

Lab #2. Regeneration of optical signal by Erbium Doped Fiber Amplifier (EDFA)

Introduction.

Devices are used in the measurement procedure.



[1] Optical Spectrum analyzer (IQ-203) - instruments that measure the optical power as a function of wavelength or frequency.

[2] EDFA (Erbium Doped Fiber Amplifier) is a kind of fiber optic amplifier which used to re-amplify an attenuated signal without converting the signal into electrical form.

Manipulated parameters



[1] The laser pump (PUMP Module) of 980 nm controlled by the on/off and rotary element

[2] Distributed FeedBack (DFB module) laser operating at the wavelength of 1550 nm

[3] on/off switch

The measurement procedure

1. *The current-power characteristic of the DBF laser source:*

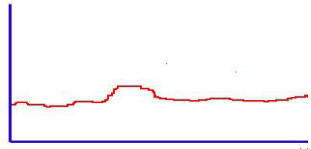
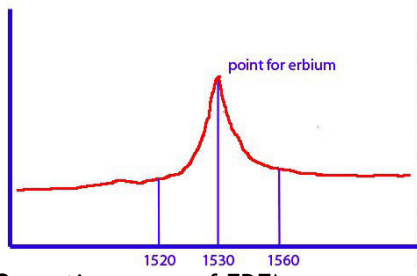
Measure $P_{dfb1550} = f(I_{dfb1550})$ for $I_{pump980} = 0$

PUMP is swithed off	$I_{dfb1550}$ [mA] current	P [dBm]= $f(I_{dfb1550})$ power level
$I_{pump980}=0$	15	No significant amplification of optical signal. Noise level.
$I_{pump980}=0$	17	
$I_{pump980}=0$	20	
$I_{pump980}=0$	25	Very small peak is appeared.

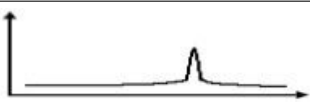
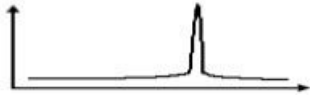
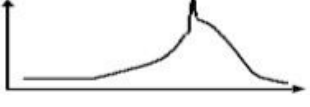
2. *The operation range of the EDFA amplification:*

Measure $P = f(\lambda)$ for $I_{pump980} > 0$ and $I_{dfb1550} = 0$

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PUMP is switched on. I_{pump980} [mA].	DFB is switched off	Comments
70	$I_{\text{dfb1550}}=0$	
120	$I_{\text{dfb1550}}=0$	
150	$I_{\text{dfb1550}}=0$	 <p>Operating range of EDFA</p>

The spectral characteristic of the custom signal at the wavelength of 1550 nm before and after amplification.

I_{pump980} [mA]	I_{dfb1550} [mA]	$P[\text{dBm}]=f(\lambda)$	Comments
0	17		Very small peak detected - close to a noise level
50	17		Peak at 1550nm. Point of saturation.
150	17		Higher noise around saturation point. It means after 30-50mA only background amplification is working (uselessness).

3. The current-power characteristic of the regenerated signal

$P = f(I_{\text{pump980}})$ and $I_{\text{dfb1550}} = 17\text{mA}$

I_{pump980} [mA]	I_{dfb1550} [mA]	$P[\text{dBm}]=f(I_{\text{pump980}})$	Comments
0	17	-70	No amplification
20	17	-60	SNR 17 dB
40	17	-32	SNR 43 dB
60	17	-27	SNR 44 dB
70	17	-26	SNR 44 dB
80	17	-25	SNR 43 dB

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120	17	-23	SNR 43 dB
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Saturation point is near $I_{\text{pump980}}=62\pm3$ mA. If it is increasing further, then pumping current gives slightly increment power value. It means too much power for nothing.

EDFA amplifiers advantages and disadvantages.

- + cost effectiveness
- + low noise
- + relative flatness of the top of the gain spectrum
- + useful for long distances (allows eliminate repeater using)
- + high saturation power
- + can be improved by gain-flattening optical filters
- there is always some output even with no signal input (spontaneous noise)
- are not small
- gain saturation effect