

Hints on Spectrum Analyzer Measurements

Agilent E4402A Spectrum Analyzer

1. The Spectrum Analyzer (SA) is an important tool for analyzing the frequency content of signals, and is a basic instrument of importance in a number of fields in electrical and computer engineering. This document is a quick start on using the Agilent SAs available in Room D115. Additional information on reading SA displays is available in the PowerPoint document “Reading SA Displays”.
2. It is usually a good idea to check the calibration of the SA before you begin using it, even if the unit is “self-calibrating”, as is the E4402A. We will also use this operation to learn how make a basic measurement. A reference signal is available at a connector on the lower front of the unit, to the right of the input connector. Connect this signal to the spectrum analyzer input using a BNC-BNC coaxial cable. Activate the reference signal by pressing the INPUT/OUTPUT button, and then pressing the AMP TD REF OUT button. The calibration signal provides a reference signal at 50 MHz and a level of -20 dBm.
3. Now, set the display to show the reference signal spectral content. First set the center frequency of the display to 50 MHz by pressing the FREQUENCY button and entering this value. Next, set the range of frequencies shown across the display to 10 MHz by pressing the SPAN button and entering this value. You should see the spectrum corresponding to a sinusoid of frequency 50 MHz. The peak of this line should appear in the exact center of the screen.
4. The next setting to adjust is the reference level, which sets the signal power level corresponding to the top line of the display. There are two settings to be adjusted here. First, set the units for the display. Suppose we wish to use dBmV. Press the AMPLITUDE button, then press MORE, then Y AXIS UNITS. Select DBMV. Next, set the reference level to a convenient value. For example, 60 dBmV corresponds to 1 Vrms. Press the AMPLITUDE button, then press REF LEVEL, and enter “60 dBmV”. Now the top line of the display corresponds to a signal level of 60 dBmV. Your display should look like that shown in Figure 1 below.

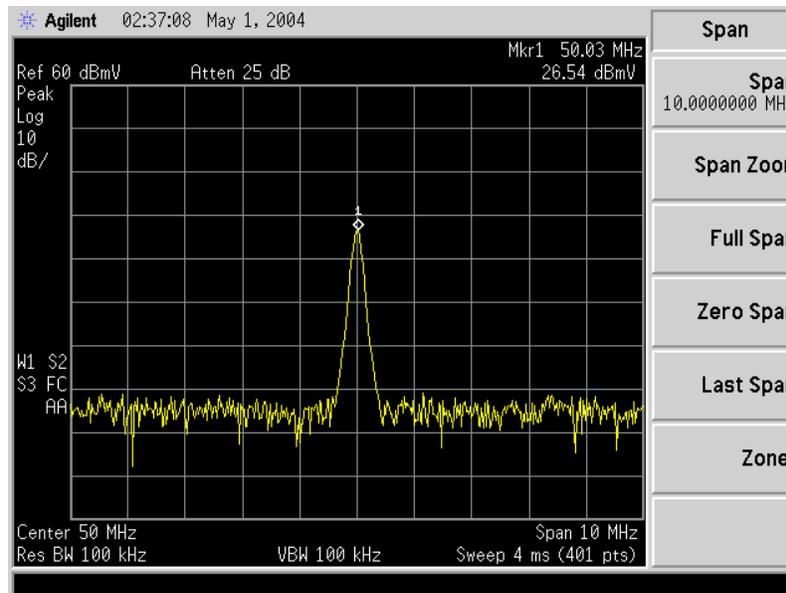


Figure 1. Spectrum Analyzer Display for reference signal.

5. Now you are ready to make a signal measurement. The E4402B has many convenient features to make measurement simple. Press the PEAK SEARCH button, which puts a marker at the highest peak on the display. The pertinent parameters for that peak are shown on the display. As shown, the reference signal has a frequency of 50 MHz and a level of 26.7 dBmV. If you do not know how to determine these values, refer to the “Reading SA Displays” document.
6. The display can be saved as a bitmap to a floppy and printed. To do this, Press the FILE key, and then the SAVE key. There are several types of files to save, and in this case we will be saving the screen display. Press the TYPE key and select SCREEN to save the entire screen display. Insert a floppy disk into the drive. To select the floppy, selected DIR UP, and then use the up arrow key to select the A:\ drive. Press the DIR SELECT key, and then SAVE NOW to save the screen display to the floppy disk. The file has been saved as a GIF format bitmap by default.
7. Before leaving this exercise, turn off the reference signal output. You are now ready to make measurements using the E4402B Spectrum Analyzer.

Notes on dB units

There are several units used in SA displays, but they fall into two major categories. Before showing the two categories, it must be stressed that the dB unit is a power unit. All dB measurements measure a signal power level. Sometimes the signal level is expressed explicitly as a power in dBs, such as dBm. Sometimes, the level is expressed as an equivalent rms voltage level, as in dBmV. The various units are reviewed here.

$$P_{dBW} = 10 \log_{10} \left(\frac{P_{sig}}{1Watt} \right) \quad P_{dBm} = 10 \log_{10} \left(\frac{P_{sig}}{1mW} \right)$$

$$P_{dBV} = 20 \log_{10} \left(\frac{V_{sig,rms}}{1Vrms} \right) \quad P_{dBmV} = 20 \log_{10} \left(\frac{V_{sig,rms}}{1mVrms} \right)$$