

## 409B External Reference, Application Note AN006

This application note provides an example showing how to program the 409B to use an external reference of 80MHz and a clock multiplier of 6. This example is specific to the Model 409B-AC/R/E.

a) Connect an 80MHz signal to the 409B-AC/R/E rear SMA connector labeled REF. Connect the serial port of the 409B-AC/R to the serial port of a windows computer. Apply power to the 409B-AC/R and open the SOF8\_409 windows application on your computer..

b) Select the SOF8\_409 **Clear/Clear 409 (Restores factory defaults)** menu. The outputs should now be 10MHz.

c) Click the SOF8\_409 **Display Current Settings** button. The Response text box will now show six lines of text. The last two digits on the last line indicates the Firmware revision number. This number must be 21 or higher.

d) Select the SOF8\_409 **Clock/Enter External Clock Frequency** menu. Click the yes button indicating you have an external clock signal connected and then enter “80” in the input box and click ok. Eighty is the frequency in MHz of your external clock.

e) Select the SOF8\_409 **Command/Send a Command to the 409B** menu. When the input box appears enter “kp 86”. This will set the range bit high (see para 4.10 of the 409B manual) and set the clock multiplier to 6.

f) Select the SOF8\_409 **Clock/Set 409 to External Clock Operation** menu. (This sends the “C E” command.) Verify that you receive an OK in the response box.

g) Set output to 10MHz. Select the **Frequency/Set Output 0 Frequency** menu and enter “8.9478485”. Output channel 0 should now be generating 10MHz. Click **Display Current Settings** and confirm that the **Output 0 Frequency** display shows 10MHz.

h) Set output to 150MHz. Select the **Frequency/Set Output 0 Frequency** menu and enter “134.2177280”. Output channel 0 should now be generating 150MHz. Click **Display Current Settings** and confirm that the **Output 0 Frequency** display shows 150MHz.

Model	External Reference Connections
409B	Connect an external reference up to 500MHz to the rear BNC connector labeled REF IN.
409B-AC	Connect an external reference up to 500MHz to the rear BNC connector labeled REF IN
409B-AC/R and 409B/R	Connect an external reference of 10MHz only to the rear BNC connector labeled REF IN. The /R option adds an internal circuit board that phase locks the internal clock oscillator to the external 10MHz reference.
409B/R/E and 409B-AC/R/E	Connect an external reference of 10MHz only to the rear BNC connector labeled REF IN. The /R option adds an internal circuit board that phase locks the internal clock oscillator to the external 10MHz reference. You can also connect an external reference up to 500MHz to the rear SMA connector labeled EXT. By default the /R 10MHz external reference will be used but you can switch off the /R operation and use the SMA External Reference by sending the “C E” command.

### Paragraph g) and h) calculations:

$$F_c = (F_o \times \text{Internal Clock}) / (\text{REF} \times K_p)$$

where:

F<sub>c</sub> is the Frequency Command, F<sub>o</sub> is the desired Frequency Output, Internal Clock is 429.4967296MHz, REF (External Reference Clock) is 80MHz and K<sub>p</sub> (Clock Multiplier) is 6.

#### Para. g: Set 10MHz Calculation:

$$F_c = (10 \times 429.4967296) / (80 \times 6) = 8.9478485$$

#### Para. h: Set 150MHz Calculation:

$$F_c = (150 \times 429.4967296) / (80 \times 6) = 134.2177280$$