January 2013

Issue: 7

# THE FLEX INSIDER

## In This Issue

Is A Dedicated RX Antenna Needed....?

Lab Quiz

Multiple Slices / Multiple Panadapters Video

## A Word from our CEO - FLEX-6000 Signature Series Development / Delivery Update

**Dear Customer,**

First off, I'd like to say "Happy New Year" and a happy year we expect it to be as we approach production shipments of the new FLEX-6000 Signature Series.

I'd like to answer the question of delivery right up front and then address the reasons behind the schedule delay. Our plan is to ship the Limited Edition radios during Q2 2013. That means that we expect to ship early orders near the beginning of the quarter and late orders toward the end of the quarter. It is possible that some of the later orders could spill over into early Q3. Post Limited Edition orders will begin shipping in Q3.

Can we be 100% certain that we can exactly meet the schedule outlined above? No. Is the new schedule probable? Yes. Why? Because we now have the goal line in sight and the added engineering resources discussed in the December FlexInsider are having a positive impact.

There are a number of factors that contributed to the delay from our original schedule. The simple explanation is that we underestimated the magnitude of the work and resources available. If you're interested in a more detailed description, here are the highlights:

1. This is the most sophisticated and complex amateur radio transceiver that we have ever produced. While we have delivered products to the government that use a number of the core technologies, the FLEX-6000 Series radios contain an even higher level of system complexity.

## Upcoming Events

February 2, 2013
Frostfest
Richmond, VA

February 8-10, 2013
HamCation
Orlando, FL

February 15-16, 2013
Yuma Hamfest
Yuma, AZ

Charlotte Hamfest
March 8-9, 2013
Concord, NC

March 8-9, 2013
Acadiana Hamfest
Rayne, LA

March 23, 2013
Greater Houston Hamfest
Rosenberg, TX

March 30, 2013
RARSFest
Raleigh, NC

2. We started with a clean sheet of paper. While we brought forward our 10 years of SDR experience and knowledge, every line of code and every circuit is based on a new vision of the future, not the past.
3. We are eternal optimists. If we weren't, the FLEX-6000 would never have gotten off the drawing board. We would have chickened out. I'm glad we didn't. I am confident that you will be glad as well.
4. There were some "science projects" that we did not anticipate. A science project is an element of work with an unpredictable schedule and outcome. Sometimes things that seemed trivial at the onset, turn out to be the biggest time sinks. Sometimes things that look hard turn out to be easy. You never know.
5. We really believed what we said. (See #4)
6. In some cases we are delivering more than we promised. We specified that the spectral display (panadapter) would cover up to 384 KHz. We are now delivering up to 10 MHz per panadapter on both the FLEX-6500 and FLEX-6700. We are also delivering high definition, real time spectral display technology never before seen in ham radio.
7. Software development schedules are extremely difficult to project accurately over long periods of time.
8. Stuff happens...
9. Even in retrospect, we couldn't have developed a radio of this sophistication in any other way. With hindsight (which is always 20-20), there are a few things we might change about how we did things but not much.
10. This is an amazing radio! Some of the best wine just takes time.

We recognize the trust you have put in our company by placing your order early and we are working hard to provide you a radio platform that you will be proud to own and enjoy for years to come. If you want to get a firsthand look at the FLEX-6000 series, please see us at one of the upcoming events detailed on our home page at www.flexradio.com or schedule a time to visit our office if you are in the Austin area.

73,

Gerald Youngblood, K5SDR
President & CEO

## Is a Dedicated RX Antenna Needed for the FLEX-6000 Signature Series SDRs?

- by Tim Ellison, W4TME, Product Management, Sales & Support

Due to the RF wide band digitization provided by the high

performance Signal Capture Units™ (SCUs) in the FLEX Signature Series SDRs, 14 MHz of RF spectrum is viewable at one time using the panadapter high definition spectrum display. This new "wide band" capability has generated much discussion regarding antenna requirements in regards to receiving for the FLEX-6700™ and FLEX-6500™.

Most hams have antenna systems which are designed and optimized primarily for transmission on the ham bands, be it resonant dipoles, multi-band beams, quads, loops or verticals. Transmitting antennas also make good receiving antenna due to the Green's theory of electromagnetic reciprocity, which implies that an antenna's electrical properties, such as the radiation and receiving patterns, are identical. But does that actually preclude using an antenna like a resonant 20m dipole with a 1:1 balun at the feed point for wide band reception? The best way to answer that question is to perform a "real world" test and evaluate the results.

For this experiment, a very close to resonant (R=48 ohms, X=1 @ 14.200 MHz) 20m wire dipole that is 15m above ground level is used. The value R noted previously is the resistance of the antenna system and the value X indicates the reactive component; for most ham radios, the closer R is to fifty (50) and X is to zero (0) the closer to resonance the antenna system will be at a particular frequency. This particular antenna has a moderate Q factor, which is a measure of resonant bandwidth of an antenna relative to a center frequency point. At the band edges, our test antenna only has a value of X = 7 so it is fairly resonant throughout the 20m ham band.

Using the wide band spectrum view afforded by SmartSDR™ for Windows, the RF signal strength in the frequency domain is directly observable. One might presume that a signal level increase in the RF spectrum centered on 14.200 MHz would be observed due to RX/TX antenna reciprocity and signal would be attenuated on either side of the peak. But the observed RF spectrum tells a much different story. As can be seen from the spectrum view below, with the 20m pre-selector filters not enabled, the noise floor is essentially flat from 7.5 to 21.5 MHz and there are strong visible SWL broadcast signals clustered at 9.5 MHz. The expected increase in signal strength at 14.200 MHz was not observed, indicating that the 20m test dipole does a very good job of receiving signals well outside of its designed frequency range.

Figure 1. Spectrum View with 20m Pre-Selector Turned Off
Click here to download a high resolution view of the above image

The next question that should come to mind is what difference can be observed by using the ham band pre-selector filter capability included in the FLEX-6500 and FLEX-6700 Signature Series SDRs? The function of a pre-selector or narrow band pass filter is used to reduce or reject out-of-band unwanted interference that may interfere with your signals of interest. Again, the result of enabling the 20m pre-selector is observed by the wide band spectrum view shown below.

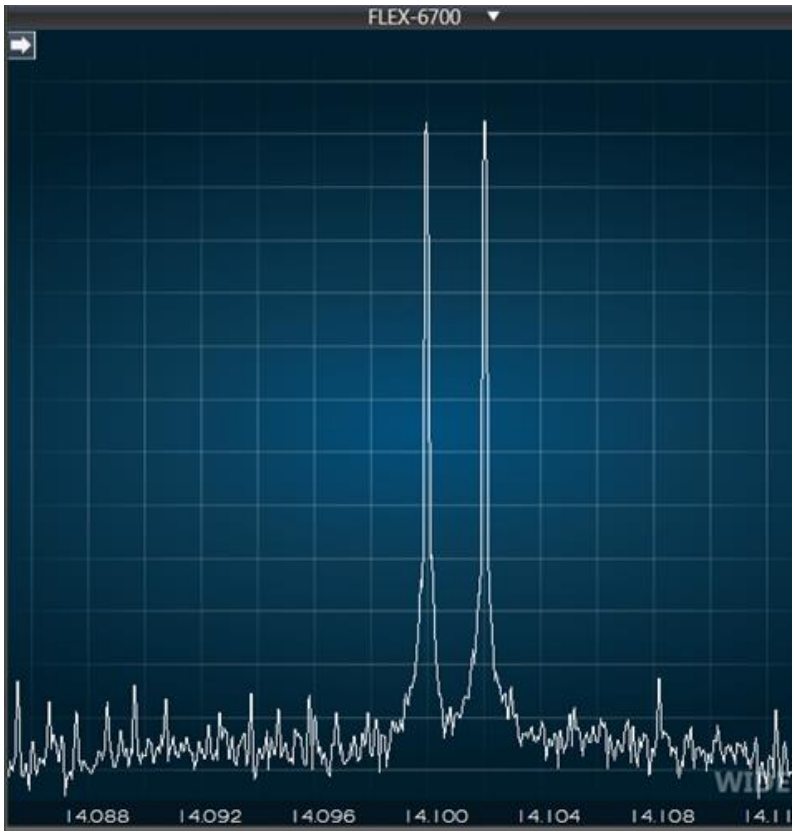
Figure 2. Spectrum View with 20m Pre-Selector Turned On
Click here to download a high resolution view of the above image

What is noticeable is the large signals that were present on either side of the center frequency of 14.270 MHz have been significantly reduced, but the signals in the 20m segment of the band have not. This is the expected behavior when enabling a band specific pre-selector.

There is another interesting bit of information that can be extracted from the above frequency spectrum views, which is being able to directly observe the MUF or maximum usable frequency. The MUF is the highest radio frequency that can be used for transmission between two points. The test results above were taken at 8:00 PM local time when the 20m band was just about to close. With the 20m pre-selector turned off (figure 1), the spectrum view shows strong signals below 20m, but very few signals above 16.500 MHz, indicating the MUF at this time was approximately 16 MHz, showing another one of the inherent capabilities of the wide band digital down conversion (DDC) technology provided by the SCUs used in the FLEX-6000 Signature Series SDRs.

# Lab Quiz

This is a two tone test measured at 2 KHz tone spacing on a FLEX-6700 receiver. The measurement was made with the 20m preselector engaged and the preamps off. The tones were confirmed by external test equipment to be 0 dBm per tone (1 mW). That is the equivalent of S9 + 73 dB per CW tone or S9 + 79 dB PEP combined. The IM3 measurement is -103.4 dBm. What is the equivalent IP3? (Note: "Your actual mileage" may vary.) Post your answer on the FlexRadio Facebook page.




## FLEX-6000 in Real Time - Multiple Slices / Multiple Panadapters

In the second installment of our SmartSDR Introduction Video Series, we expand the new SmartSDR "Slice" concept to show multiple receiving slices and multiple panadapters.  Check out the video below.  I hope you'll agree... THIS IS COOL!  73, Greg - K5GJ

SmartSDR Multiple Slices - Multiple Panadapters

FlexRadio Systems
4616 W. Howard Lane, Ste. 1-150
Austin, TX 78728
512-535-4713(main), 512-233-5143 (fax)
www.flexradio.com / sales@flexradio.com