

IFR SYSTEM ANALYZER NOW MEASURES GROUP DELAY

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The unique 6840 series of Microwave System Analyzers from IFR (Wichita, KS) now offers group delay measurements of components through to complete radios. The MSA's ability to measure frequency converting devices and networks by combining a spectrum analyzer with a fully synthesized source and scalar analyzer has been enhanced by the addition of frequency modulation and group delay options.

An essential feature of a communications link or signal processing device is its ability to convey information without distortion. This requires a flat amplitude response and a linear phase response over the bandwidth of interest. Phase linearity is commonly specified in terms of group delay flatness, which is traditionally measured with a vector network analyzer. Whilst these instruments have high accuracy there are complications when characterizing frequency converting devices. By using the receiver in the spectrum analyzer as a tuned scalar input, the MSA with group delay option overcomes such problems and provides a more cost-effective solution.

The source is frequency modulated with a known low frequency and applied to the device under test (DUT). After passing through the DUT, the signal is demodulated and the recovered low frequency is phase compared with the original modulating signal. The envelope delay is the average value of group delay over the modulated signal bandwidth. The bandwidth of the modulated signal is known as the measurement aperture and needs to be small in comparison with the group delay variations for accurate measurements.

The IFR MSA series comprises 7 models with source and spectrum analyzer frequency ranges in several combinations from 1MHz to 24GHz.

Model	Source Frequency	Spectrum Analyzer
6841	1 MHz to 3 GHz	1 MHz to 4.2 GHz
6842	10 MHz to 8.4 GHz	10 MHz to 20 GHz
6843	10 MHz to 20 GHz	10 MHz to 20 GHz
6844	10 MHz to 24 GHz	10 MHz to 24 GHz
6846	10 MHz to 8.4 GHz	10 MHz to 24 GHz
6847	10 MHz to 20 GHz	10 MHz to 26.5 GHz
6848	1 MHz to 3 GHz	10 MHz to 20 GHz

All are now available with Option 22, Group Delay, which is an additional module that fits into an expansion slot inside the basic unit. All hooks, control and measurement software are provided internally by the MSA, and the group delay functions are accessed via the front panel softkeys as with other measurement parameters.

Display Modes

Multiple measurements can be displayed simultaneously. Since the group delay measurement is made using the source and spectrum analyzer, the amplitude versus frequency response can also be measured. The extensive marker functions can then be used to investigate the data, including peak to peak ripple across any specified sub-band within the measurement bandwidth, maximum slope (deviation from linear) and maximum rate of change of slope (deviation from parabolic).

Figure 1 shows a screen shot of the 6844 making a group delay and frequency response measurement on a bandpass filter. In this instance the marker functions have been used to find the 3dB bandwidth of the filter using the amplitude response and then display the 3dB bandwidth on the group delay characteristic. For reasons of clarity, the use of the marker function to display the peak to peak variation within a sub-range has been omitted.

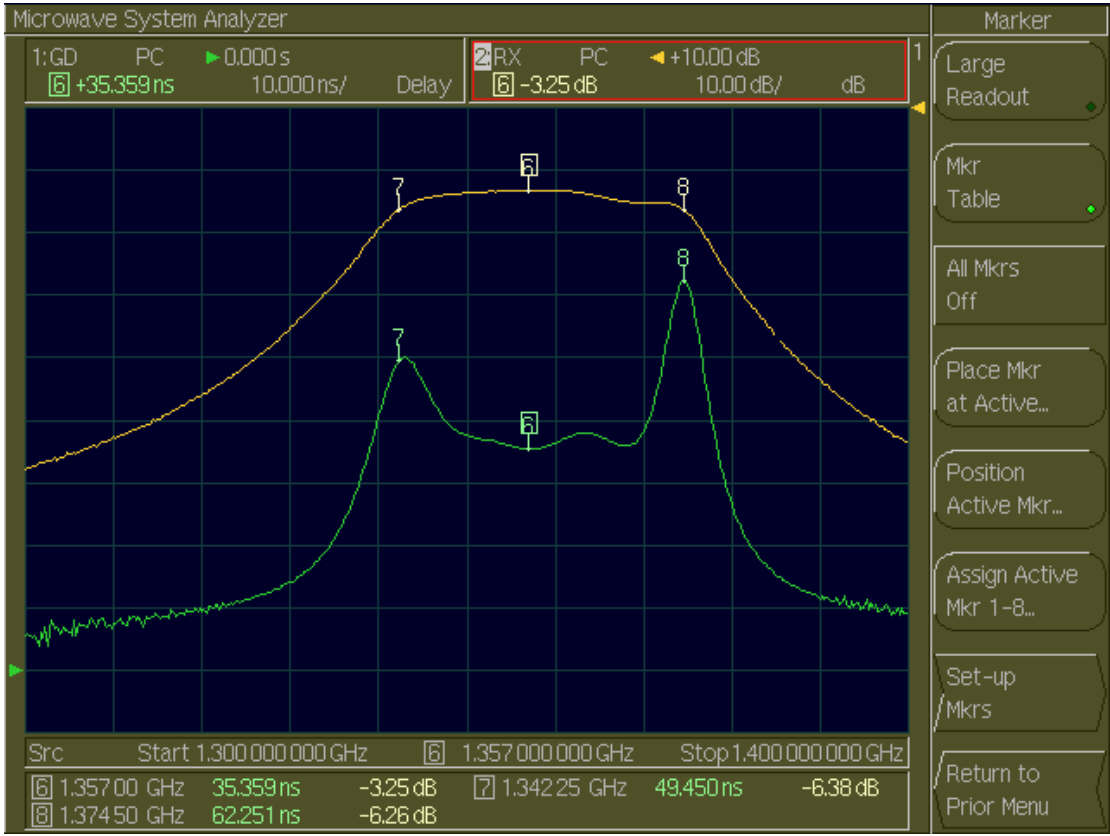


Figure 1 Amplitude and delay response of a bandpass filter.

Frequency Converting Networks

In the MSA the source and receiver can be made independent of each other so that the stimulus can be set to one frequency while the receiver receives at another. As the group delay measurement is derived from the modulation envelope and the modulation is preserved through a frequency translation, direct characterisation with no extra mixers is possible.

Figure 2 shows a screen shot of the amplitude and delay response of a 2.2GHz to 500MHz downconverter. This measurement was calibrated using a through connection at the source frequency range, although “golden standard” techniques could be used for better flatness.

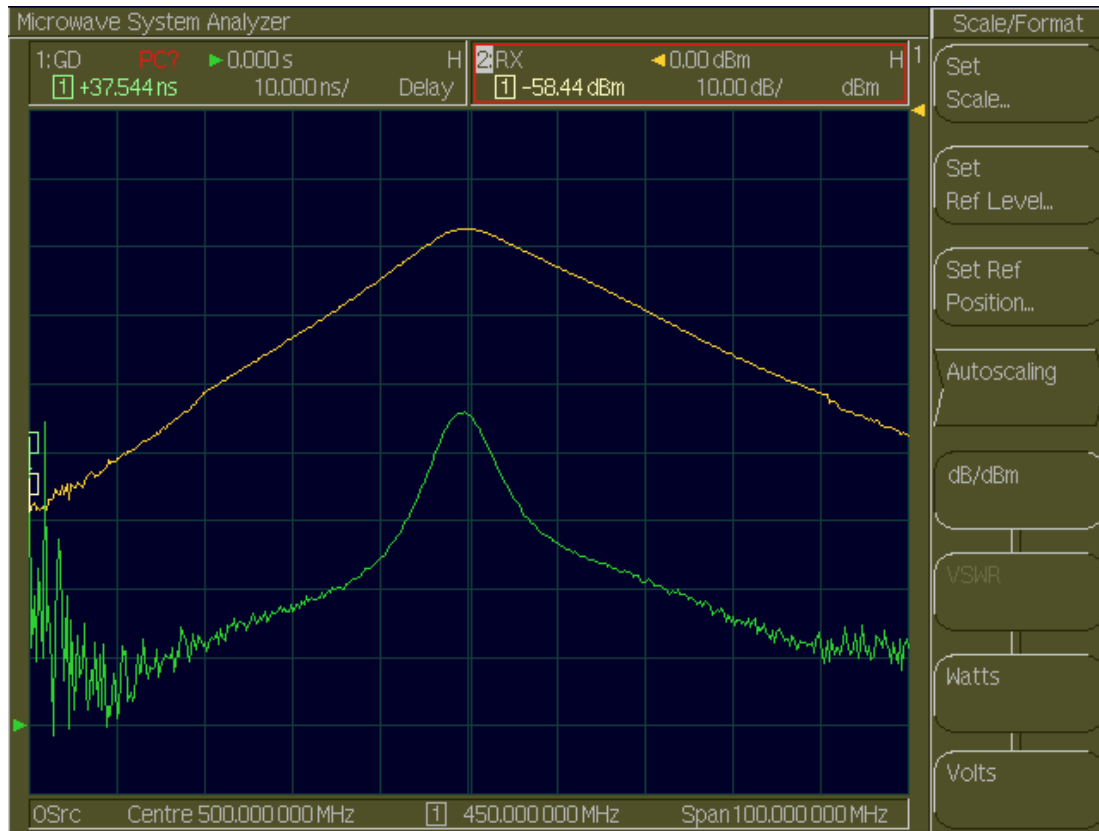


Figure 2 Amplitude and delay response of a downconverter.

Specifications

Group delay range is from 1nsec to 10 μ sec with a resolution of 0.1nsec and absolute accuracy of 0.5nsec. When making comparative peak to peak measurements the accuracy is generally better than 0.1nsec.

Frequency modulation of the source is provided with the group delay option, from 0.1Hz to 500kHz.

P & A

The price of the standard models ranges from \$30K to \$60K, and of the Group Delay option from \$3.4K to \$5K. Delivery is 4-6 weeks.