Re: Help with correct use of spectrum analyzer (power measurement)

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2008−02/msg01218.html

- *From*: varsakelis@xxxxxxxxx
- *Date*: Sun, 10 Feb 2008 14:12:41 −0800 (PST)

On 8 ¦µ², 19:41, "Steve" <sjbur...@xxxxxxxxxxx> wrote:

> <varsake...@xxxxxxxxx> wrote in message
>
> news:80a04323−c99c−4f71−b89b−cd1f498c7425@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
>
>> I am trying to use a spectrum analyzer to ID various RF signals in an urban environment and measure their power. I am having trouble interpreting some of my measurements, and I would greatly appreciate any help:
>>
>> 1) I start out by sweeping the range 0.5GHz to 6.5GHz, using large RBW and VBW (50MHz). The trace I see contains 3 very prominent peaks. They are centered at 1.8GHz (−22dBm), at 4.08GHz (−15dBm), and at 6.13GHz (1.1dBm!), and each is approximately 200MHz wide at its "base".
>>
>> 2) I "zoom in" on the largest of the 3 peaks (select a 6.13GHz center frequency, and a span of 200MHz), and cut the RBW down to 3MHz or 1MHz. Now, the large peak that used to be there has disappeared completely (why?).
>> If I now set the spectrum analyzer to "pulsed mode" for detecting pulsed signals, then I see instead a series of roughly 10 peaks, however their magnitudes are much lower than the large peak I saw when measuring with the larger RBW, e.g., −22dBm instead of +1.1dBm before (why such a huge difference?).
>> These smaller peaks do not stay at fixed frequencies but "move around" with each successive sweep(why?).
>> Slower sweeps reveal many more peaks than fast sweeps do (why?).

> Finally, out of the two magnitudes of the frequency peaks (the large values seen when measured with the 50MHz RBW, versus the smaller peaks when using 3MHz RBW), is either one supposed to be close to reality?
> I thought that the large dBm value (1.1dBm) obtained with the 50MHz RBW filter in place might correspond to the total power within the filter's bandwidth which then appears "broken up" over many peaks when using the narrower RBW, but that doesn't seem right because there aren't that many of the smaller −22dBm peaks to justify a total of 1.1dBm.
>
> Thanks in advance to anyone who may be able to shed some light.
>
> Dimitris

Dimitris:
When looking at wideband modulated signals, the spectrum analyzer is not the best instrument for measuring total power. You've seen the reason − a modulated signal is spread out in various ways, depending on how its modulated. In fact, for most modulation types, most of the power is everywhere *except* in the center.

The SA complicates your perceptions, because you are looking at the signal through a sweeping filter. The SA never really sees all of the signal at one time, but the screen gives the appearance that it does. Changing RBW affects how much the SA sees at one time, and it reports the total power in that filter, as it swept across that frequency, at that instant.

For wideband signals, your SA probably won't have resolution bandwidths wide enough (or properly shaped) to take in all the power at one time, and give you a single numeric result.

For narrow band signals you can often make an approximation by choosing a span just wide enough to let you see the entire signal, and then choose a RBW large enough that the signal appears almost like a straight line across the entire span. (this means RBW > Span). The measured power at the center frequency will then be close to containing all the signal power. As you decrease the RBW, you'll see the peak power decreasing as the sweeping filter sees less of the entire signal.

But there are some cautions here − if there are adjacent signals, their power is also included in this measure, so you get too high a value. And the shapes of your filters are a factor, as are some other things. But as a first approximation, its usually within 3 dB. If you have a sign gen that does FM, you can fool around with changing the deviation to spread the signal more or less and see how the RBW gets you closer to the known power of the generator, as the RBW increases.

> You can always take the plot data and integrate under the curve to get a manual solution.
>
> Hope this helps
>
> Steve

Steve: Thank you for your help. I knew that increasing RBW would lead to higher measured power exactly for the reasons you mentioned, but was surprised to see that the effect of reducing RBW from 50MHz to 3 MHz was so huge (peak power went from +1dBm down to −22dBm or even less). This signal is always within the 6.103−6.171GHz band, and there are no "adjacent" signals, so I tried the technique you suggested and got the +1dBm figure I mentioned.

I'm working on getting access to a sig.gen., but in the meantime, I think I'll try to find out what transmits in that band anyway in hopes of knowing its frequency hoping rate − it must be pretty fast, judging from the rate at which signal strength seems to "disappear" with a lower RBW.

In any case, I appreciate your suggestions.

Dimitris
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