



Fast Frequency Switching with the 1140A Microwave Synthesizer

The 1140A offers a number of different modes to accommodate various frequency switching needs. Each mode has different advantages and limitations.

Standard Switching

In normal operation, the 1140A is commanded to change frequencies by writing a VXI message to the instrument. A typical message might be “:FREQ 3.752 GHZ” to switch the unit to 3.752 GHz. There are many factors influencing how fast this message can be transferred to the instrument - the type of VXI interface, speed of the computer, programming language, etc. - but simple measurements indicate that a time of 25 milliseconds is not difficult to achieve. After the instrument receives the command, it must parse it and calculate the loop frequencies necessary to produce it. This is included in the 25 millisecond time. Then the instrument must program these frequencies, unlock the YIG oscillator, move it and the output YIG filter to the new frequency, and acquire lock. This time required for this process is specified at 50 milliseconds, but has been measured to very constantly about 30 to 35 milliseconds. So from initiation of computer command to the frequency settling at the new value the time is about 60 milliseconds. It should be noted that this time is constant regardless of the size of the frequency jump - if this technique of frequency changing is used a 10 kHz step takes as long as a 10 GHz step.

Triggered List Mode

A variation of the above technique that is often useful is what is called the triggered list mode. Here, the frequencies desired are preloaded into the 1140A. The frequencies can then be stepped through by either sending a VXI command, triggering via the VXIbus hardware trigger lines, or in response to an internal delay timer. Up to 201 frequencies can be stored. This mode can overcome the 25 millisecond bus overhead and can also synchronize the frequency switching with an external event via the VXI hardware trigger. However, the 35 milliseconds switching time remains. That is, the new frequency will appear approximately 35 milliseconds after the VXIbus trigger is applied.

Using the IF Input

If faster switching is desired, the 1140A offers a technique where it upconverts an externally applied signal to any frequency within its output range (see the note “Complex Modulation with the 1140A Microwave Synthesizer” for a technical description of how this works). If the fast frequency jump can be generated at a frequency between 300 and 1000 MHz and the bandwidth required (i.e. largest frequency change) is less than 50 MHz, then this technique can offer frequency switching/hopping at microwave frequencies as fast as they can be produced at the IF input. The limitation to this technique is that all the frequencies must fall within 50 MHz and that an external source must produce a baseband signal to be upconverted. For special applications, the 50 MHz bandwidth can be increased over some narrower output ranges - inquire for more information.

Direct Control of the DDS

For very specialized applications, the 1140A offers a mode where the direct synthesizer used in the 1140A internal fine loop can be moved. This provides extremely fast phase coherent switching. However, the bandwidth of this control is only 2 MHz and it is only accessible over the bus, not with the triggered list mode. Therefore the 25 milliseconds VXI overhead is always present, showing up as a delay before the frequency change takes place. When it does take place, it is extremely fast - less than a microsecond.

Summary

The 1140A offers a variety of ways to change the output frequency, each with its advantages and disadvantages. If you have a special application and think we can help, we are always happy to talk to you about our products. Contact at any of the ways listed below.

Phase Matrix, Inc.
109 Bonaventura Drive, San Jose CA 95134
Toll Free: 1-877-447-2736, Web: www.phasematrix.com