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Test Procedure for RF Frequency Doubler

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## 1 Introduction

The following Test Procedure describes the test of proper operation of the RF Frequency Doubler.

## 2 Test Equipment

- Voltmeter
- Oscilloscope
- Stanford Research SR785 analyzer
- Tektronix AFG3101 function generator (or similar)
- RF Power Meter HP E4418A
- Board Schematics—[Frequency Doubler](#)

## 3 Tests

*The RF Frequency Doubler comes with a number of different power supply boards so I will assume that we are using the latest which is the Low Noise Power Module (D0901846) with the RF Distribution Amplifier :Interface (D1000064).*

- 1) **Verify the proper current draw.** Using a bench DC supply apply  $\pm 24$ Volts to P7 and  $\pm 17$  Volts to P6 of the low noise power Module (D0901846). Measure the current draw of the board.

+24 Volt current \_\_\_\_\_ 0.1 A Nom.

-24 Volt current \_\_\_\_\_ 0.0 A Nom.

+17 Volt current \_\_\_\_\_ less than 1.0 A

-17 Volt current \_\_\_\_\_ less than 0.01 A

- 2) **On the low noise power module check the voltage on TP 1-13.**

TP1 (+17V) \_\_\_\_\_ TP2 (-17V) \_\_\_\_\_

TP3 , 4 ( GND ) TP5 (+ 5V)\_\_\_\_\_

TP6 (-15V) \_\_\_\_\_ TP7 (+24V) \_\_\_\_\_

TP8 ( GND ) TP9 (-24V) \_\_\_\_\_

TP10 ( GND ) TP11 (+15V) \_\_\_\_\_

TP12 (+VREF) \_\_\_\_\_ TP13 (-VREF) \_\_\_\_\_

**3) If TP 1 , 2, 7 , 9 and 8 are correct then pin 5 on U1 and U7, TP14 (OK) should be Logic high ~3Volts. The front panel LED should be on.**

**Confirm.**\_\_\_\_\_

**4) The noise on TP 12, 13, 11 and 6 should be measured with a SR785 using an rms power spectrum.**

TP12 noise \_\_\_\_\_ less than 20 nVrms/ $\sqrt{\text{Hz}}$  at 140 Hz

TP13 noise \_\_\_\_\_ less than 30 nVrms/ $\sqrt{\text{Hz}}$  at 140 Hz

TP11 noise \_\_\_\_\_ less than 40 nVrms/ $\sqrt{\text{Hz}}$  at 140 Hz

TP6 noise \_\_\_\_\_ less than 60 nVrms/ $\sqrt{\text{Hz}}$  at 140 Hz.

**5) Test the RF monitor by applying a 80 MHz RF signal to J1. Monitor the nominal output power at J2 and measure the output voltage at mon1.**

Nom output pwr	Input pwr dBm	Mon volt (M)	Measured volt.	Measured Pwr
13 dBm		2.9V (0.725)		
10 dBm		3.2V (0.800)		
7 dBm		3.5V (0.875)		
0 dBm		4.2V (1.05)		
-10 dBm		5.2V (1.30)		
none		6.2V (1.55)		

6) Test the RF output powers by applying a 80 MHz/10dBm RF signal to J1. With a RF power meter measure the power at the output (13 dBm nominal). If the output power is consistently too high an attenuator A1 has to be adjusted accordingly. Nominal output power is 13 dBm.

Output: \_\_\_\_\_ (13 dBm nominal)

7) Measure the phase noise of an 80MHz OCXO driving the RF Frequency Doubler. Use a 160MHz OCXO as the second oscillator to compare the output signal of the doubler, using the Wenzel single channel phase noise measurement technique (3.5.3), Figure 3.5.2-1, which can be found at

[http://www.wenzel.com/pdf/files1/BP1000Manual/BP\\_1000\\_v101\\_2\\_.pdf](http://www.wenzel.com/pdf/files1/BP1000Manual/BP_1000_v101_2_.pdf) .

A reasonable FFT analyzer is the SR785, which can be set to measure power units if you start in Display Setup. A Reference Source must be provided which can be just a Wenzel crystal oscillator of frequency close enough to lock, properly powered and connected to the Wenzel phase noise measurement system. The output of the RF Frequency Doubler will need to be attenuated to the amplitude needed by the Wenzel phase noise measurement system (about 10 dBm). Compare to the phase noise of the OCXO datasheet, add 6dB to the noise of the 80MHz unit and add it in quadrature to the noise of the 160MHz unit. The noise of the doubler should be within 3dB.

Offset (Hz)	Phase noise spec (dB/Hz)			Measured (dB/Hz)
	80 MHz	160 MHz	total	
10	-90	-84	-81	
100	-110	-104	-101	
1000	-140	-134	-131	
10000	-160	-154	-151	