Or Bahari #51277200

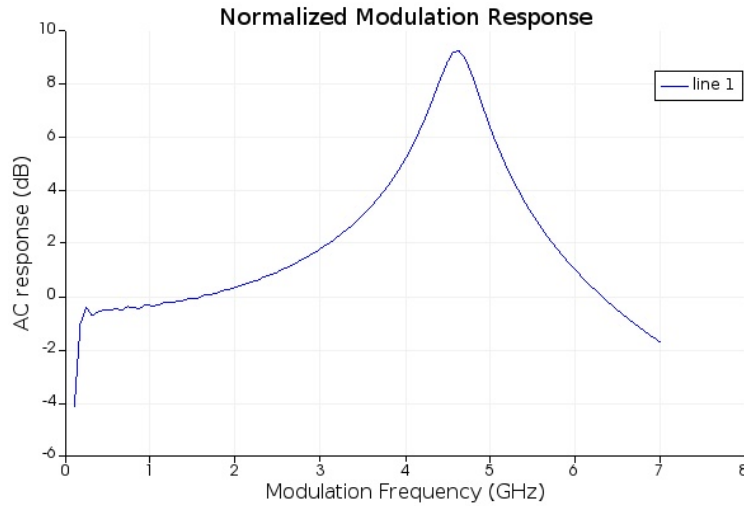University of British Columbia, Canada

orbahari@mail.tau.ac.il
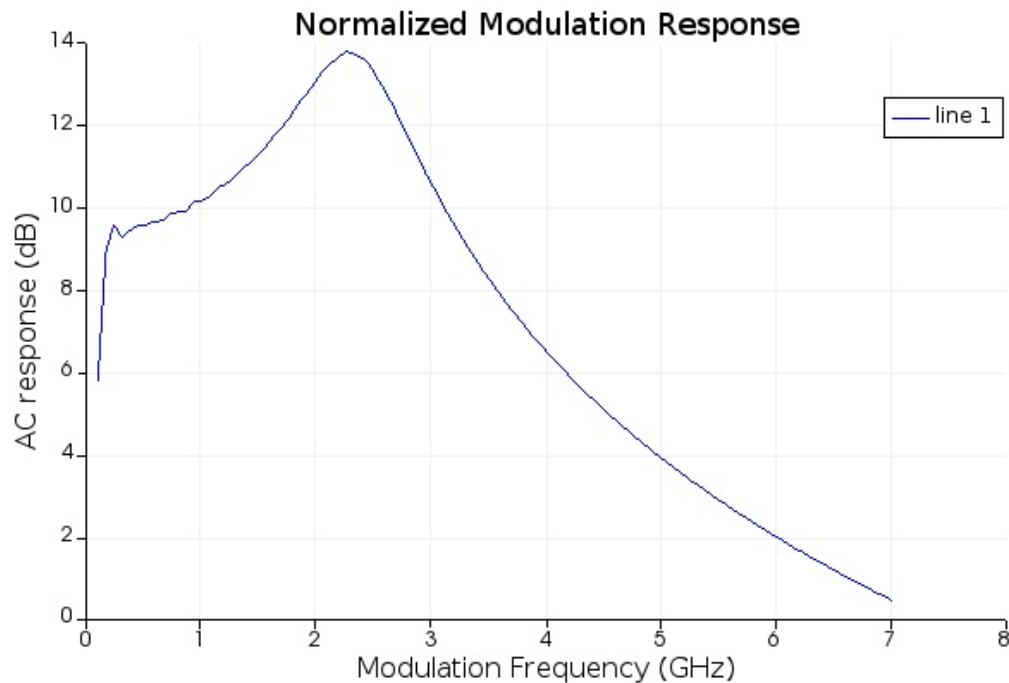
ELEC413 – Lumerical Modulation HW

Modulation Response:

No Saturation, compression factor 1e-100.

I=16.5mA:

Frequency 4.63Ghz, amplitude 9.23.

I=6.6mA:

Or Bahari #51277200

University of British Columbia, Canada

orbahari@mail.tau.ac.il

Frequency 2.26GHz, amplitude 13.78.

Analytic Calculation – matlab code:

freq_i2 =

  2.1785e+09

>> freq_i5

freq_i5 =

  4.3569e+09

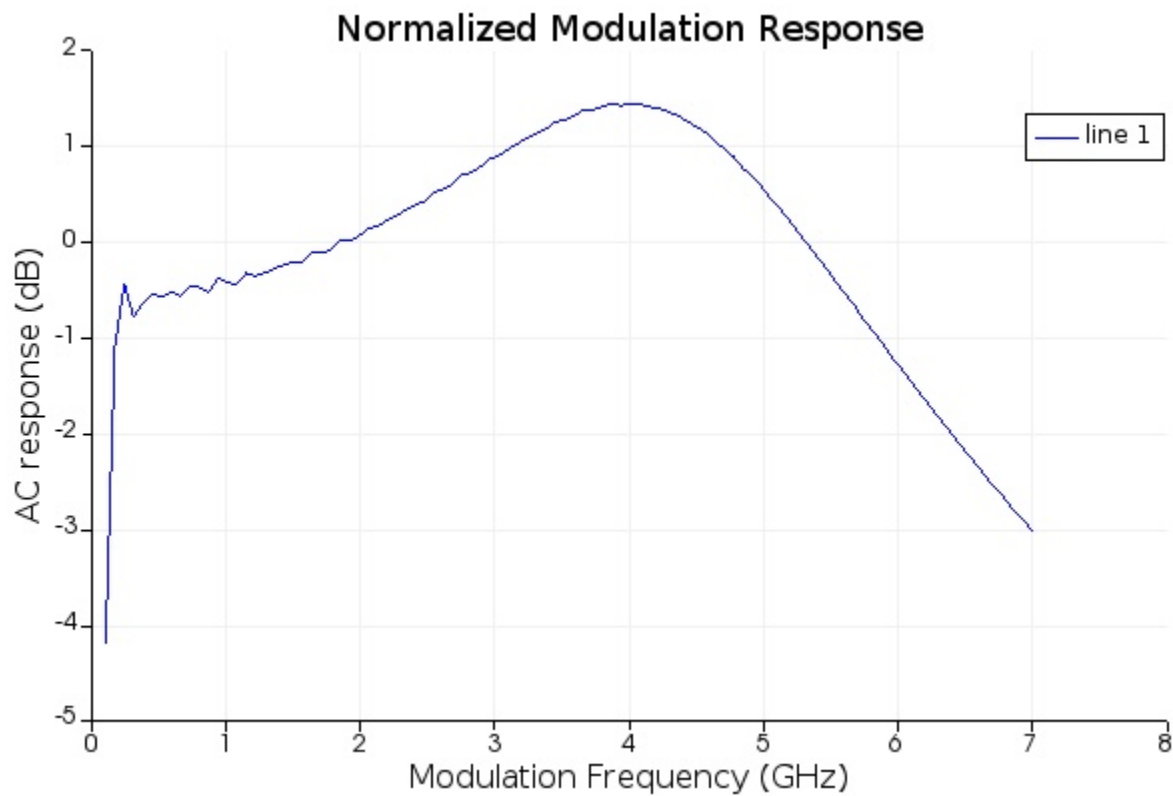Results in the same result – 4.3Ghz!

Code:

```
clear all;
clc

tau = 3e-12;
c = 3e8; %m/sec
n = 3.6; %group index
G = 1e4;
Width = 2e-6; %m
Length = 100e-6; %m
t = 1e-6;
V = Width*Length*t;%m^3
A = G*V*(n/c);
P0_i2 = (2.4e-3/4.27e-8)/V;
P0_i5 = (9.6e-3/4.27e-8)/V;
omega0_i2 = sqrt((A*(c/n*P0_i2)/tau));
omega0_i5 = sqrt((A*(c/n*P0_i5)/tau));
freq_i2 = omega0_i2/(2*pi);
freq_i5 = omega0_i5/(2*pi);
>>
freq_i2; freq_i5;
```

Or Bahari #51277200
University of British Columbia, Canada
orbahari@mail.tau.ac.il

Mod.Response with dumping:
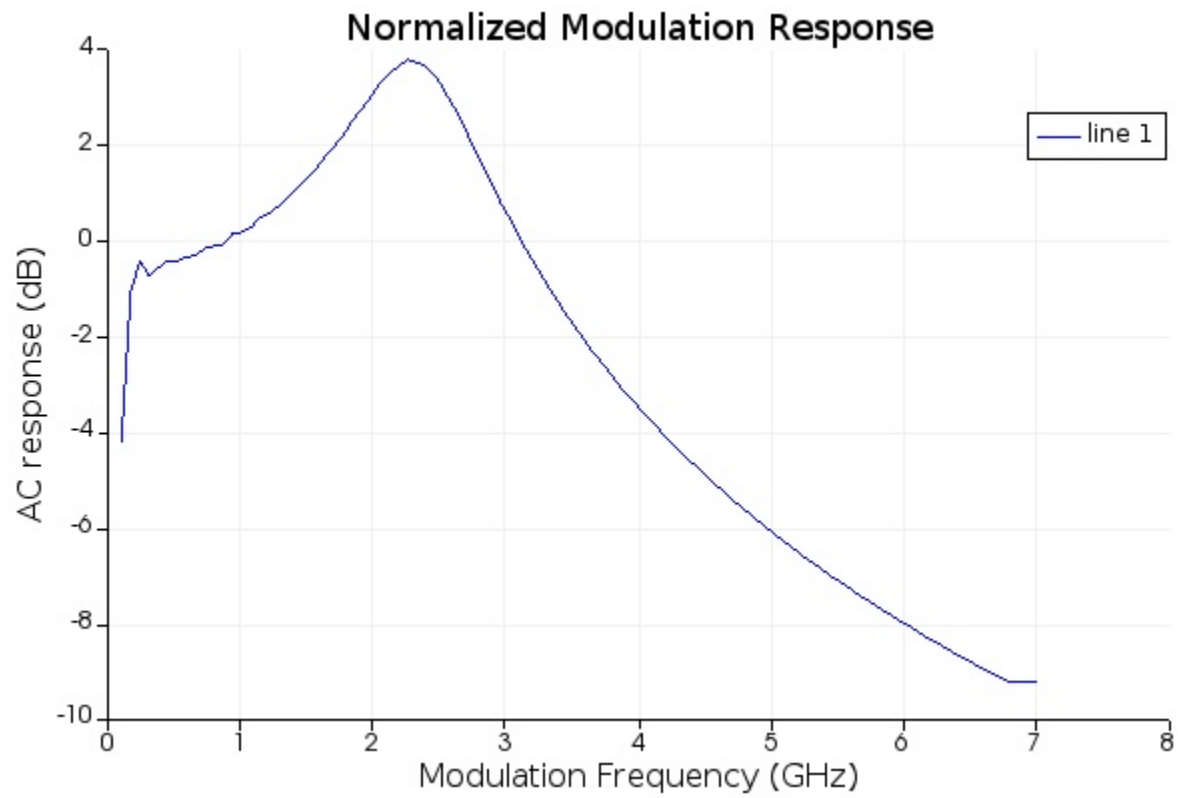
With compression factor 4e-23 we get:

I=16.5mA:

Frequency 3.93Ghz, amplitude 1.42. amplitude 6 times lower with gain compression.

I=6.6mA:
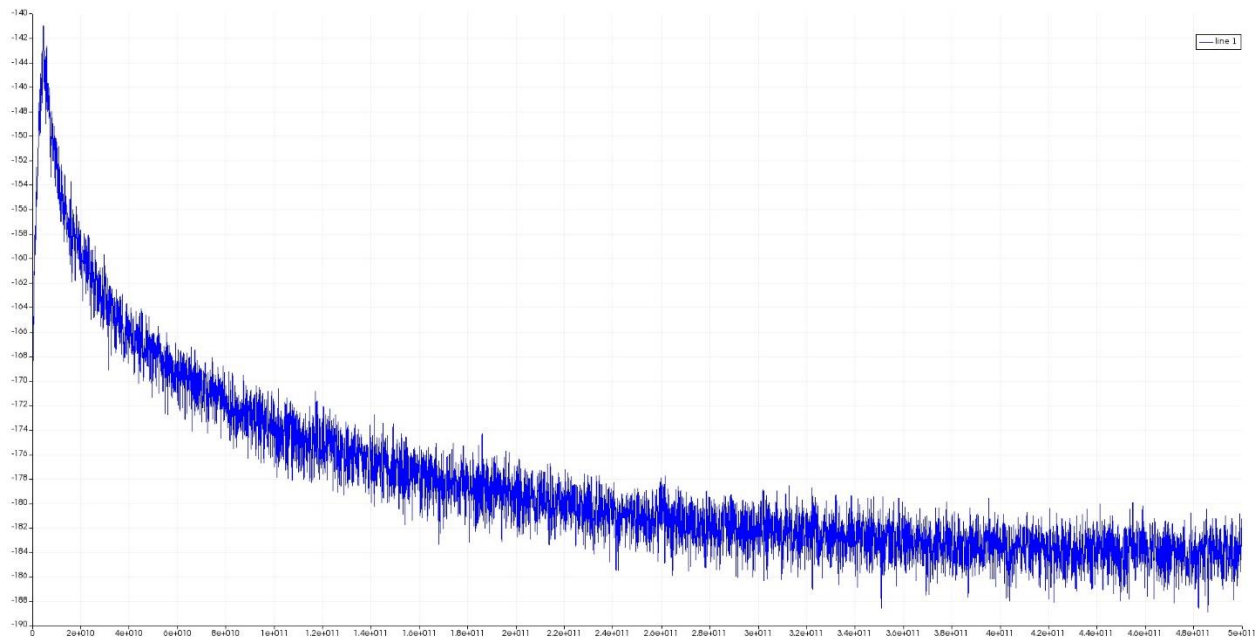
Or Bahari #51277200
University of British Columbia, Canada
orbahari@mail.tau.ac.il

Frequency 2.26Ghz, amplitude 3.78. about 4 times lower amplitude.

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University of British Columbia, Canada
orbahari@mail.tau.ac.il

RIN
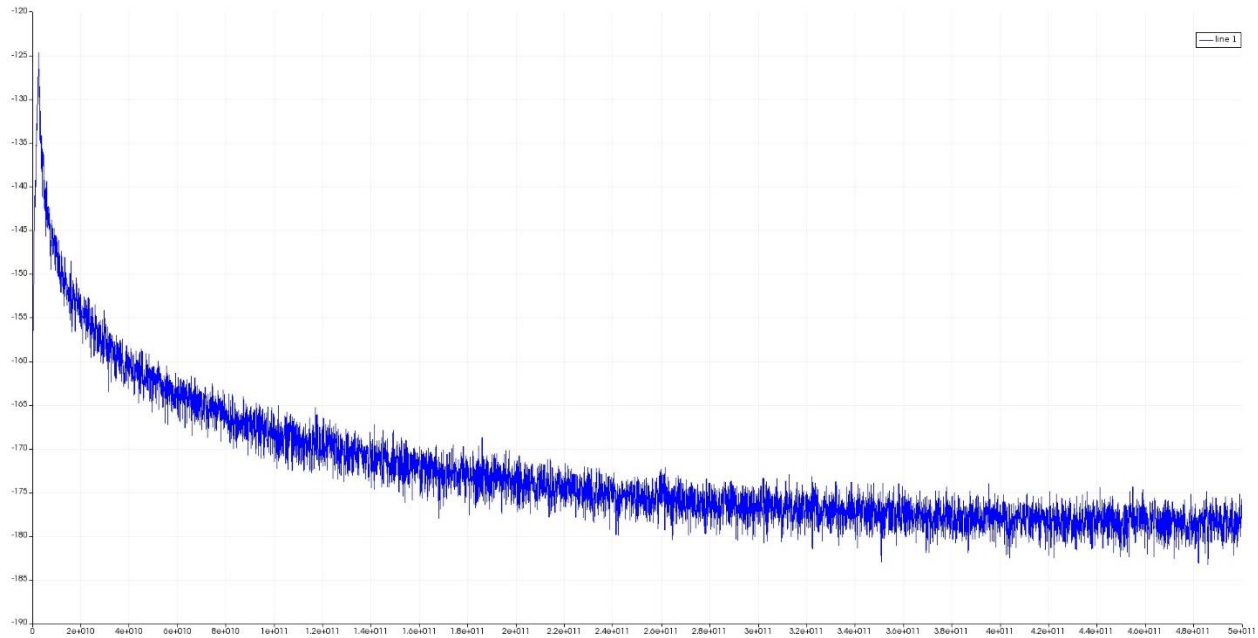
I=16.5mA

we can see that the resonance frequency is (the peak) is at about 4.43GHz and the amplitude:

-141db/Hz.

Or Bahari #51277200
University of British Columbia, Canada
orbahari@mail.tau.ac.il

I=6.6mA:

With peak at about: 2.45GHz, and amplitude -124 (dB/Hz) (zoom in).

Eye diagrams

Eye diagrams for different modulation rates:
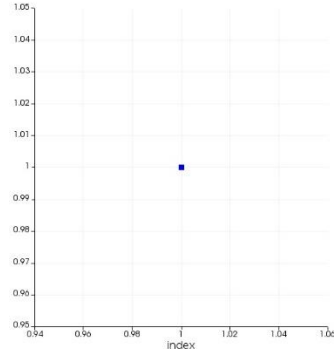
Using 2 filters: one with cutoff frequency 50GHz – Filter1. and the other one with [0.75*bitrate] – Filter2.

Mod rate = 2GHz/sec:
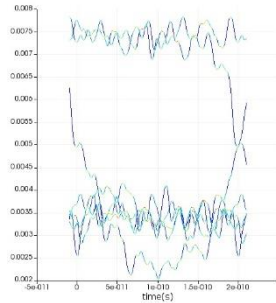
Filter1:
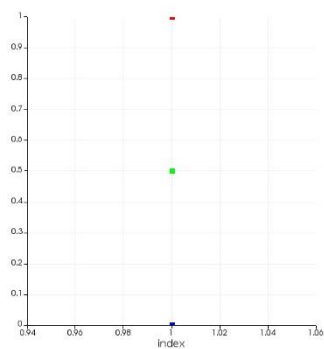
Filter2:

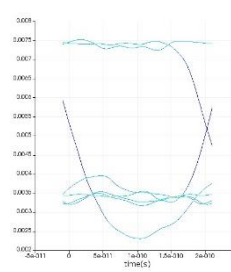Mod rate = 5GHz/sec:

Filter1:   Filter2:
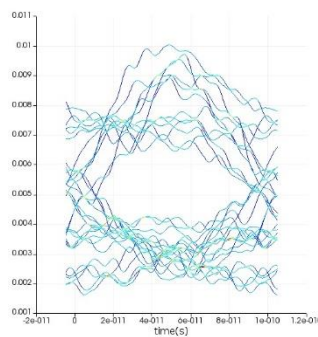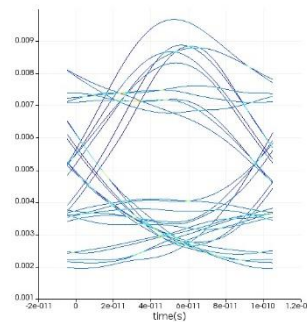

We can see that the eye opening is larger than 0.5.

Mod rate = 10GHz/sec:

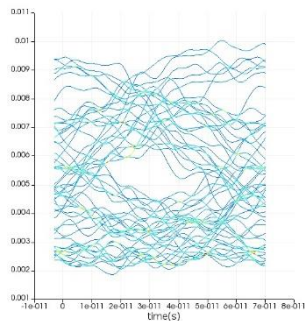Filter1:   Filter2:
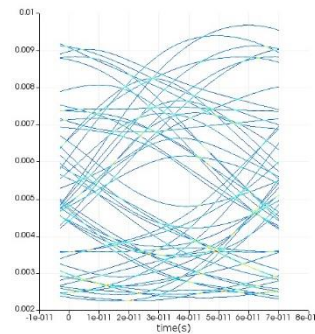

We can see that the eye opening is larger than 0.5.
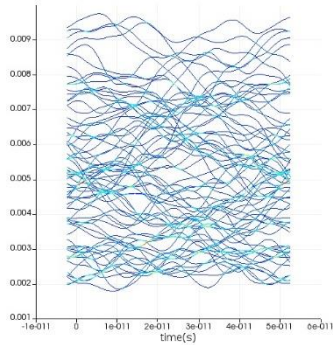
Mod rate = 15GHz/sec:

Filter1:   Filter2:
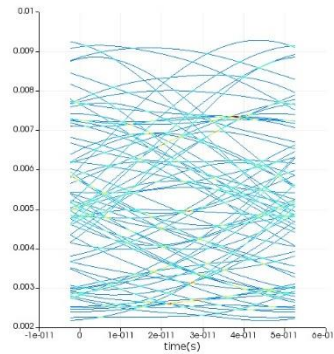

Hard to say if the eye opening is larger than 0.5, doesn't look like an eye anymore.. means the link is starting to be bad…

Or Bahari #51277200

University of British Columbia, Canada

orbahari@mail.tau.ac.il

Mod rate= 20GHz/sec:

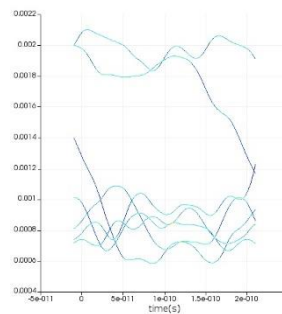Filter1:   Filter2:

Bad link, does not look like an eye anymore.

About the filters: obviously Filter2 has less noise, can see the "Eye" more clearly... we will use this Filter from now on.
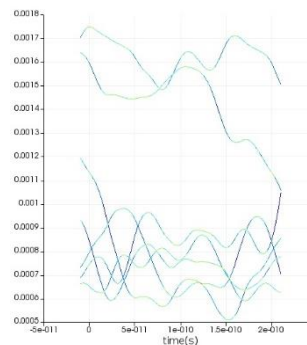
Fibre:

With a 30km fibre. At modulation rate 5GHz/sec.

With enhancement factor 5 in the laser:

Comparing to without Fibre: we see a bit of noise, clearly the long fibre does no good (means that real results would be nastier than reality).

And without the linewidth factor (used factor=1e-100):

More or less the same result, without the factor the structure is a bit wilder.