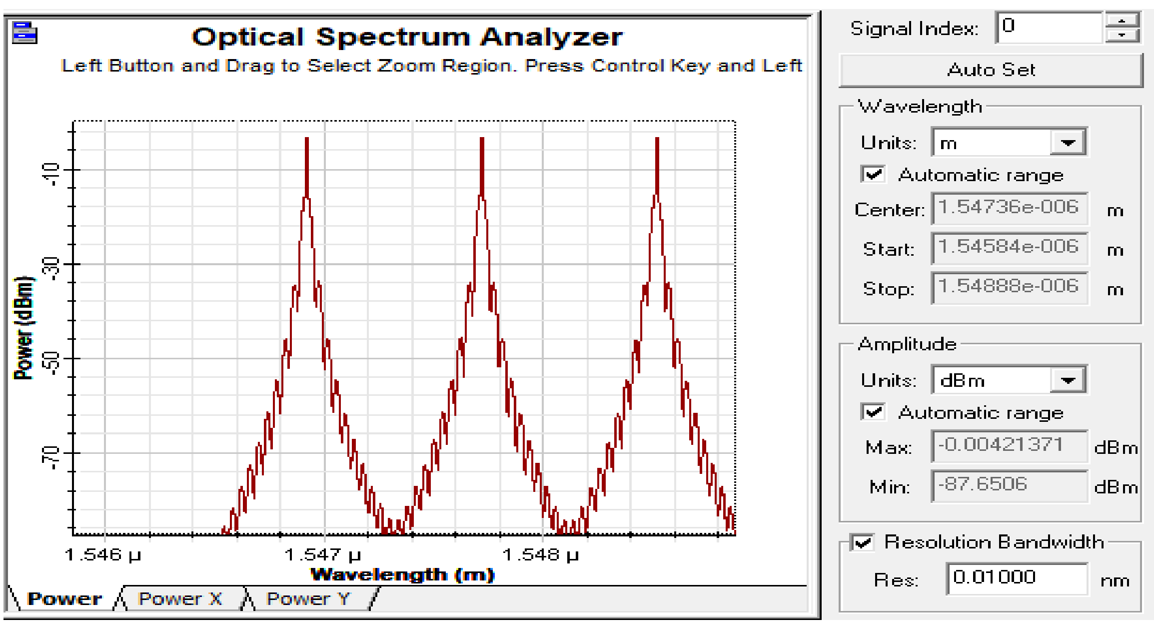
Iteration-5



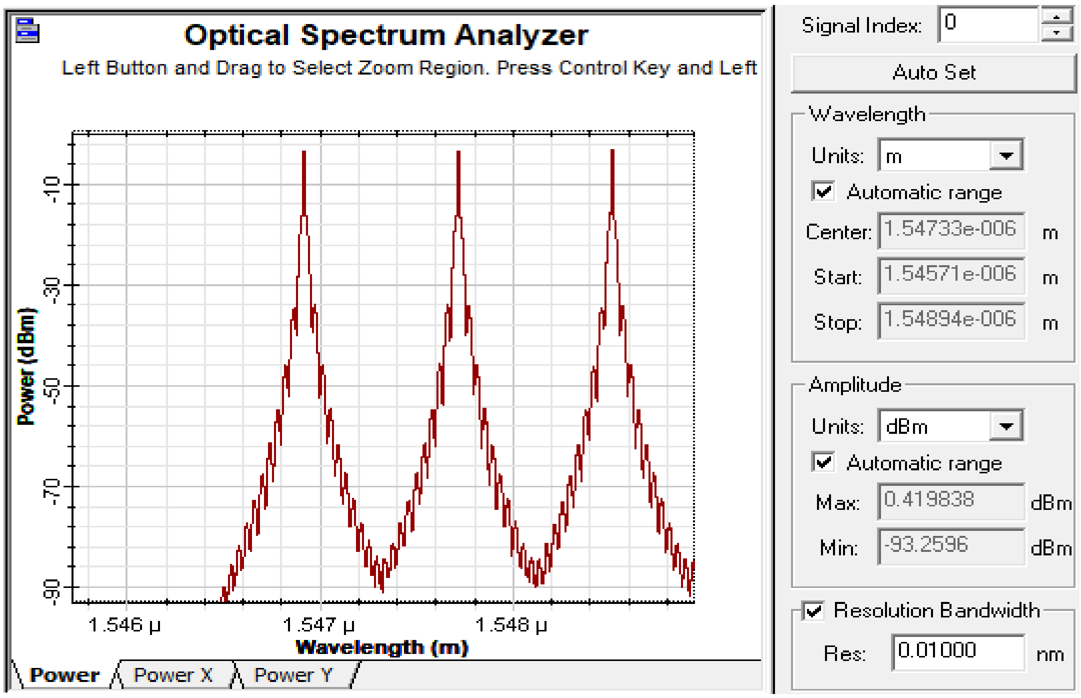
Iteration-6



Iteration-7



Iteration-8

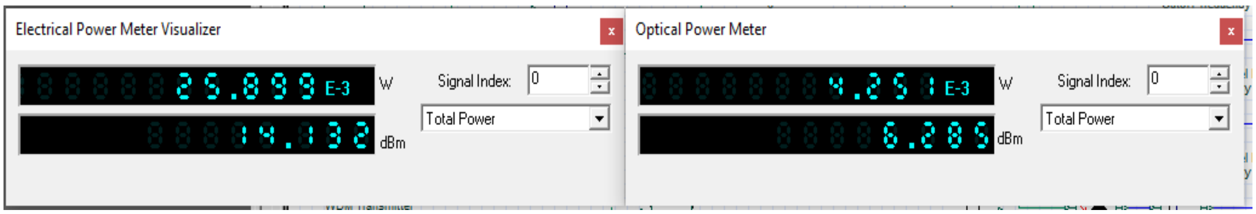


Optical Spectrum Analyzer
Left Button and Drag to Select Zoom Region. Press Control Key and Left
Power (dBm)
-10
-30
-50
-70
-90
1.546 µ
1.547 µ
1.548 µ
Wavelength (m)
Power
Power X
Power Y
Signal Index: 0
Auto Set
Wavelength
Units: m
Automatic range
Center: 1.54733e-006 m
Start: 1.54571e-006 m
Stop: 1.54894e-006 m
Amplitude
Units: dBm
Automatic range
Max: 0.419838 dBm
Min: -93.2596 dBm
Resolution Bandwidth
Res: 0.01000 nm

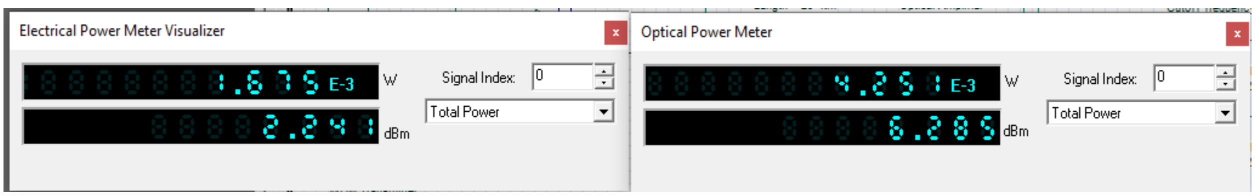
Power meter (Tx - Rx)

TX RX

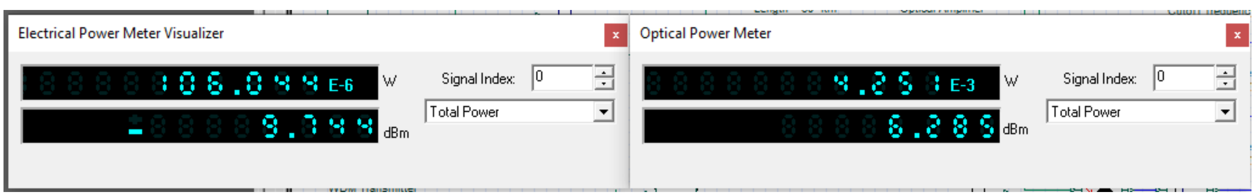
Iteration-1



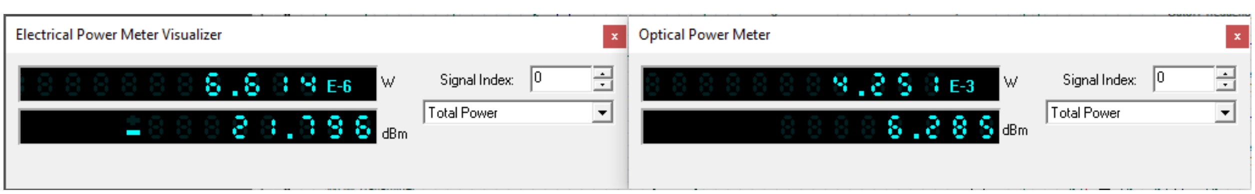
Iteration-2



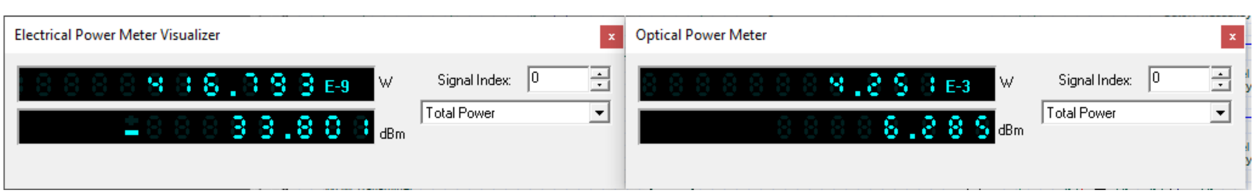
Iteration-3



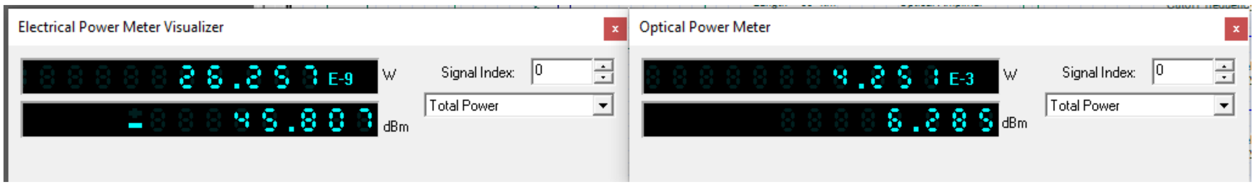
Iteration-4



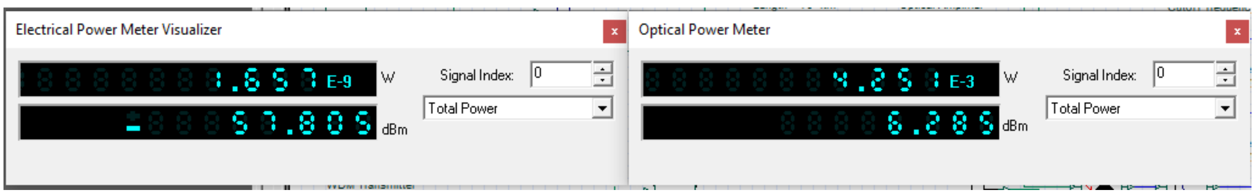
Iteration-5



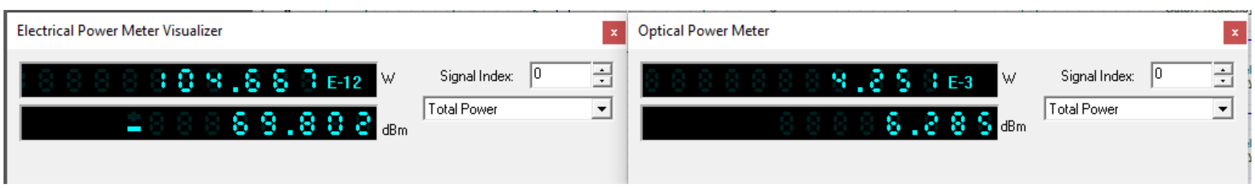
Iteration-6



Iteration-7

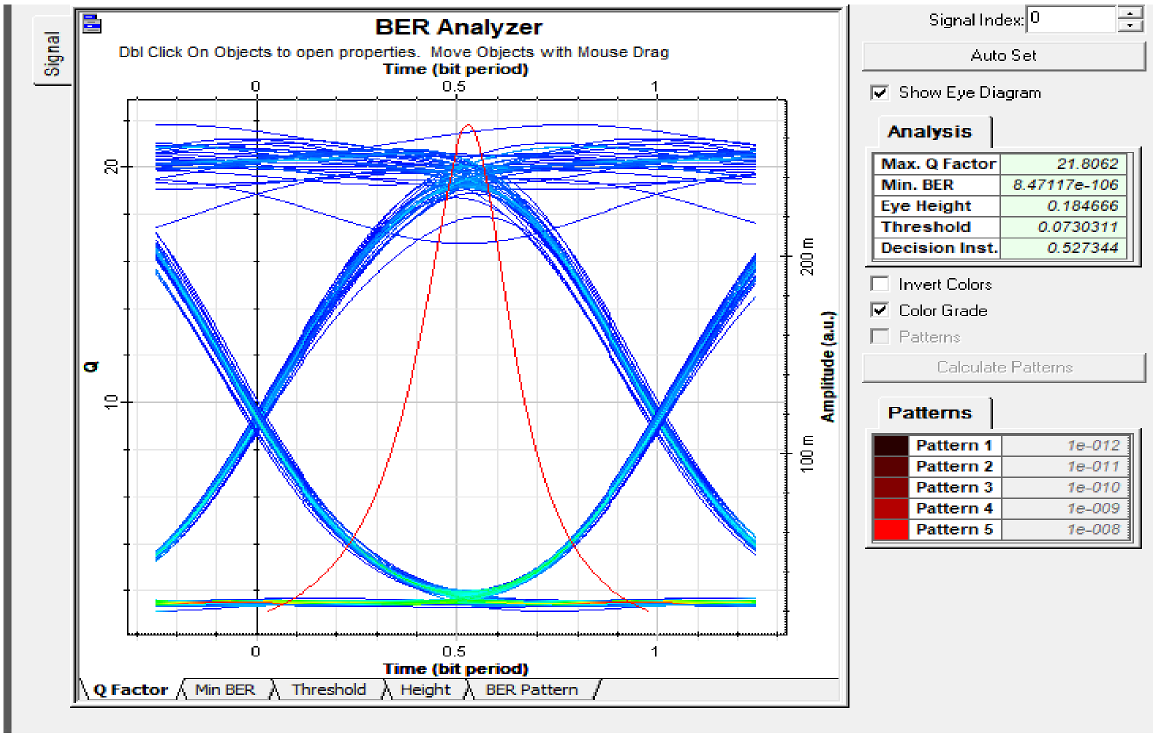


Iteration-8



BER Analyzer(Eye diagram)

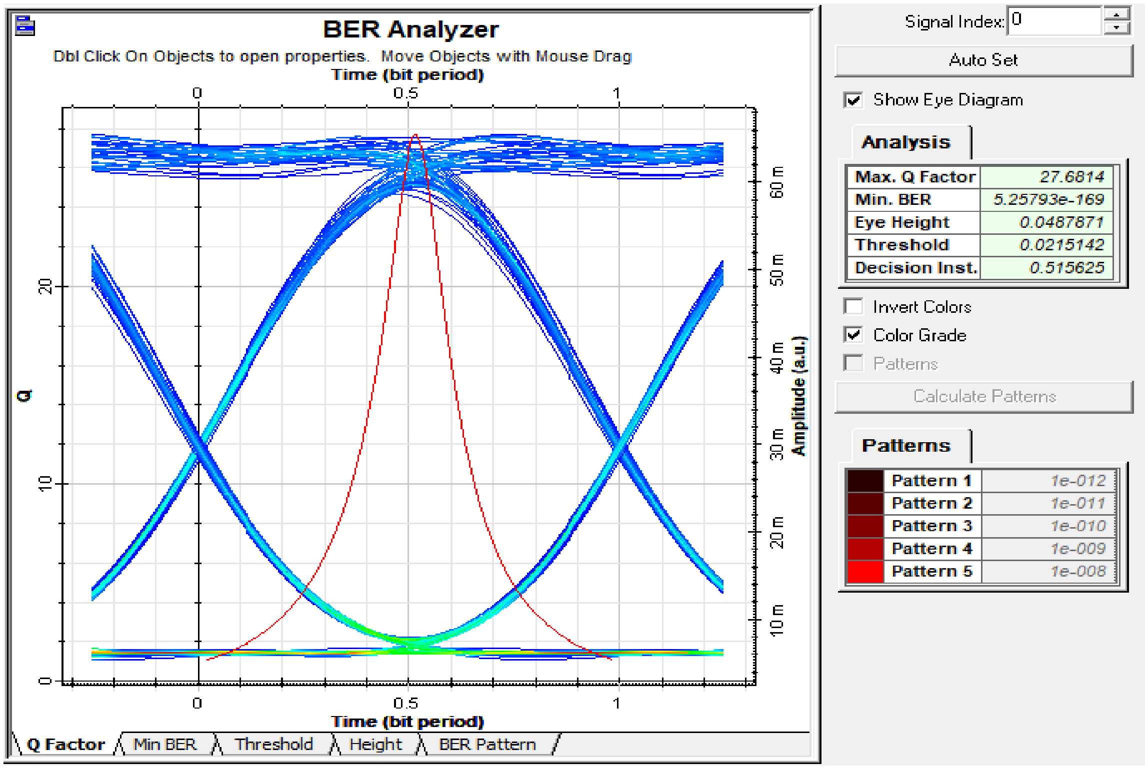
Iteration 1:



Max Q-factor : 21.8062

Min.BER: 8.47117e^{-106}

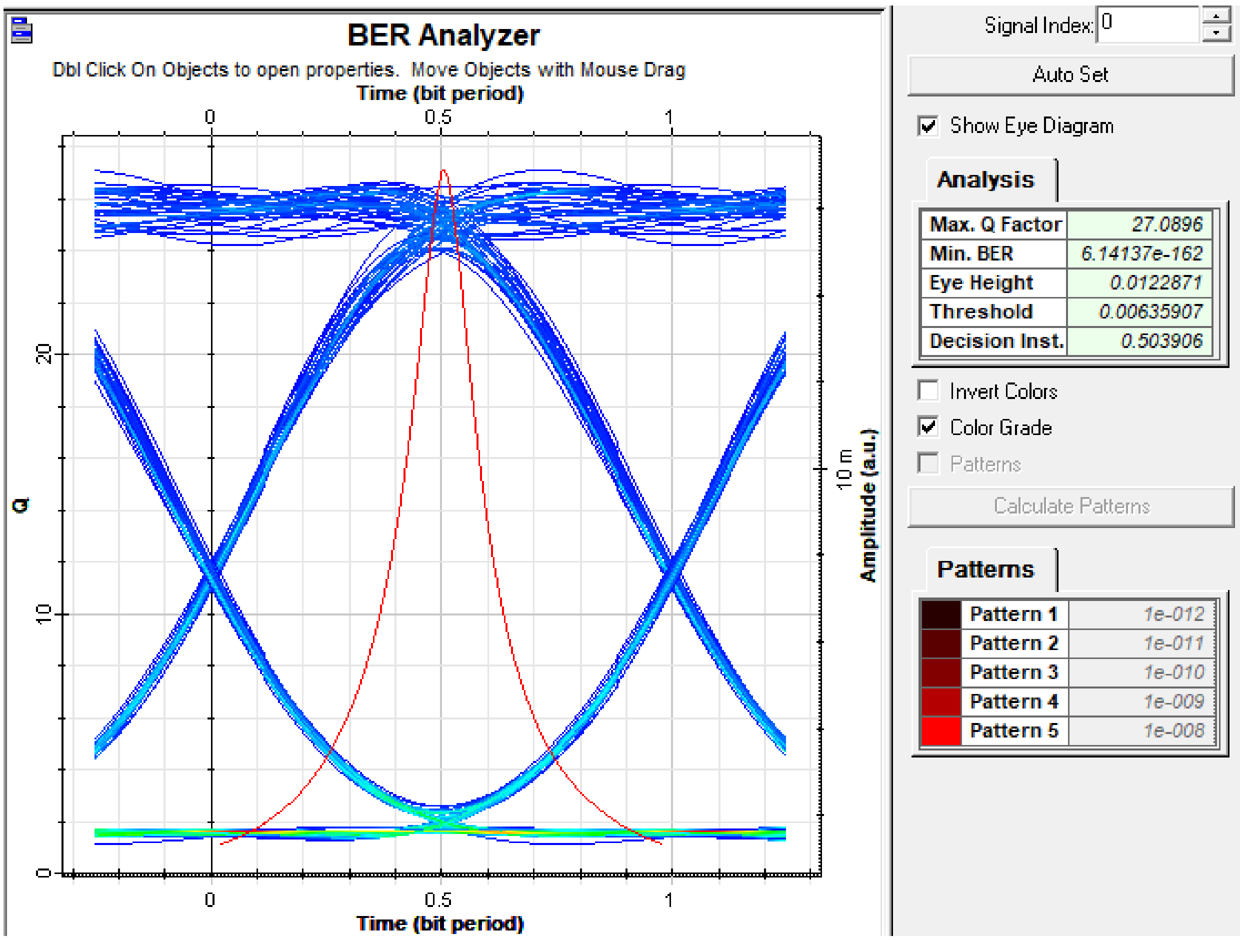
Iteration 2:



Max Q-factor :27.6814

Min.BER: 5.25793e^{-169}

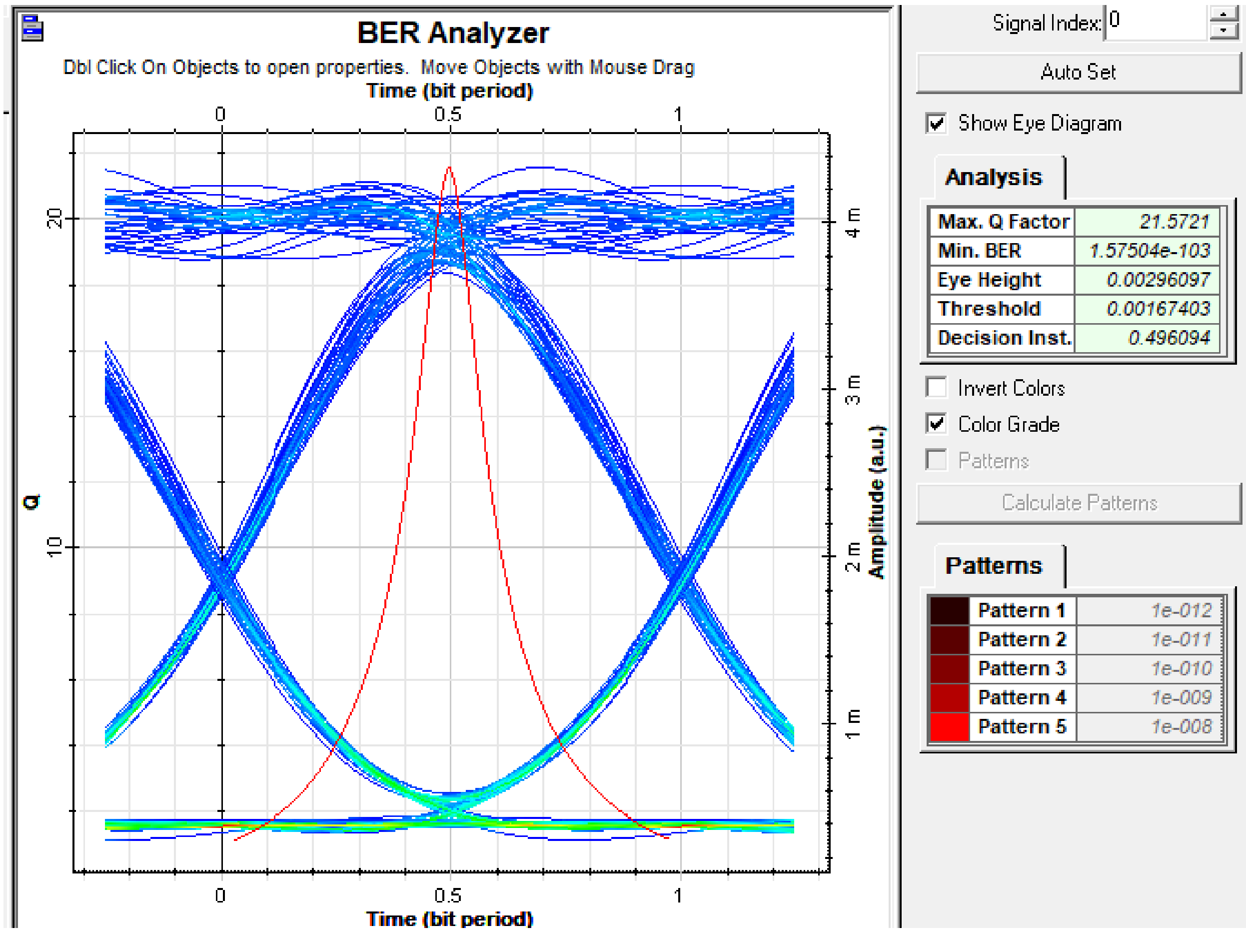
Iteration 3:



Max Q-factor :27.0896

Min.BER: $6.14137e^{-162}$

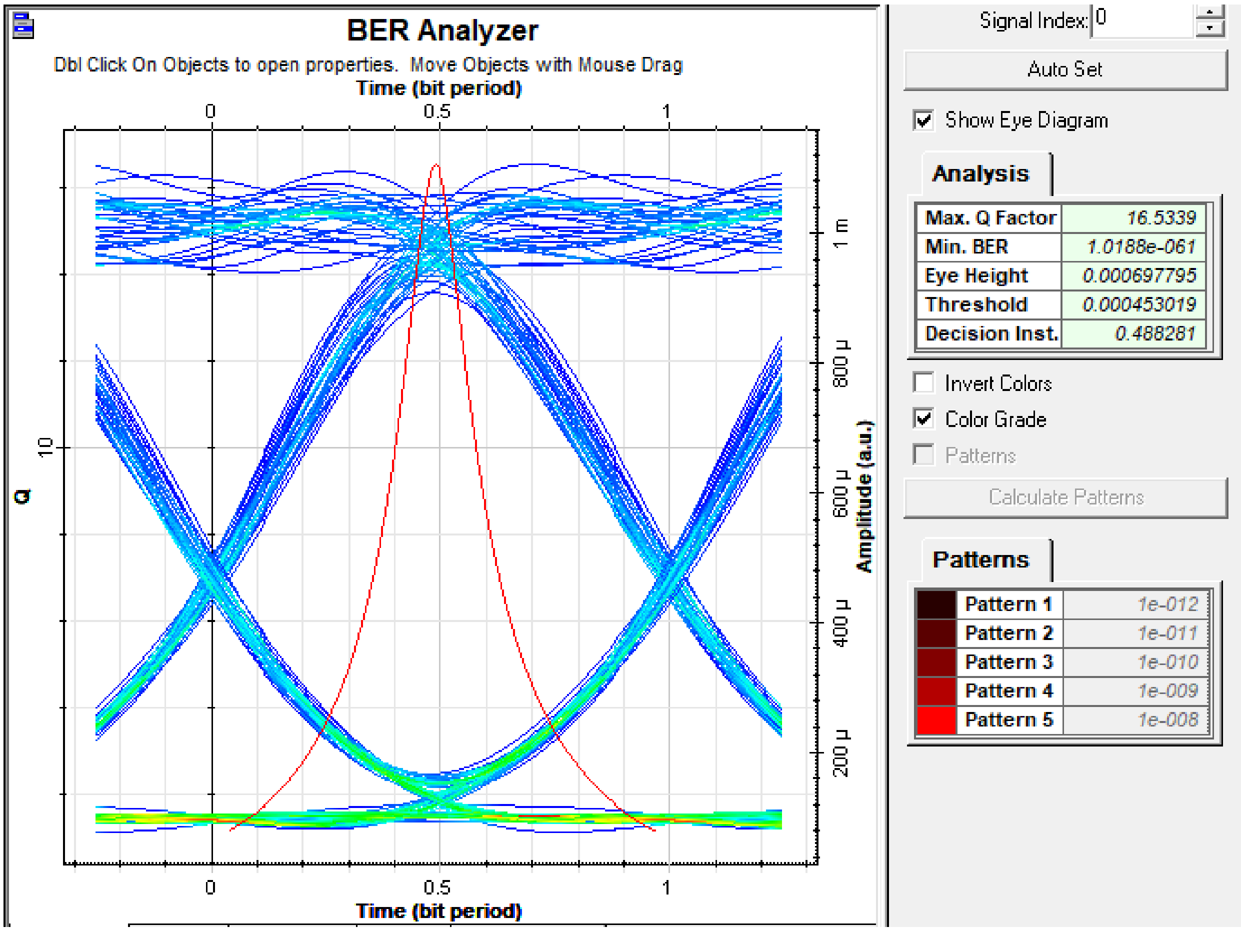
Iteration 4:



Max Q-factor :21.5721

Min.BER: 1.57504e^{-103}

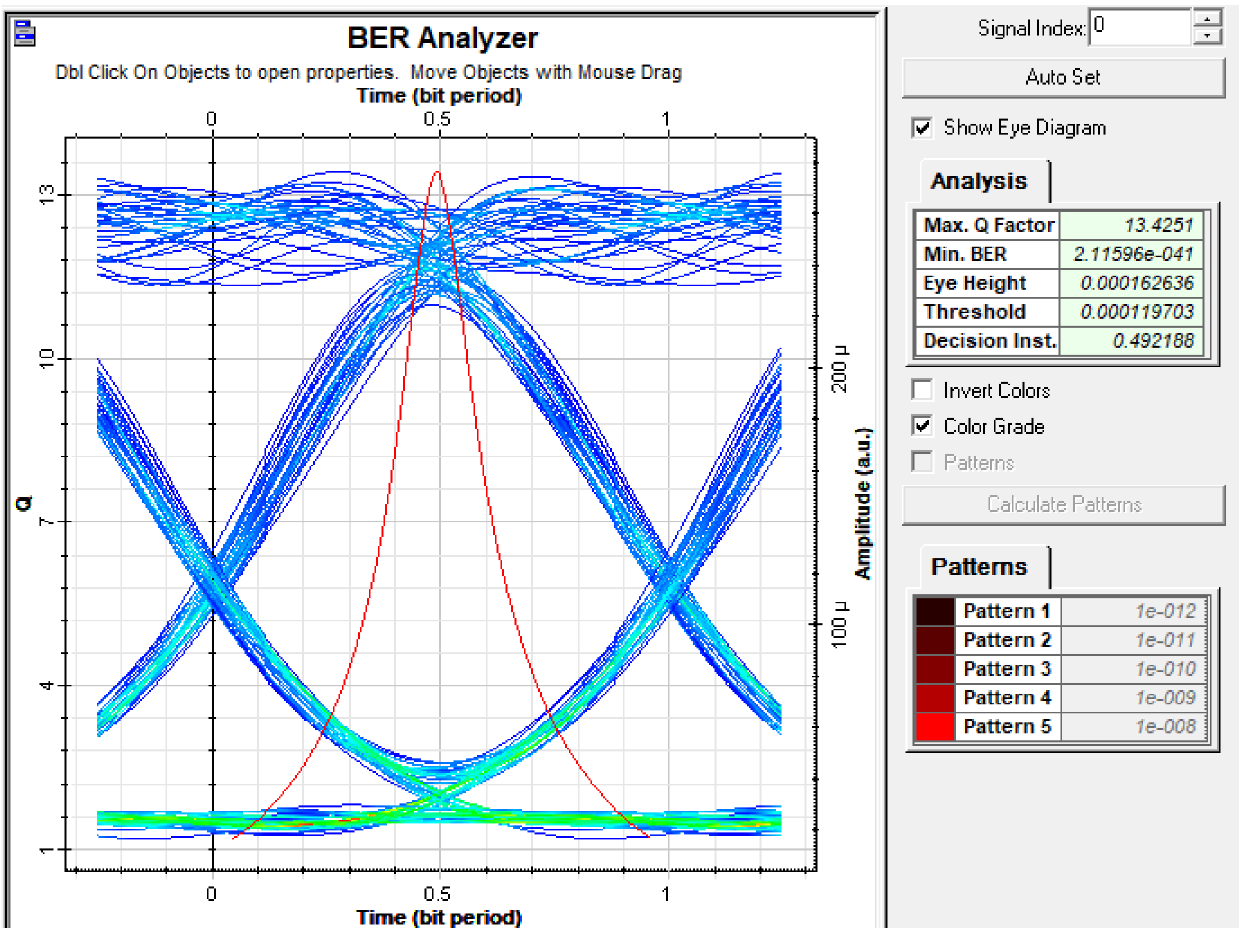
Iteration 5:



Max Q-factor :16.5359

Min.BER: 1.0188e^{-061}

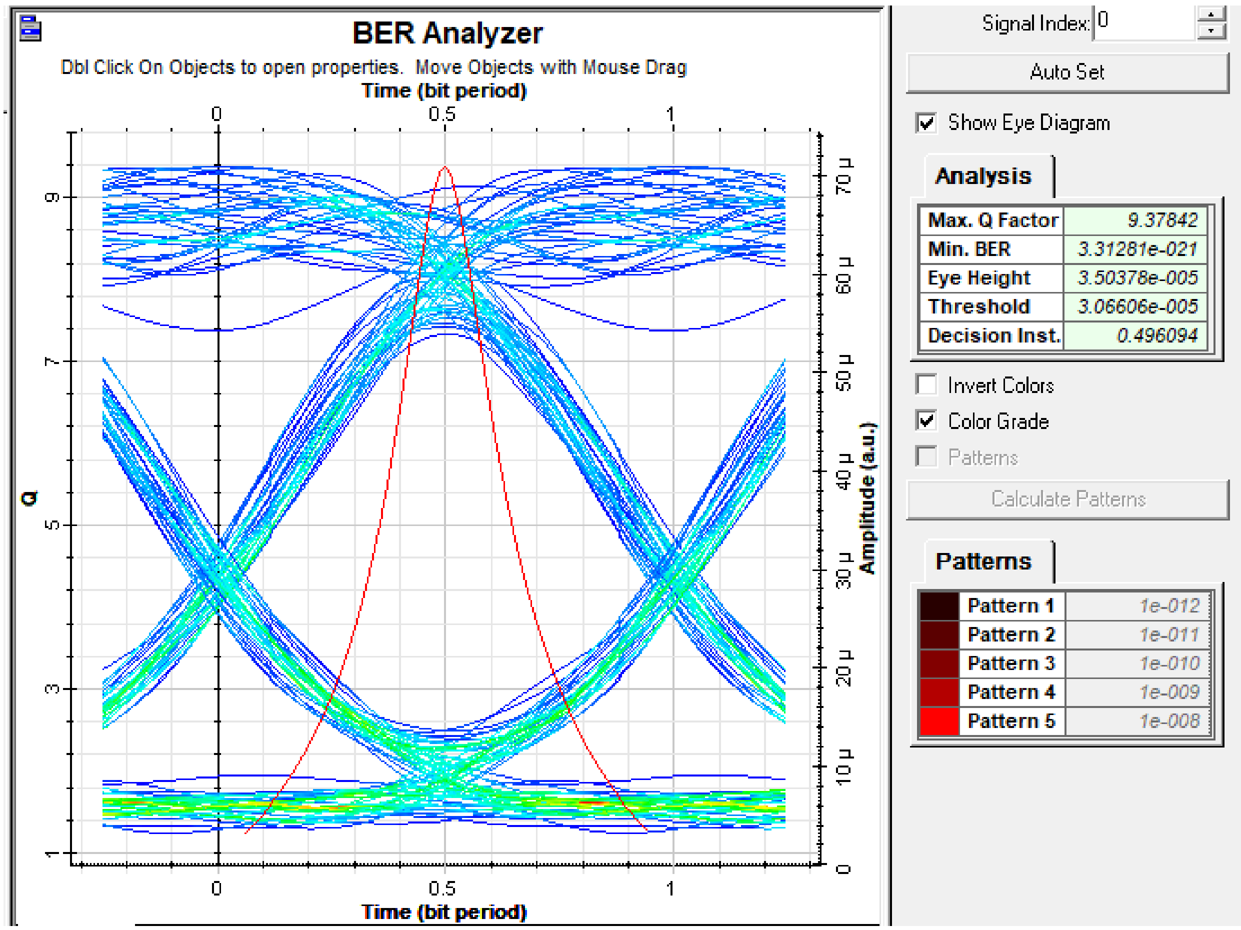
Iteration 6:



Max Q-factor :13.4251

Min.BER: 2.11596e^{-041}

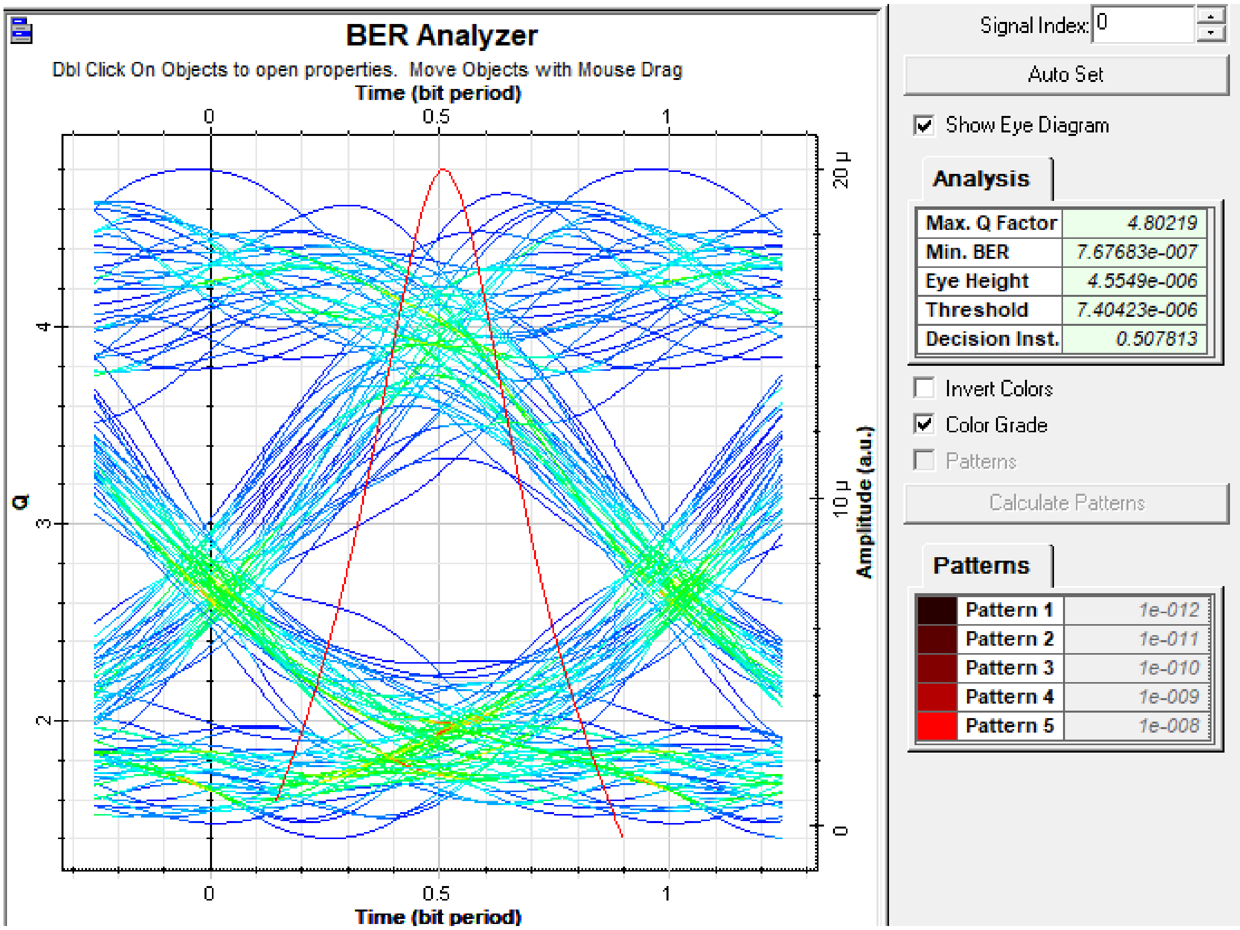
Iteration 7:



Max Q-factor :9.37842

Min.BER: 3.31281e^{-021}

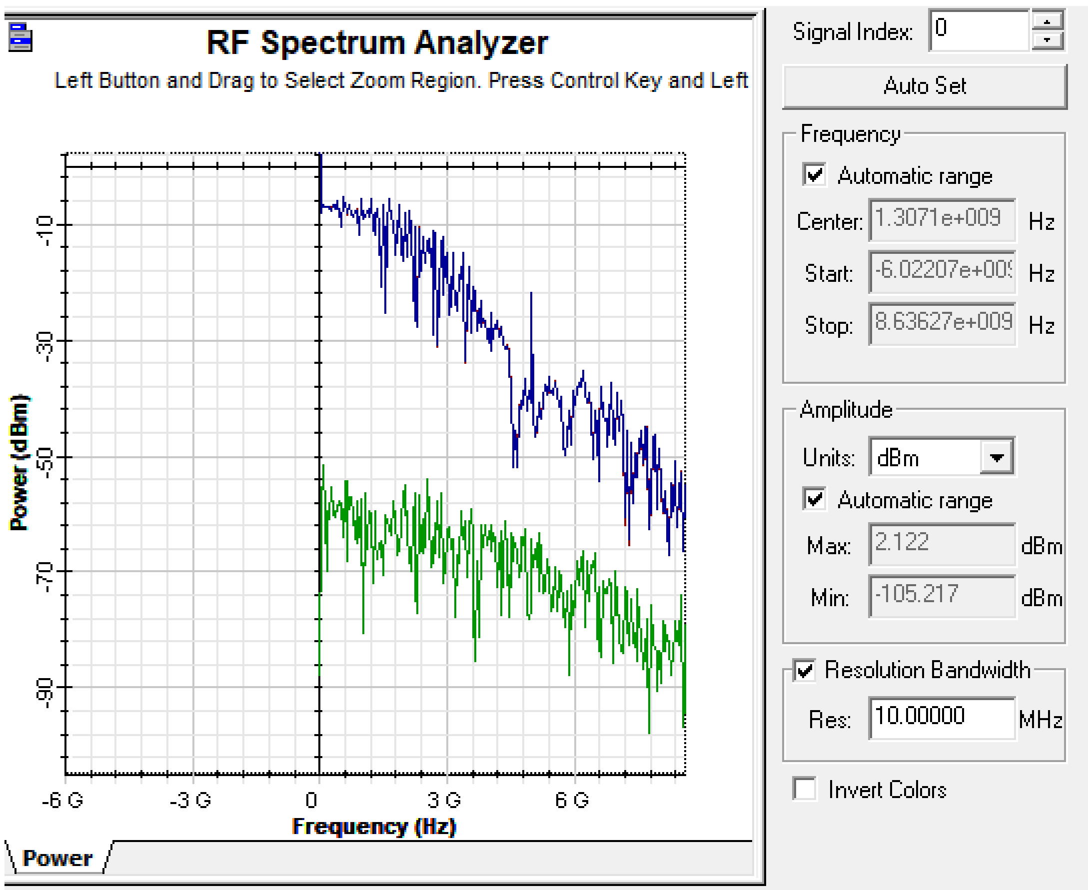
Iteration 8:



Max Q-factor :4.80219

Min.BER: 7.67683e^{-007}

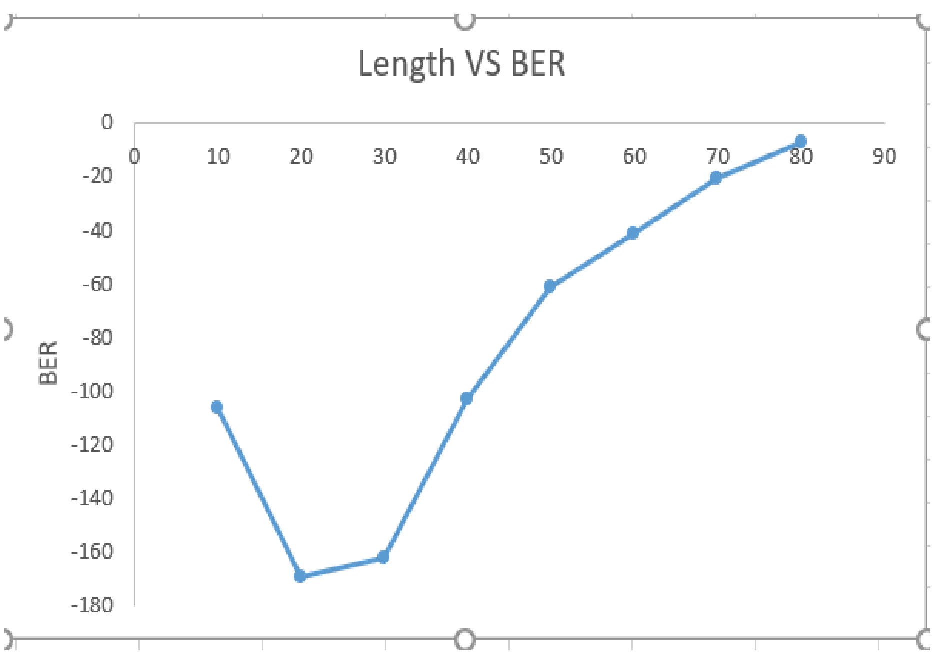
RF spectrum analyzer (system bandwidth)



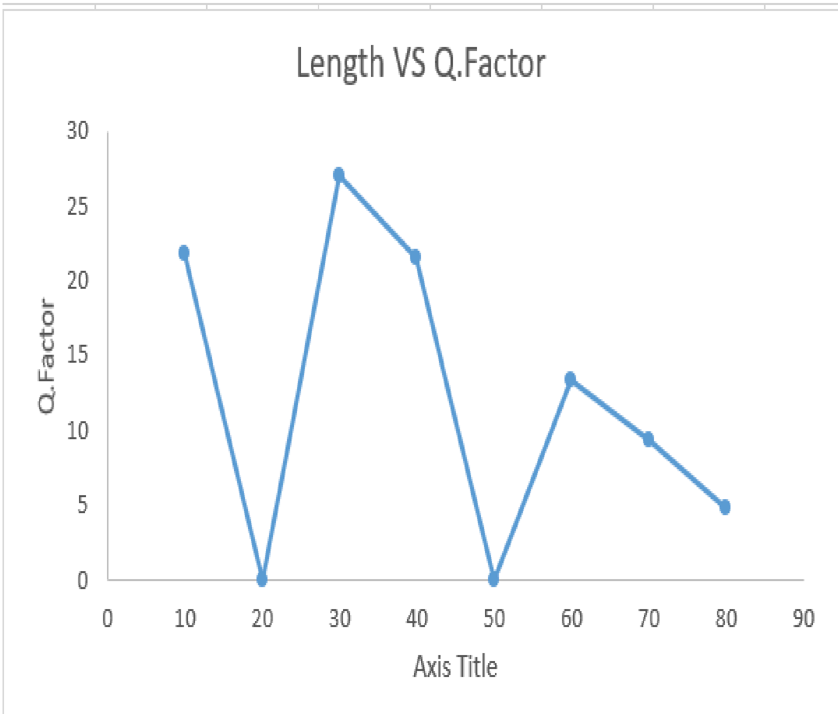
Graph Data

Length	BER	Q.Factor
10	-106	21.80
20	-169	27.68
30	-162	27.09
40	-103	21.57
50	-061	16.53
60	-041	13.42
70	-021	9.37
80	-007	4.80

Length VS BER



Length VS Q.Factor



Iteration 4:

Iteration 5:

Iteration 6:

Iteration 7 :