Review: inexpensive RF generator

Kenneth Wyatt  - November 02, 2013

During one of my presentations on low-cost EMC troubleshooting tools at the IEEE EMC Symposium
last August, one of the attendees, Doug Miller, mentioned a small PC-controllable RF generator for
just $190. Of course, I had to buy one and try it out!

The Trinity Power Inc., RF Synthesizer (Version 5) is available from RF design consultant, Robert
Yarbrough (http://www.rf-consultant.com), for $190 postpaid in the U.S. It’s about the size of a deck of
playing cards and is powered and controlled from a Windows PC. The software and USB cable are
supplied. Yarbrough also has a more expensive "calibrated" synthesizer (but slightly lower power
output) for $330. Both units cover 35 to 4400 MHz in several bands. The design of the unit is based
on the Analog Devices ADF4351.

Figure 1 - The TPI RF generator is about the size of a deck of cards.

Using the simple Windows software, you can either step the frequency anywhere within the entire
35 to 4400 MHz range, or set the unit to sweep continuously within any of the individual bands
(rounded off frequencies listed):
Figure 2 - The Windows-based control screen allows adjustment of output power and sweeping or stepping the frequency.

Band 1: 35 to 68.75 MHz
Band 2: 68.75 to 137.5 MHz
Band 3: 137.5 to 275 MHz
Band 4: 275 to 550 MHz
Band 5: 550 to 1100 MHz
Band 6: 1100 to 2200 MHz
Band 7: 2200 to 4400 MHz

The maximum output power is about +15 dBm (tapering down, starting at 3700 MHz, to about +10 dBm at 4400 MHz) and may be adjusted in four decreasing power levels about 3 dB apart. There are three RF ports. The 50-ohm RF output is an SMA connector. There is also a 10 MHz reference output and an external 10 MHz input. The frequency accuracy is controlled by a temperature compensated clock oscillator of +/- 2.5 ppm over -30 to +85C. The phase noise is particularly low at -91 dBc/Hz (at 1 GHz with 10 kHz offset). The unit may be adjusted in steps as small as 1 kHz.
Figure 3 - Setting the output to 1 GHz and zeroing in on the phase noise (RBW = 100 Hz), I was surprised how low it was compared to other synthesizers I've seen.

A bit of concern was the series of higher-order harmonics produced, but the second harmonic was still 10 dB below the level of the fundamental. For the purposes of radiated immunity troubleshooting, this is probably not a great concern, as this second harmonic is 1/10th the power of the fundamental.

Figure 4- A display of the 100 MHz fundamental and the higher-order harmonics.

What struck me was the potential for using this unit to generate localized RF fields for troubleshooting radiated immunity issues. By connecting a small h-field or e-field probe to the output, easily controllable and localized RF fields may be generated at 3 to 20 V/m levels (depending on frequency). By either sweeping over limited bands or stepping through the typical 80 to 1000
MHz range (IEC 61000-4-3), or higher, you could quickly pinpoint areas of your circuitry that are susceptible to RF fields.

**Figure 5 - The measured output power with the levels of second and third harmonics recorded.**

*Because my spectrum analyzer only goes to 1.5 GHz, I chose to stop collecting data at 1 GHz. The second harmonic is about 10 dB down.*

What's more, you can throw it into your pocket or briefcase! What's not to like? It sure beats lugging around the old 42 pound HP 8640A RF generator I've been using.

For more information on how I use RF generators to troubleshoot radiated immunity issues, check out [this posting](#).

Can you think of other ways this instrument might be useful for EMC pre-compliance testing or troubleshooting?

For more:

- [RF generator description](#)
- [User manual (pdf)](#)