Close-in dynamic range of the BOSA and the width of the BOSA filter

Abstract: the 3dB resolution is not the only important resolution parameter, but also the resolution at deeper power levels. Measurement example of a TLS.

The BOSA implements a feature to measure the width of the signals not only at 3dB (Full Width Half Maximum, FWHM), but also at any power depth. In the following screenshots taken from real measurements we will evaluate the full width of an external cavity tunable laser (ECL TLS) at different depths.

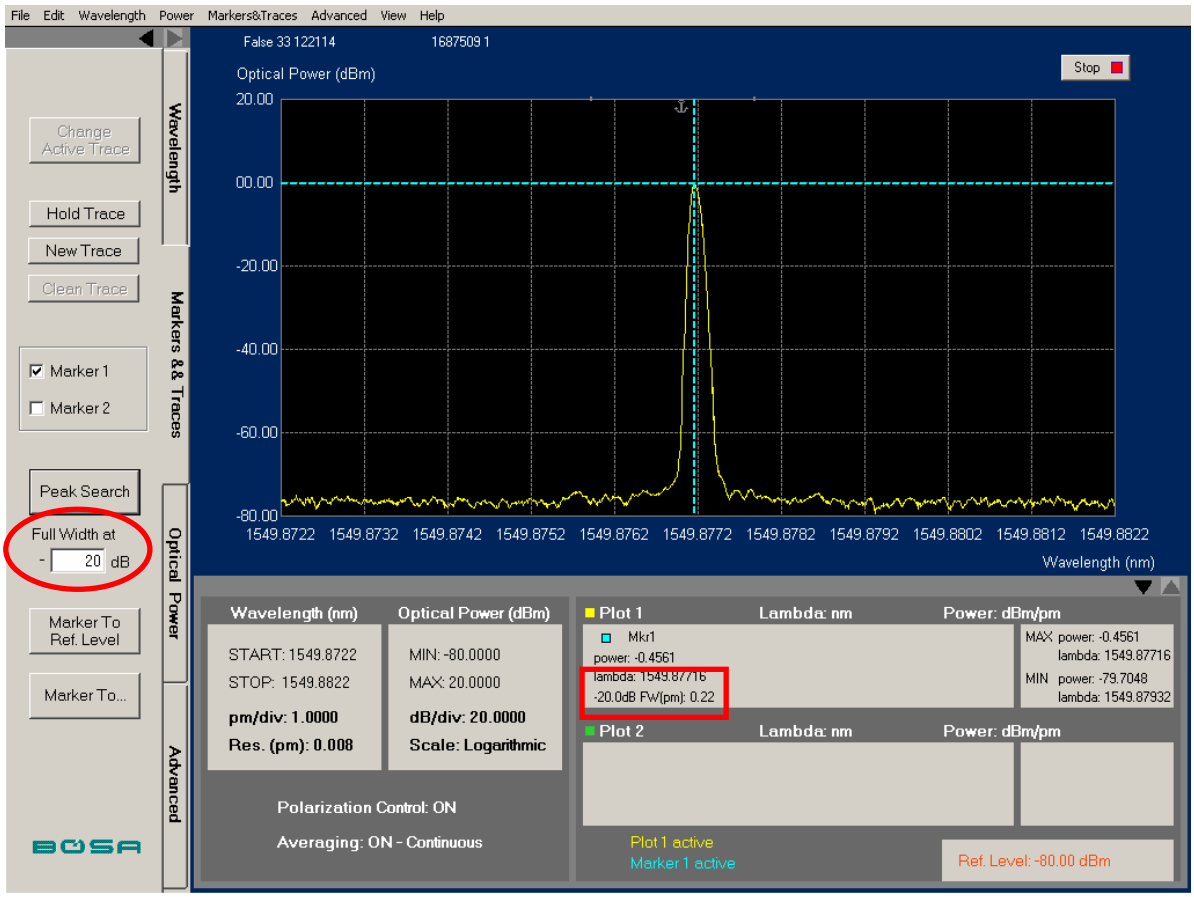

Fig 1: Full Width @ 20dB

In the *"Markers & Traces"* tab we can set the depth from the peak power at which we want to measure the full width (marked in a red oval) and the result will be displayed in the *data window*, marked with the red rectangle. It is recommended to make a peak search before measuring the full width at the desired power level. In the Figures 1, 2 and 3 we can see the same measurement, taken for three power values

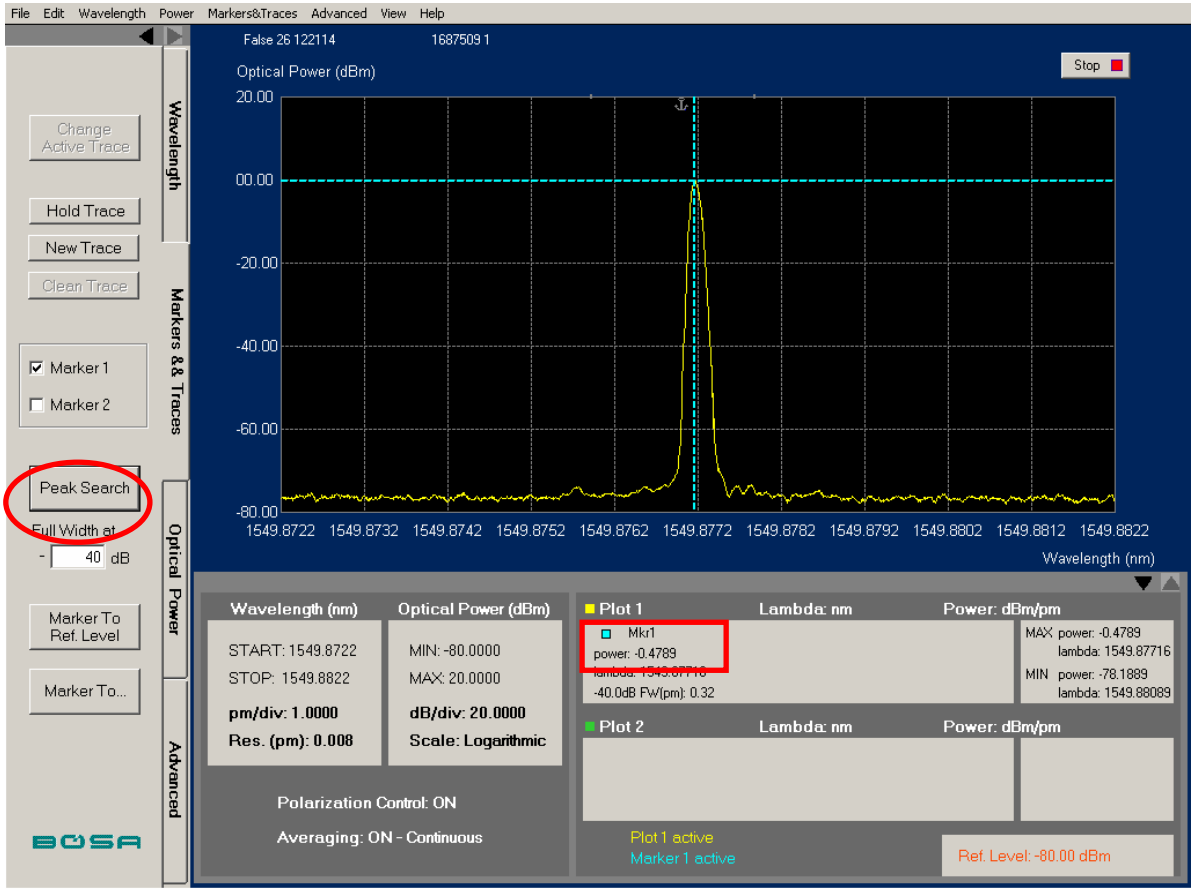

Fig 2: Full Width @40dB

The results of these full width measurements are as follows:

- 0.22pm @20dB
- 0.32pm @40dB
- 0.39pm @60dB

These values correspond to 25-50MHz. The line width of a typical ECL TLS is of hundreds of KHz, and the one measured here is certainly below 1MHz, even at low powers close to the noise floor. Clearly with a resolution above MHz it is not possible to measure line widths of narrow sources. What we are actually doing in this example is measuring the shape of the BOSA filter, and it appears to be far ahead any other similar measuring instrument.

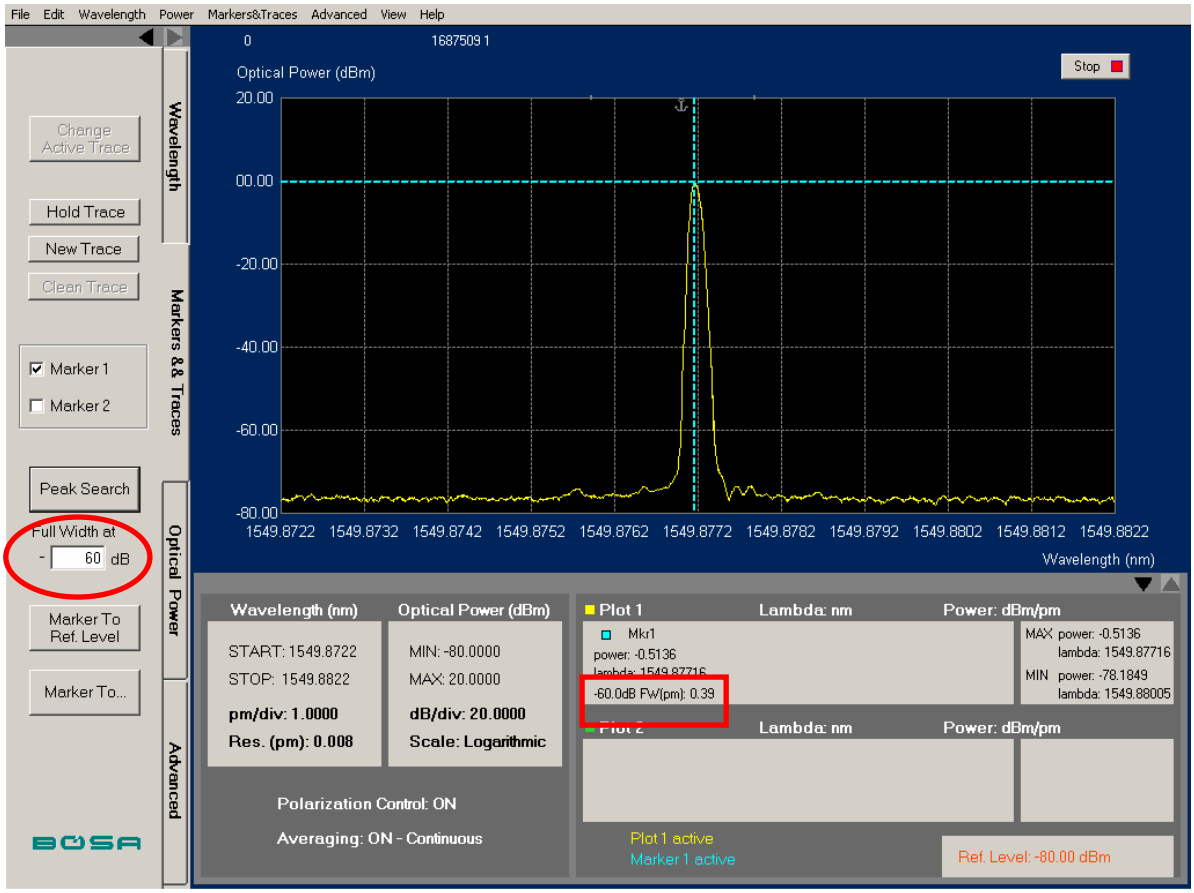

Fig 3: Full Width @60dB

If we measure close signals with a narrow filter at the top but broad at the bottom, the measurement can lead to an apparent elevation of the noise floor. Close signals (for instance 10pm, 1.25GHz) can be different lasers, sidemodes or the modulation bands of the same laser, etc...

In the Fig. 4 an example is shown. The blue lines represent a standard filtering system (electrical, grating,...). The result of the measurement of a narrow ideal signal, being $\lambda_2 - \lambda_1$ of about one GHz, would be the blue upper envelope. Measured with the BOSA, it would be the green one. The red dotted line corresponds to an ideal filter (square) of the same resolution (resolution bandwidth, or RBW) as the blue filter. This “unreal” example illustrates the importance of a narrow filter (high resolution) not only at 3dB.

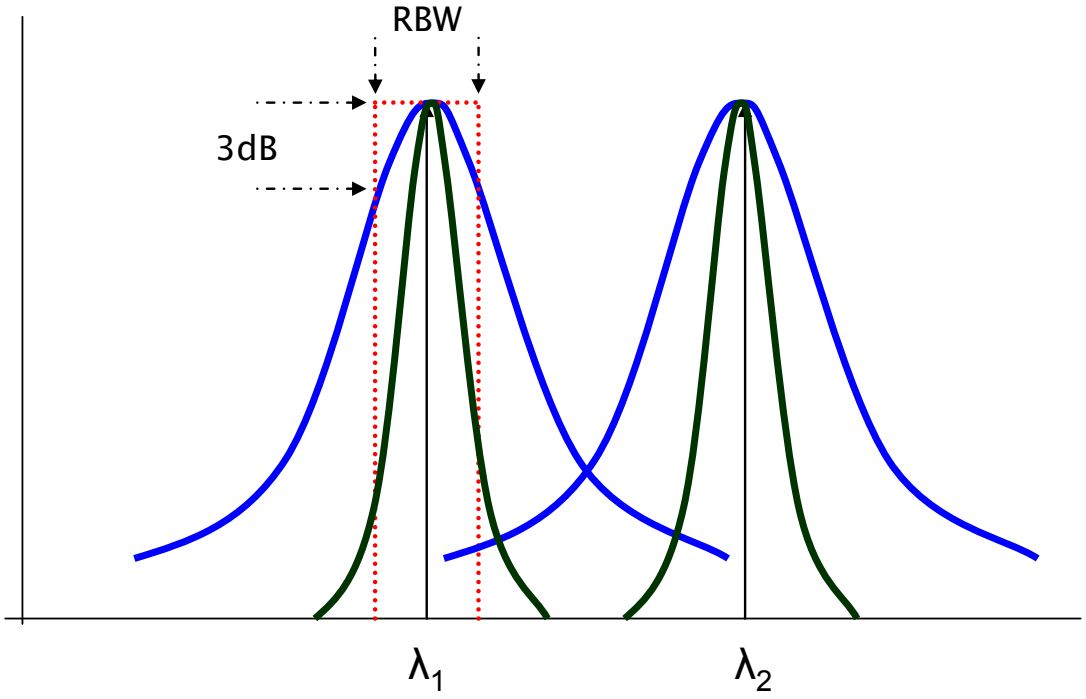

Fig 4: filter examples

The filter width can be seen specified as "Close-in dynamic range", which indicates the dynamic that can be obtained at a certain distance from the peak and is really informing about the filter width

Benefits of measuring close signals at high dynamic with the BOSA

- The BOSA has the **steepest filter** in the industry; therefore the resolution is high also at high dynamic (0.4pm @60dB).
- This is the reason why the BOSA, unlike other methods, achieves **simultaneously high resolution and high dynamic range**

All the best
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