3. Probe "backwards" through the circuit to see where you do see the signal. You should have that same signal level (0.4 to 0.7 RMS) at the output of U1b pin 7. If you do, the problem is between there and the board output.
4. If you do not, check the next amp output back in the chain: U1a pin 1. You should expect to see about half of what the expected board output was: about 0.9V p-p, or 0.3V DC with your RF probe (again depending on the RF probe and DVM used). And again carefully turn the trimpot while looking for the voltage.
5. If you do not see a signal there on U1a pin 1, then the problem is farther back toward the DDS. But if you do see a signal, the problem is somewhere between the two amplifiers U1a and U1b. Carefully look for wrong components placed, improperly soldered components, and missing/broken components.
6. Next, look for a 200 mV p-p signal (0.07 Vdc on your RF Probe + DVM) at the output of the Low Pass Filter. The output of the LPF is on the through-hole pad below the right end of C1. If you see the signal there, the problem is probably in the first amplifier stage (U1a). Again check components, etc., as previously instructed.
7. Next, look for the raw DDS output signal, also 200 mV p-p at the top of R12. If you do not see a signal there then the DDS is not DDS'ing.
8. Next, check to see that your reference clock is producing the required 30 MHz signal to the DDS chip. Probe the larger through-hole pad to the left of C19 and expect to see a whopping signal of about 4 Vp-p, or 1.4 Vdc with your RF probe and DVM. If not seen, your reference clock isn't attached properly or it is defective - either of which would inhibit your DDS card from working.

Temperature Analysis

Some builders of the DDS-60 card are surprised at how hot the components operate, particularly the DDS chip (U2) and the 5V voltage regulator device (U3). In quick summary, these components will indeed get pretty warm – in fact too warm to hold your finger on it for more than 5-10 seconds – but this is quite normal and here is how we determine that:

DDS-60 card:
Input: 13.4 volts, 128 ma
- Don't forget there's a diode between the power connector & card, amounting to a 0.2 volt drop.
- This current is for fully operating DDS chip, with PLL turned on effectively creating a 180 MHz ref clock

Regulator:
Input: 13.4 volts
Output: 5 volts, 97 ma
Tj(max) = 150-degC
Theta-JA = 53-degC

AD9851:
Power: 650 mW (worst case from spec sheet, 180 MHz @ 5V)
Tj (max) = 150-degC
Theta-JA = 82-degC

Ambient Temp = 21.1-degC

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Theta-JA = Thermal resistance from junction-to-ambient

The all-important equation for Tj (temp of internal semiconductor junction):
Tj = Tambient + (PWR x Theta-JA)
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So for the **REGULATOR** ...
Tj = 21.1 + (((13.4 - 5) x .097) x 53) = 64.3-degC

... therefore, compared to Tj(max) of 150, we are well within spec.

And for the **AD9851** ...
Tj = 21.1 + (.650 x 82) = 74.4-degC
... therefore again, compared to Tj(max) of 150, we are well within spec.

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Temperature Measurements ....
Tambient = 21.1-degC (70-degF)
Regulator case = 71.1-degC (160-degF)
(Regulator heatsink tab) = 76.6-degC (170-degF)
AD9851 case = 63.9-degC (147-degF)
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Conclusions ...

1) The DDS-60 is operating within component thermal and power specifications.

2) The "too hot to touch" observation that some have made is probably correct. Even my guitar-calloused fingers cannot be pressed on either of these chips for longer than 10 seconds without a severe "Ouch!". But this is normal and okay, as long as the ambient temperature stays below 195-degF (yes, an almost-boiling room temperature will exceed the max Tj of these components!) The packages are made for this ... our fingers are not.

3) If you want to reduce the operating temperature of the voltage regulator (U3), try supplying the DDS card with a lower voltage. The card is designed to operate with a voltage source as low as 8V. Using this level of power supply will significantly lower the operating temperature of the regulator.

PS: Voltage, current and temperature measurements were made with a Metex ME-11 DVM with a Fluke 80T-150U temperature probe.

DDS Signal Quality

Jim Kortge, K8IQY performed some signal quality measurements using his lab-quality spectrum analyzer and he captured the screen views for us. Jim writes …

"Guys, I thought you might like to have the latest plots at 10, 30, and 60 MHz using the latest PIC-EL 5.1 code and my DDS-60. I also just ran a test to make sure that the manual gain pot could be used to adjust the 60 MHz amplitude to that of the 10 MHz signal. Works like a dream! I think this DDS-60 board is a true winner and works very well."

