

NEW CHALLENGES FOR SPECTRUM ANALYZERS

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The basic measurements performed by the spectrum analyzer, component loss or gain, power output, intermodulation, frequency response, phase noise and endless combinations of these have been around as long as the RF engineer. The explosion in use of cellular/wireless phones created new demands on analyzers. Now, in addition to the basic measurements, there was a need for measurements such as spectral regrowth, adjacent and alternate channel power, power amplifier turn on time, and vco switching speed, to name a few. Since time is money, automatically performing these measurements became a very useful feature as well as the ability to perform them outdoors.

Following this boom in the wireless industry has come the advent and widespread use of wireless lans. The most common of these adhere to the 802.11a, 802.11b, or 802.11b/g standards. The 802.11a systems use an orthogonal frequency division-multiplexing (ofdm) format in the 5ghz band; the 802.11b systems use either a direct sequence spread spectrum (dsss) or frequency hopping spread spectrum (fhss) format in the 2.4ghz band. The 802.11b/g systems are a combination of the 802.11b and 802.11a systems. All of these systems are designed for high rate data transmission, indoors or out, using complex, wideband signals which can often make spectrum analysis measurements difficult. **Perhaps the most daunting aspect of making measurements on these systems is the fact that all**

transmissions are done in bursts and, in the case of the ofdm system, possibly on the order of 50 microseconds in duration. If this signal were to be fed into a spectrum analyzer, the odds are that it might never be seen, or would appear as a random blip on the screen, occurring at random times. One possible way of measuring this signal would be to perform a max hold on the display, if it is equipped with this function, so that over time the blips on the screen would form the outline of the signal to be measured. This method has the drawback of taking a very long time, as well as never providing an instantaneous view of the signal spectrum. Another solution would be to gate the spectrum analyzer to the signal to be measured. Unfortunately, this requires the analyzer to be equipped with a gating function and, as is usually case, there is no trigger signal produced by the device that is transmitting the signal.

An elegant solution to this problem is a spectrum analyzer capable of triggering off of an incoming signal or using signal-detection. In this way, the transmitted burst can be captured and an instantaneous spectrum displayed. The following figures show the advantages of this method.

Figure 1 shows a spectrum attained by using a max hold function on a typical 802.11a signal. Over time, all of the frequencies being used are captured to produce a solid, relatively flat frequency display. Due to the randomness of the signal being present when the measurement is being made, it can also be a rather slow process. **Figure 2** shows the same type of signal; this time it is measured using the signal-detect method and limiting the duration of the measurement. The displayed spectrum clearly shows the start of an 802.11a preamble field. **Figure 3** again shows a typical 802.11a signal using the signal-detect method, but this time the measurement start has been delayed from the signal detect with the measurement duration limited, in order to display the spectrum of the 802.11a data field.

If the first figure is compared to the second two, the advantage of the signal-detect measurement is clear. The first one shows a time-averaged spectrum, combining the results of many individual signals. **Figures 2 and 3** are examples of how an instantaneous spectrum measurement can be extracted from a large, complex signal. These spectrums were previously buried in **Figure 1's** time-averaged measurement.

The benefits offered by wireless LANs, such as mobility, accessibility and the economics of not having to run wires, have led to their widespread use and acceptance. You are as likely to see them deployed on college campuses and

at coffee houses as you are at the workplace. Accordingly, the environments where measurements must be made range from the open campus spaces to cramped campus dorms and busy commercial enterprises to the crowded workplace office. Loading a bench-top spectrum analyzer onto a cart or carrying around a slightly smaller "portable" analyzer are just not feasible measurement solutions. The Bumble Bee is a handheld, battery operated spectrum analyzer designed by Berkeley Varitronics Systems with just these requirements in mind. Being handheld and battery operated, it is possible to unobtrusively perform measurements in all locations and environments. Equipped with all the standard measurement functions as well as the signal-detect feature, the Bumble Bee™ is able to meet the challenging needs of today's RF environment by providing complex spectral analysis.

The Bumble Bee is yet another evolution of the spectrum analyzer as it evolves to meet the needs of the ever-changing RF world.

ABOUT BERKELEY VARITRONICS SYSTEMS

BumbleBee is one of over a dozen unique 802.11 test instruments. Berkeley Varitronics Systems, www.bvsystems.com, has been providing wireless solutions and products to the domestic and international cellular telecommunications industry for over 30 years. Since 1995, BVS has introduced over 40 unique wireless test equipment devices for a variety of applications.

BVS

CIRCLE READER SERVICE NO. 29

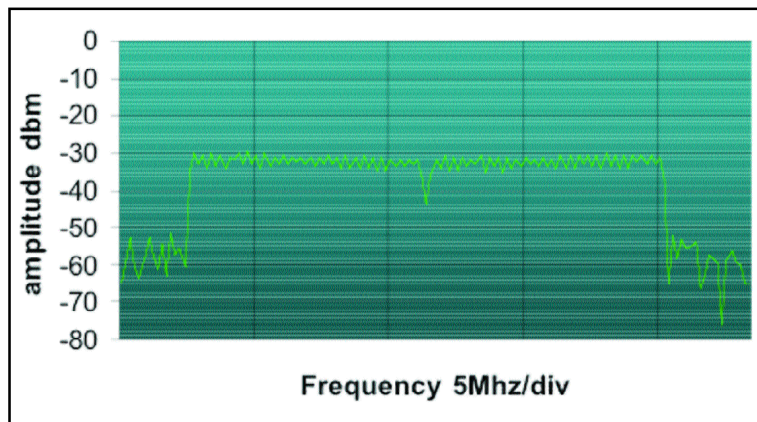


Figure 1. Time-averaged spectrum

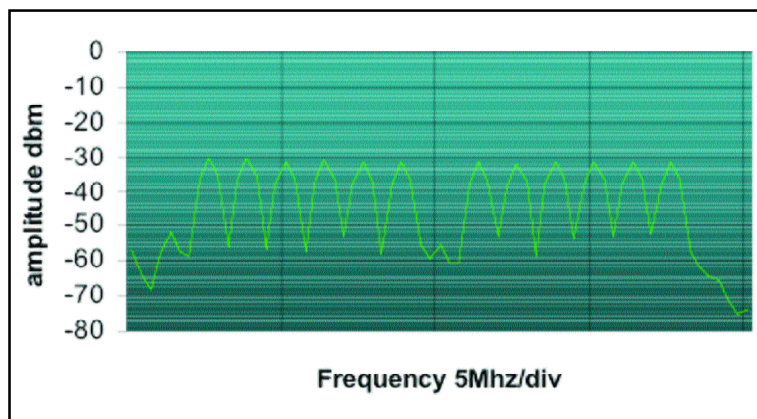


Figure 2. 802.11a preamble using signal-detect

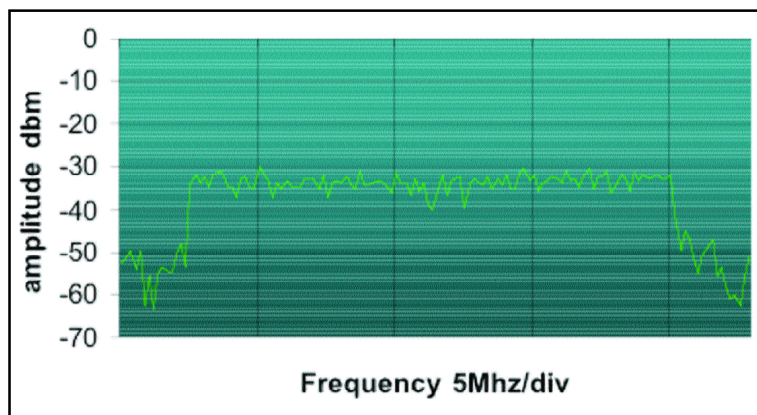


Figure 3. 802.11a data field using signal-detect



Figure 4. Berkeley Varitronics Systems BumbleBee™ Multi-Band Spectrum Analyzer