



Using Stitching for Higher Dynamic Range

Overview

This application note describes how to use stitching to increase the dynamic range in a sweep trace. Multiple sweeps are performed, one at each specified range, and the results of the individual sweeps are combined into a single sweep.

How to Turn Stitching On / Off

Stitching is applied as another type of measurement range and is specified under the Manual-Set Selected Channels Measurement Range... part of the GUI.

The screenshot shows the 'Active Channel Setup' window with the following table:

	Update	View	Name	Units	Range	LinOffset (mW)	LogOffset (dB)	Calc?	nSmooth
01_00	On	On	Ch 1	dBm	A to C Stitch	0.000000	0.000000	No	Off
04_00	On	On	Ch 4	dBm	10us 10 to -57	0.000000	0.000000	No	Off
05_00	On	On	Ch 5	dBm	10us 10 to -57	0.000000	0.000000	No	Off

Control buttons on the right side of the window include: 'Apply Stching Range A - C', 'Adjust Top Range', 'Adjust Bottom Range', and 'Back ...'. The bottom status bar shows options: '1 Graph', '2 Graphs', '3 Graphs', 'All + Selected', 'All + Adjacent', and 'Power Table'.



Applies the specified stitching ranges to the selected traces.



Adjusts the specified top range



Adjusts the specified bottom range

The stitching range can also be specified using the remote command:

```
:CONFig:CHANnel <chanlist> <range> [<"chan tag">]
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Valid <range> specifiers are:

Rng1, Rng2, Rng3, Rng4, Rng5, Rng6, Rng7, Rng8, Rng9
FixA1, FixB1, FixC1, FixD1, FixE1,
FixA10, FixB10, FixC10, FixD10, FixE10,
FixA100, FixB100, FixC100, FixD100, FixE100
ABStitch, ACStitch, ADStitch, BCStitch, BDStitch, CDStitch

If A-C Stitching is specified, then three sweeps will be done. The first sweep will be done on Range C, then B, then A.

How Sweep Data is Combined

As each new sweep is measured, the new sweep data is combined with the previous sweep data only if the previous sweep data had an over-range condition. Otherwise the previous sweep data is left alone. When sweep data is combined, then two things have to happen.

The data is adjusted on the horizontal axis to line up with the new sweep wavelength or time data. If wavelength correction is enabled either by gas-cell or wave ref card, then it is possible for the wavelength data values to vary from sweep to sweep. Also, we must take into account different nominal time shift delays due to the different ranges being measured. Following are the nominal time shift delays of the ranges.

Range	Nominal Time Delay(s)	
	Filter On	Filter Off
A	1/2500	1/7500
B	1/2500	1/7500
C	1/400	1/400
D	1	1

The only time relative time shift delay must be incorporated is when either Range C or D is one of the ranges being combined. Ranges A and B have no relative time delay. For example, if ranges B and C are being combined and filter is on the relative time delay is computed as below.

$$T_{\text{delay}} = 1/400 - 1/2500 = 0.002100 \text{ seconds}$$

In wavelength mode, the relative time delay must be converted to a relative wavelength delay. This depends upon the sweep rate.

$$\lambda_{\text{delay}} = T_{\text{delay}} \text{ (s)} * \text{sweep rate (nm/s)}$$

In the example, if we assume a sweep rate of 5 nm/s we find the following wavelength delay that must be applied when combining sweep data from ranges B and C.

$$\lambda_{\text{delay}} = 0.0021 \text{ s} * 5 \text{ nm/s} = 0.0105 \text{ nm} = 10.5 \text{ pm}$$

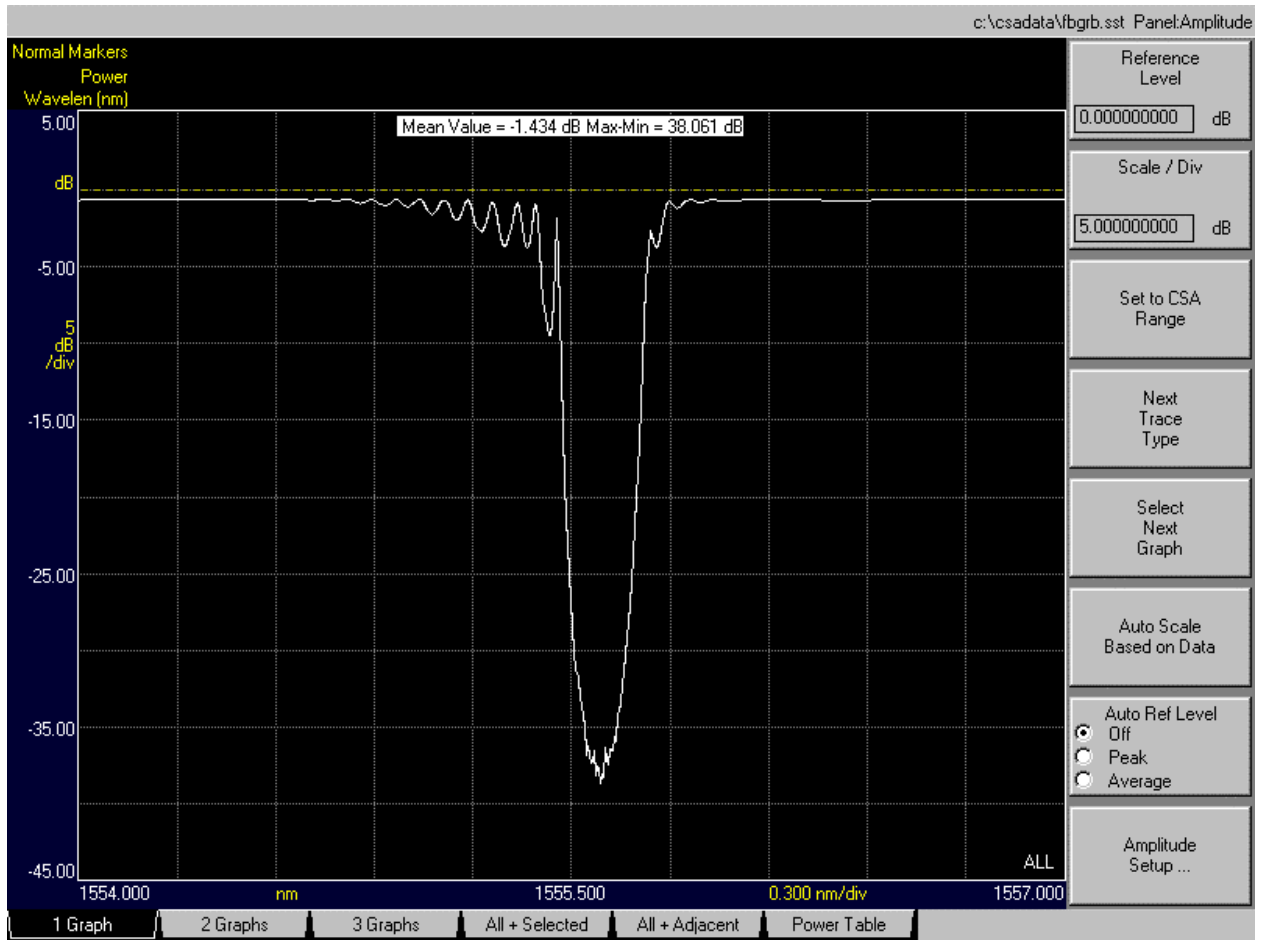
Above a high_limit, data from the higher range is used, below a low_limit, data from the lower range is used. In between the two limits, the data is combined in linear fashion, in effect blending the data as it crosses the two limits. In this way a smoother transition between the two ranges is achieved, minimizing the chances of an anomalous jump in data at the transition points. Below is a table of the high and low limits based on the ranges being combined.

Range Transition	High Limit (dBm)	Low Limit (dBm)
A-B	-30	-32
B-C	-50	-52
C-D	-58	-60
D-E	-65	-67

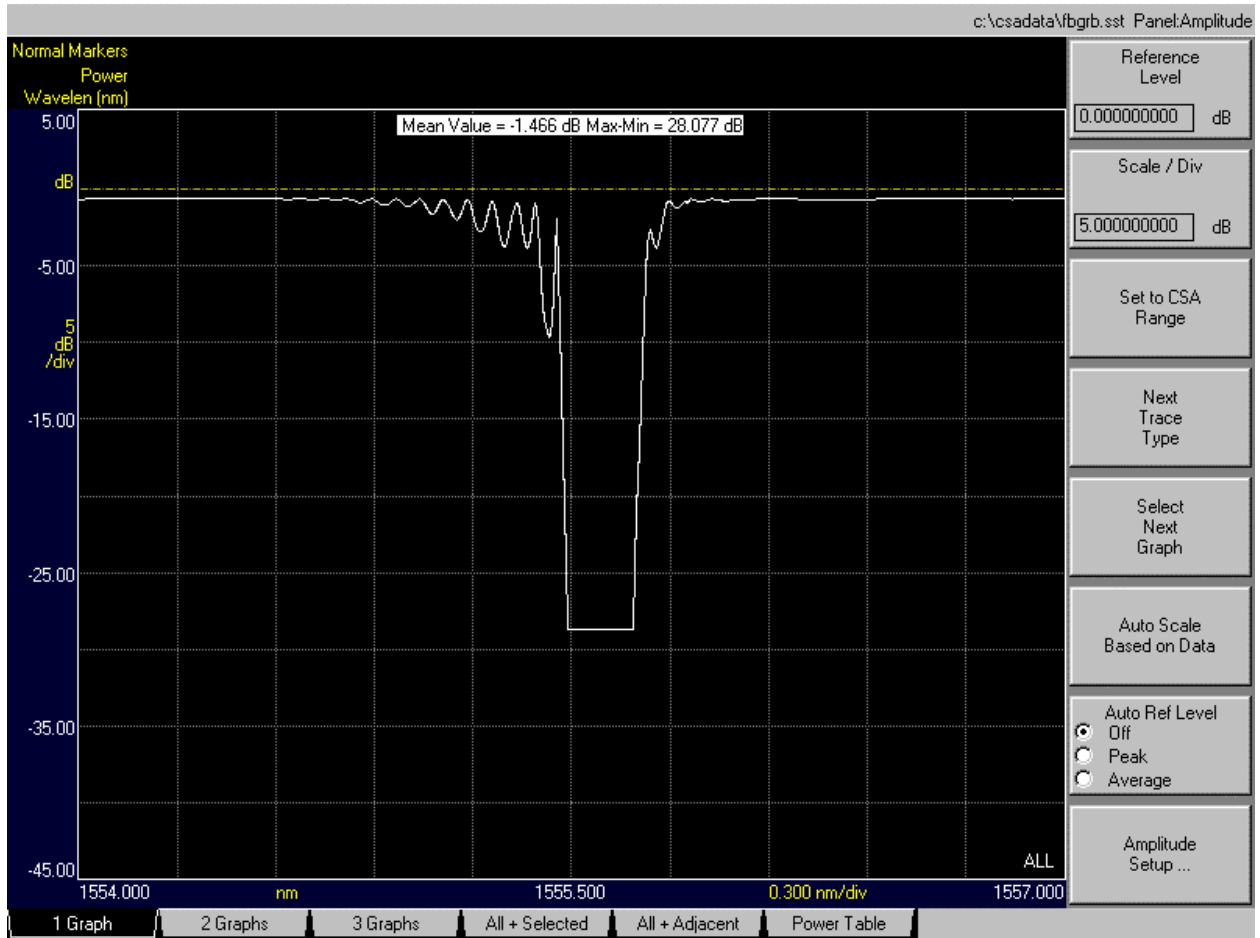
When power referencing or linear units are enabled, then additional processing time is needed to convert the measurement data into dBm.

Following are examples of a device measured using stitching.

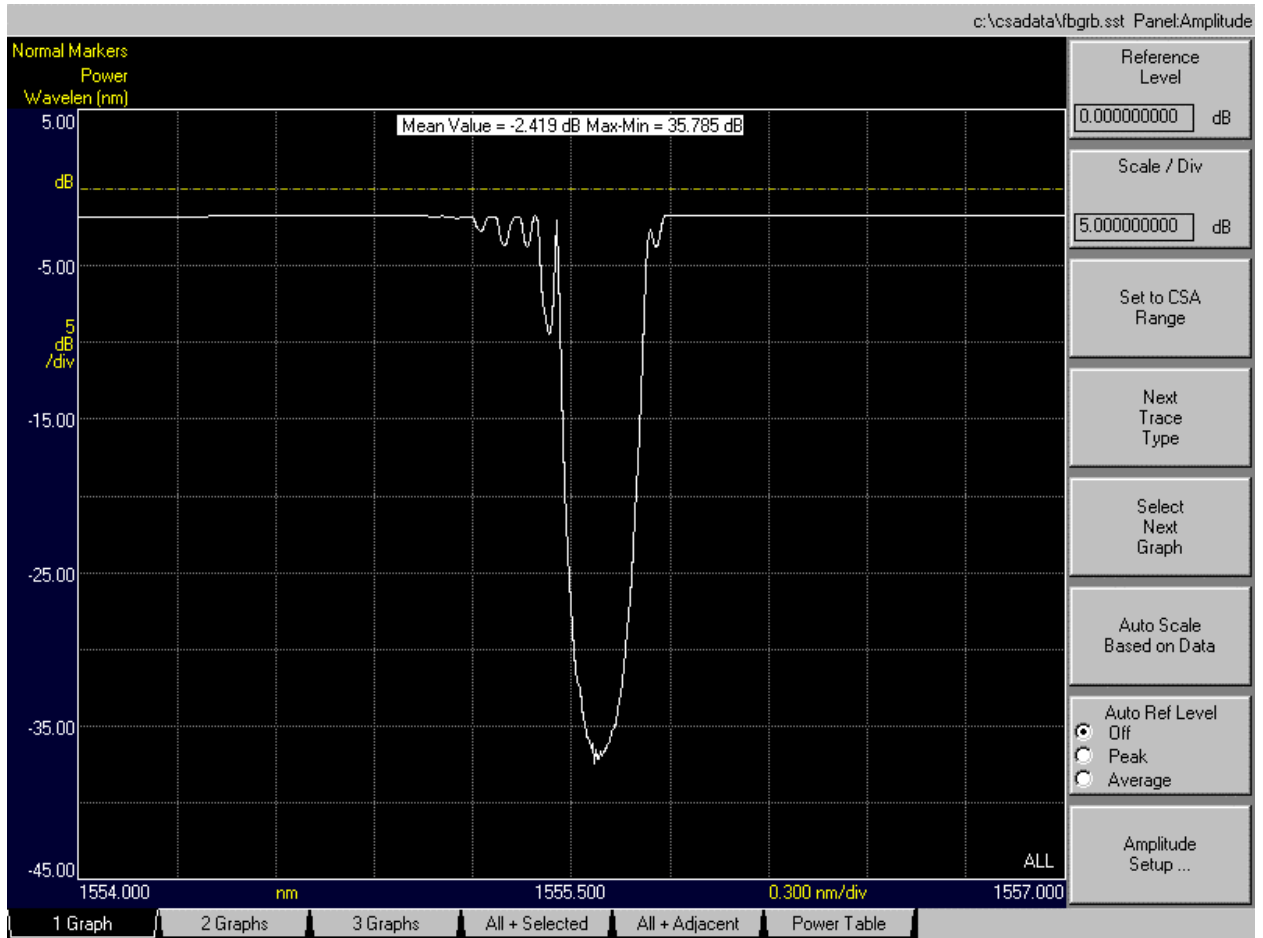
Data Using Range A



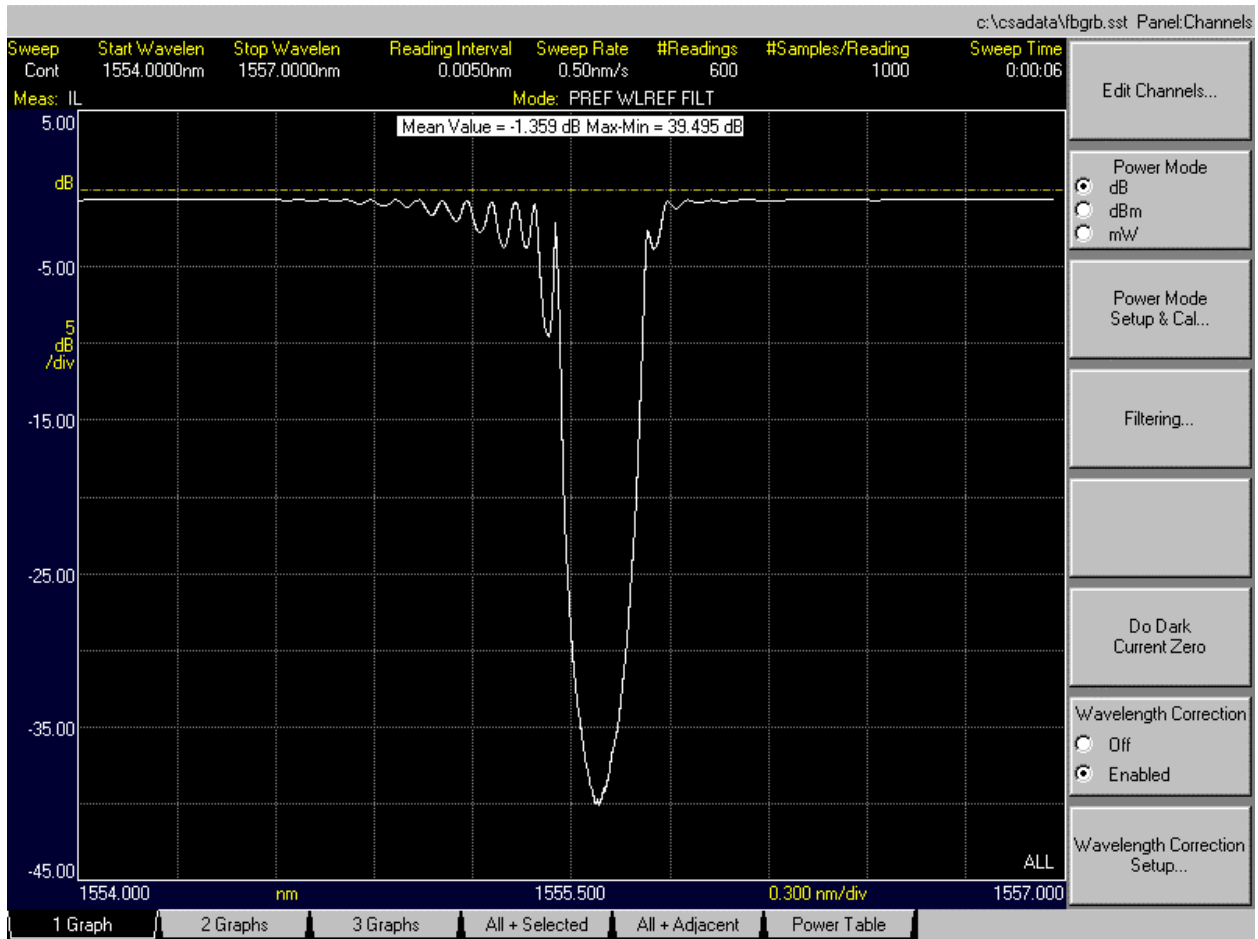
Data Using Range B



Data Using Range C



Data Using Range Stitched A-B-C



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