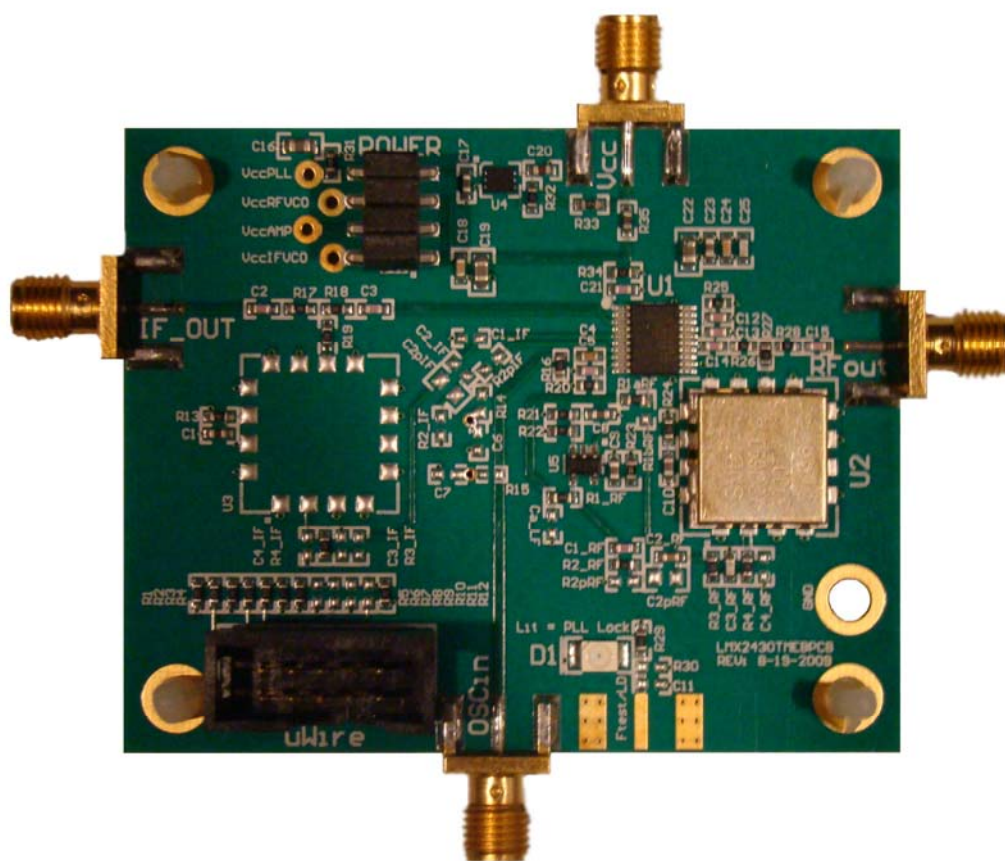




LMX2430/33/34 Family

Evaluation Board Instructions

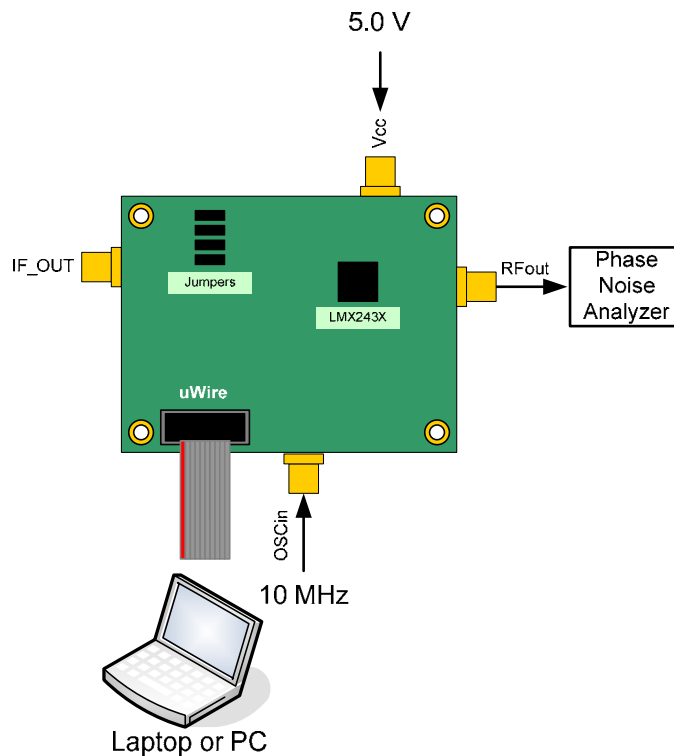


National Semiconductor Corporation
High Speed Signal Path Division
Precision Timing Devices
10-12-2009

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Quick Setup



RFout

Connect to a spectrum analyzer or phase noise analyzer. The Agilent E4445A was used for these measurements

Vcc

Connect to a 5.0 volt power supply. Note that there is on-board regulator (LP5900) that regulates this voltage down to 2.5 volts for the PLL.

uWire

Connect to a computer with CodeLoader software

OSCin

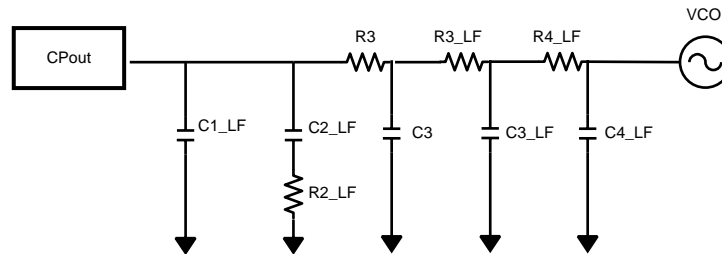
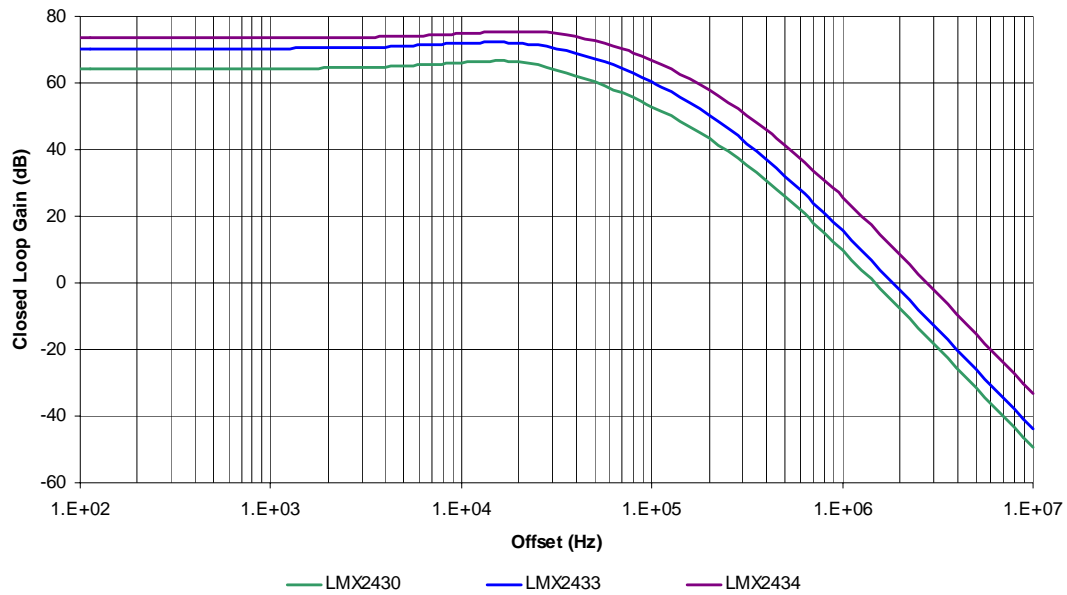
Connect to a clean reference source, such as the back of the spectrum analyzer. Be aware that tunable frequency sources, such as the signal generators can be noisy and degrade the PLL phase noise measurements.

IF_OUT

This output is the output of the IF PLL. There is no IF VCO on the board, but there is the option to add one.

Loop Filters

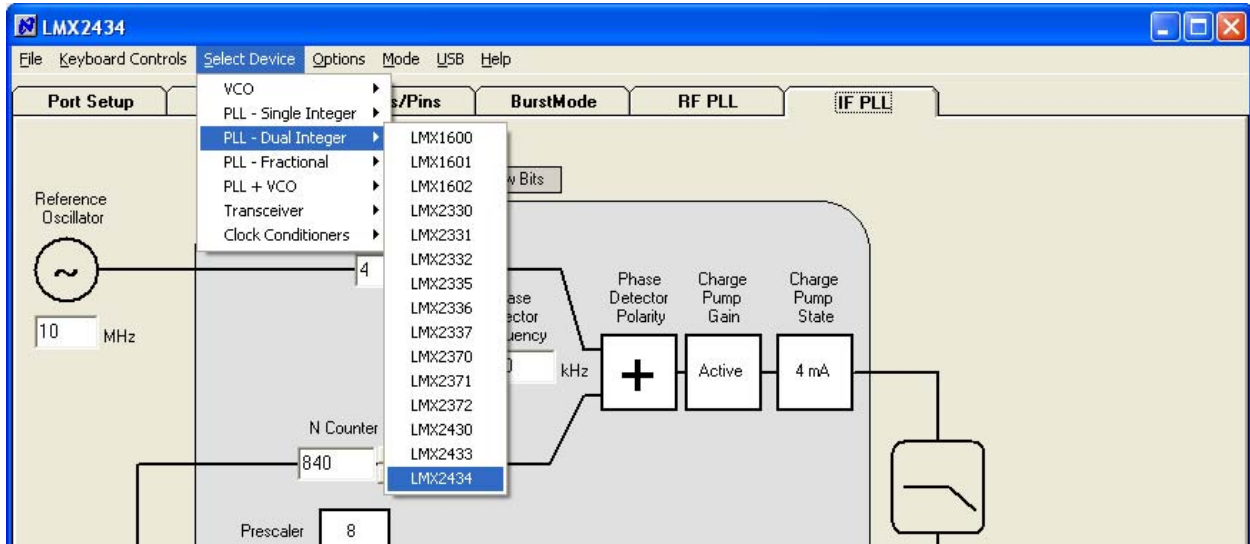
Closed Loop Transfer Function



Parameter	LMX2430	LMX2433	LMX2434
VCO Frequency (MHz)	1600 – 1675	3200 - 3400	4690 - 4890
VCO Gain (MHz/V)	32	90	94
Charge Pump Gain (mA)	4	4	4
VCO Input Capacitance	39	22	12
Phase Detector Frequency (MHz)	1	1	1
OSCin Frequency (MHz)	100	100	100
Loop Bandwidth (kHz)	27.9	31.1	41.2
Phase Margin (deg)	56.8	59.6	58.4
Gamma	0.57	0.90	0.87
T3/T1 Ratio (%)	220.8	177.1	213.9
C1_LF (nF)	0.18	0.27	0.1
C2_LF (nF)	6.8	10	3.9
C3_LF (nF)	1	1	1
C4_LF (nF)	Open	Open	Open
R2_LF (Kohm)	2.2	1.8	3.3
R3_LF (Kohm)	0.82	0.82	0.68
R4_LF (Kohm)	0	0	0

CodeLoader Setup

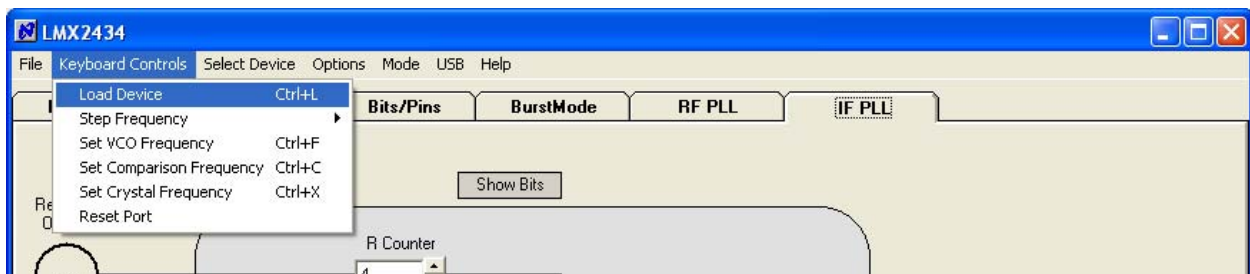
Select the part. It should be the LMX2430, LMX2433, or LMX2434.



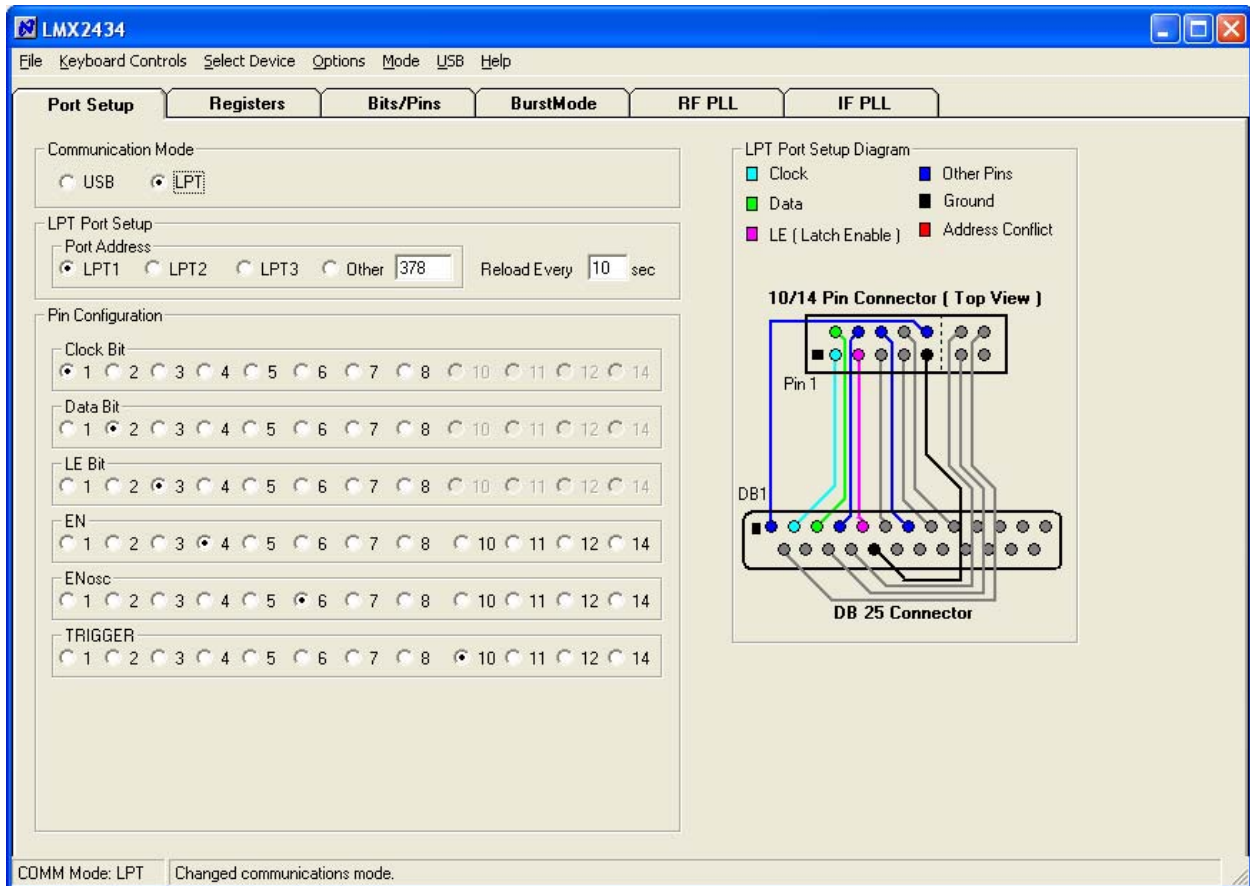
Choose the correct startup mode. The Active Filter mode is the more recent version.



Load the part. You can load it from the menu or also press Cntrl + L. The current consumption should change and the red LED should come on when the board is loaded.



On the Port Setup tab, the user may select the type of communication port (USB or Parallel) that will be used to program the device on the evaluation board. If parallel port is selected, the user should ensure that the correct port address is entered.



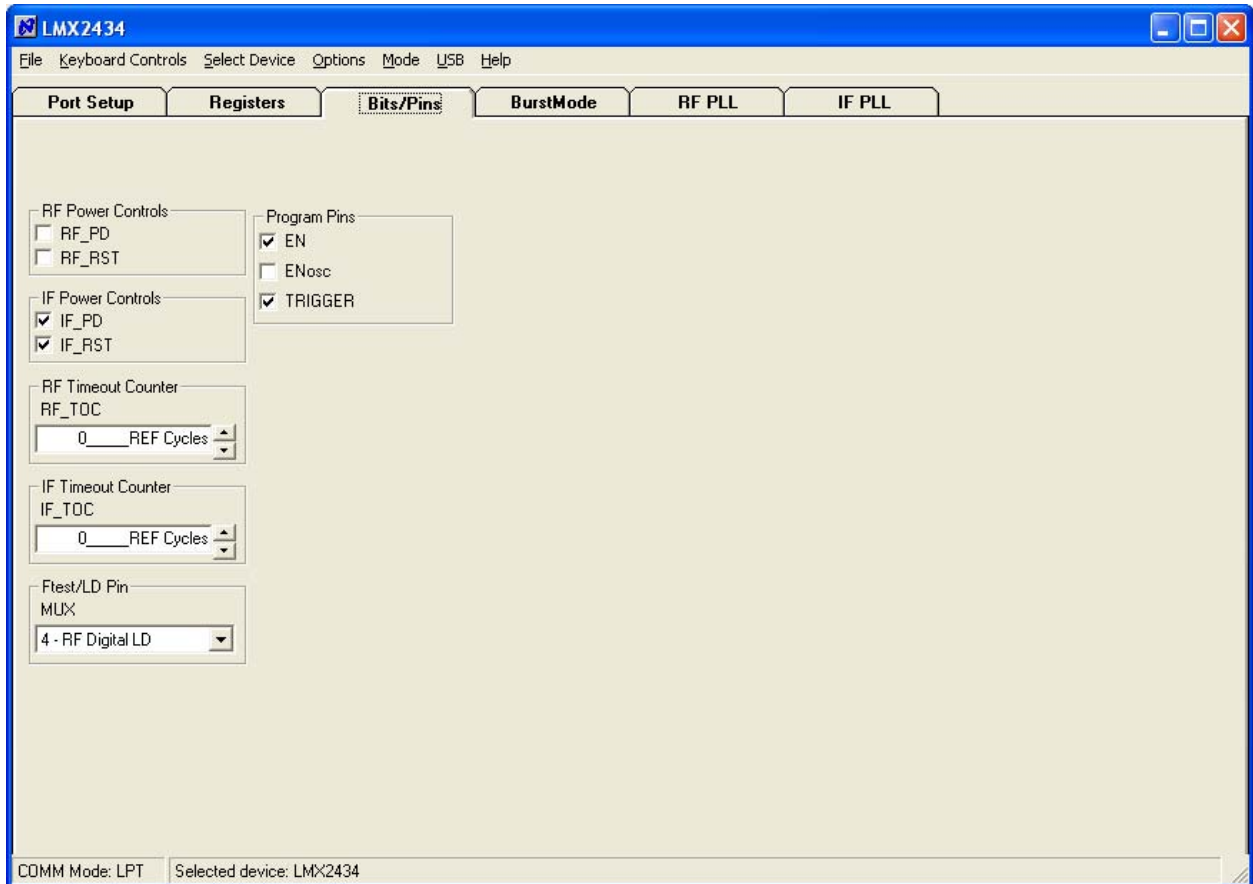
The Pin Configuration field is hardware dependent and normally SHOULD NOT be changed by the user.

The evaluation board is typically shipped with a parallel port cable that is used to interconnect the board to a PC LPT port, enabling the board to be programmed.

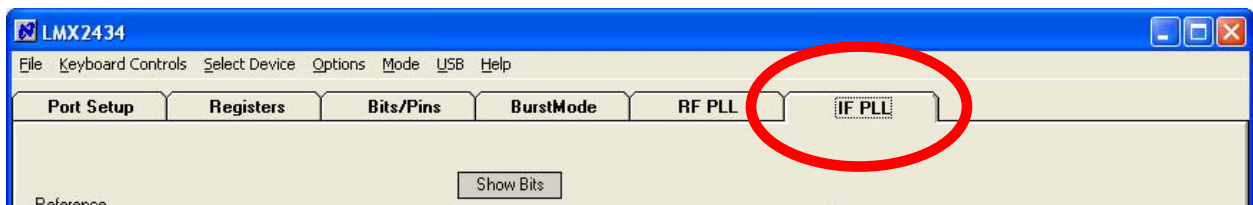
Separately available is a USB2UWIRE-IFACE board which simplifies evaluation by enabling the user to establish a USB connection from the Codeloader 4 software to the evaluation board.

http://www.national.com/store/view_item/index.html?nsid=USB2UWIRE-IFACE

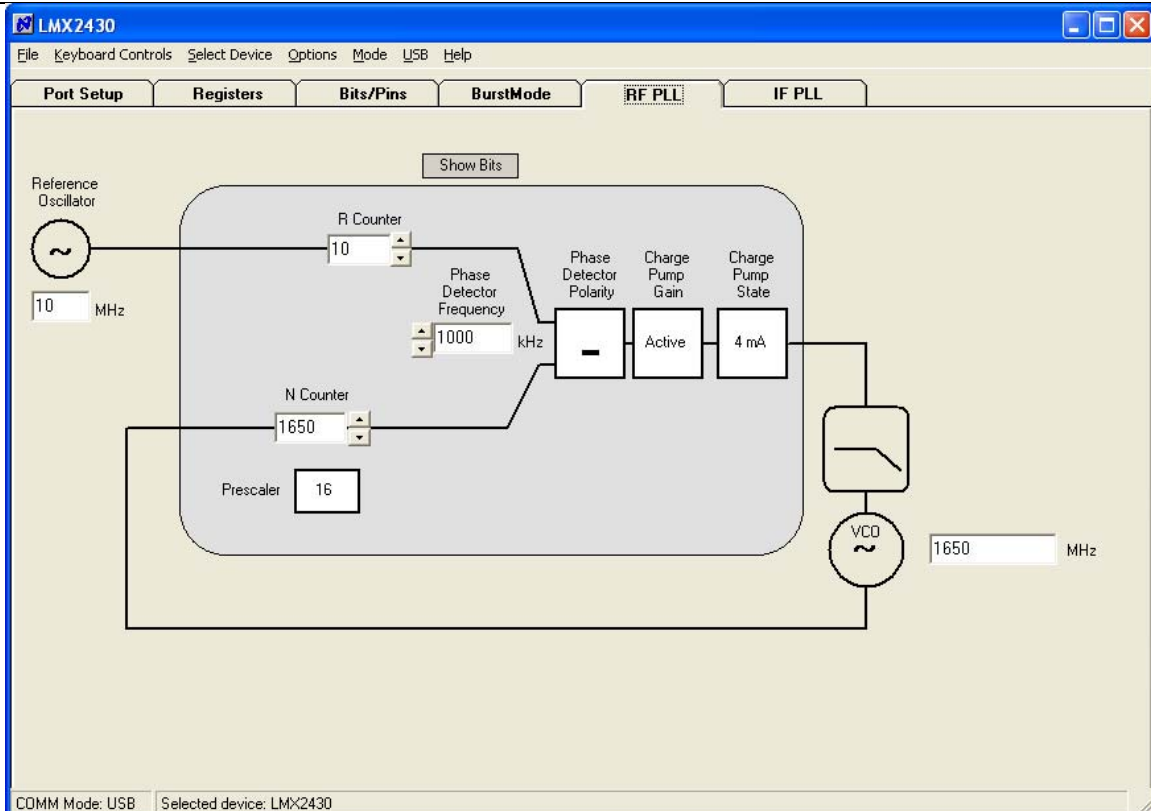
To view the function of any bit on the CodeLoader configuration tabs, place the cursor over the desired bit register label and click the right mouse button on it for a description. This Bits/Pins configuration is common to all options of the LMX2430 evaluation board.



Note that there is an IF PLL Tab. CodeLoader can be used to program the IF PLL, but it is not used in this case. Make sure not to mix up the IF PLL and the RF PLL.



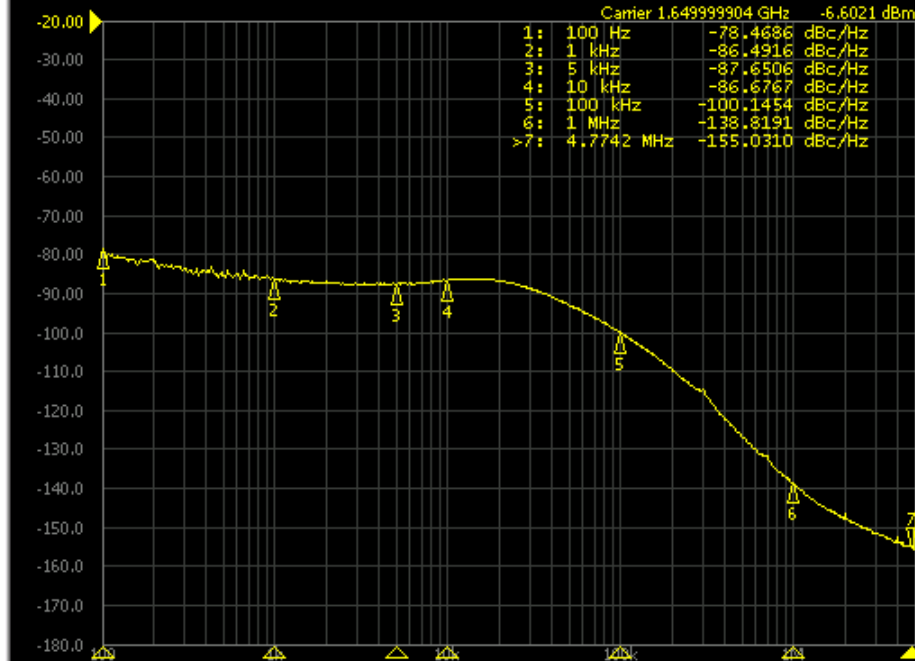
LMX2430 Measurements



Agilent E5052A Signal Source Analyzer

Marker 7 4.774199927592 MHz

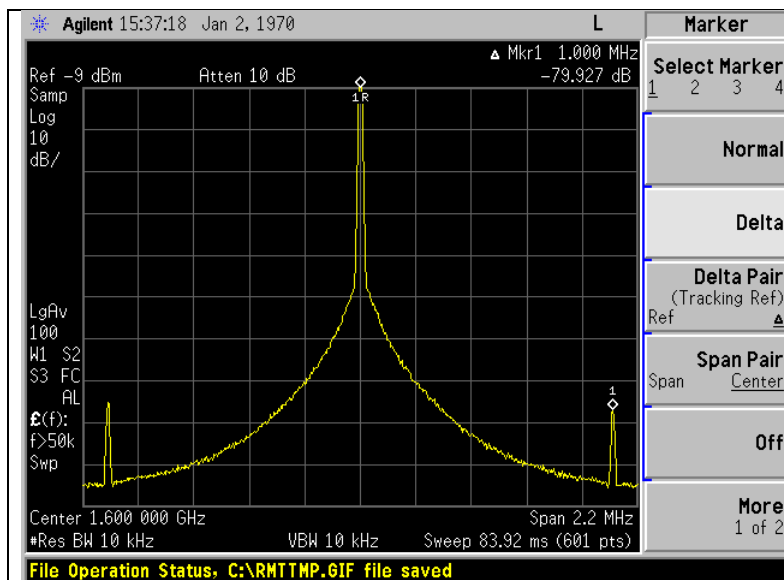
Phase Noise 10.00dB/Ref -20.00dBc/Hz



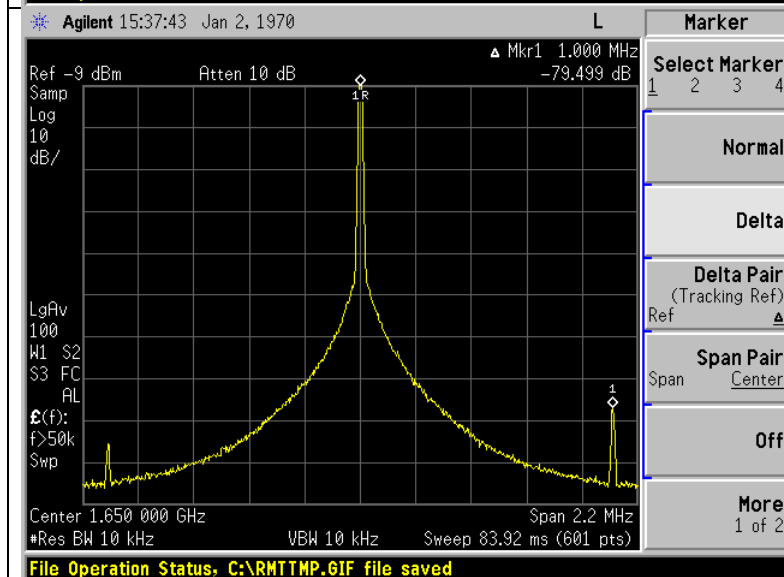
IF Gain 20dB | Freq Band [300M-7GHz] | LO Opt [<150kHz] | 607pts | Corre 10

Phase Noise Start 100 Hz | Stop 5 MHz | 10/16 | 68.2%

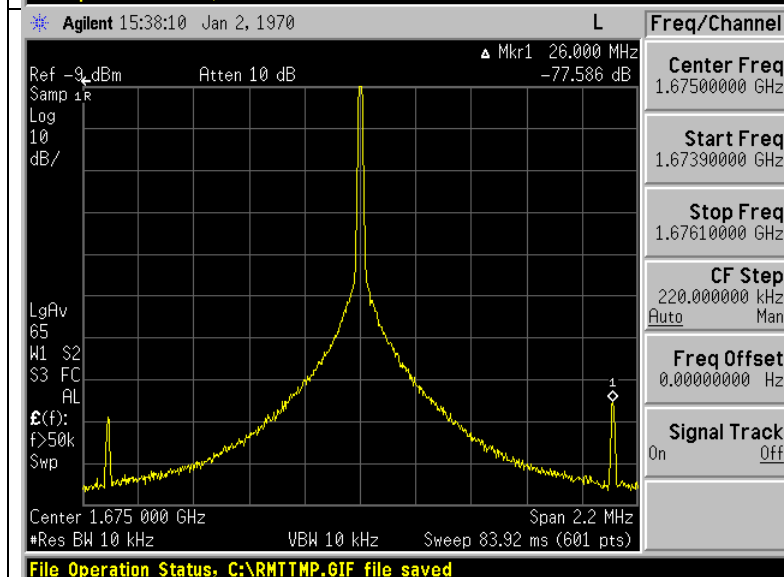
Set RF ATT 0dB | Phase Noise: Meas | Cor | Ctrl 0V | Pow 0V | Attn 5dB | ExtRef | Stop | Svc | 2009-10-14 09:28



Spur at 1600 MHz VCO frequency is -79.9 dBc.

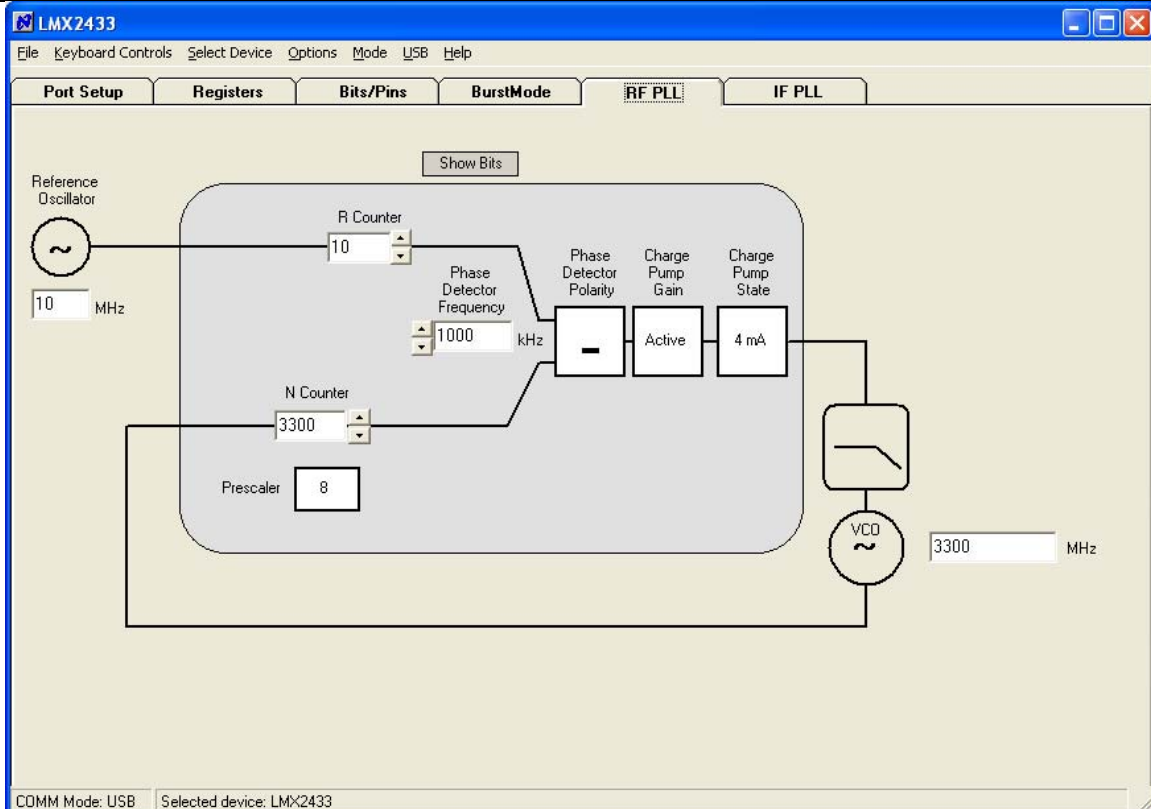


Spur at 1650 MHz VCO frequency is -79.5 dBc. Note that this spur is not symmetrical.



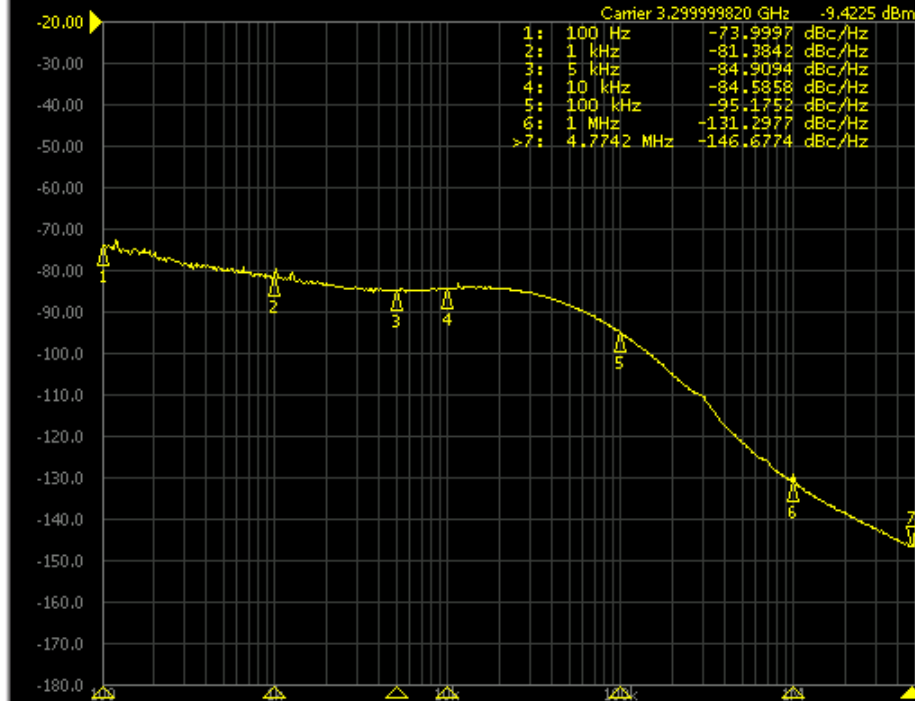
Spur at 1675 MHz VCO frequency is -77.6 dBc.

LMX2433 Measurements

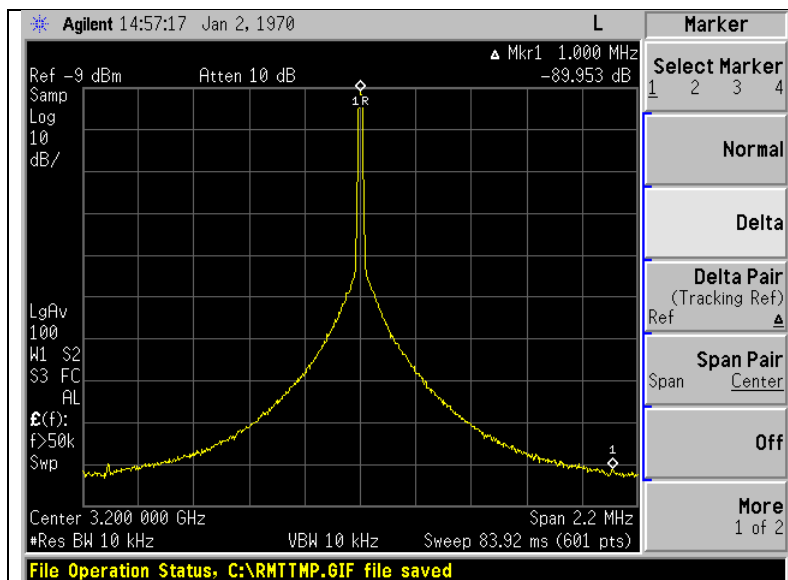


Agilent E5052A Signal Source Analyzer

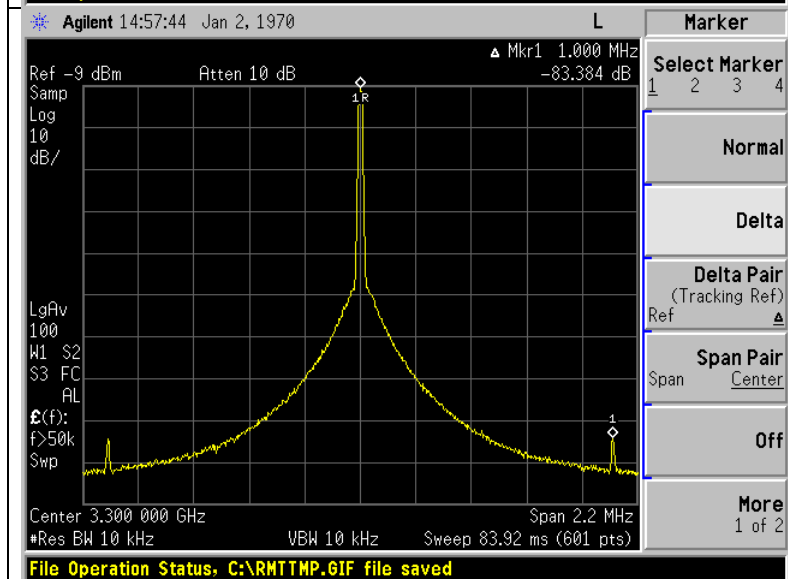
Phase Noise 10.00dB/ Ref -20.00dBc/Hz



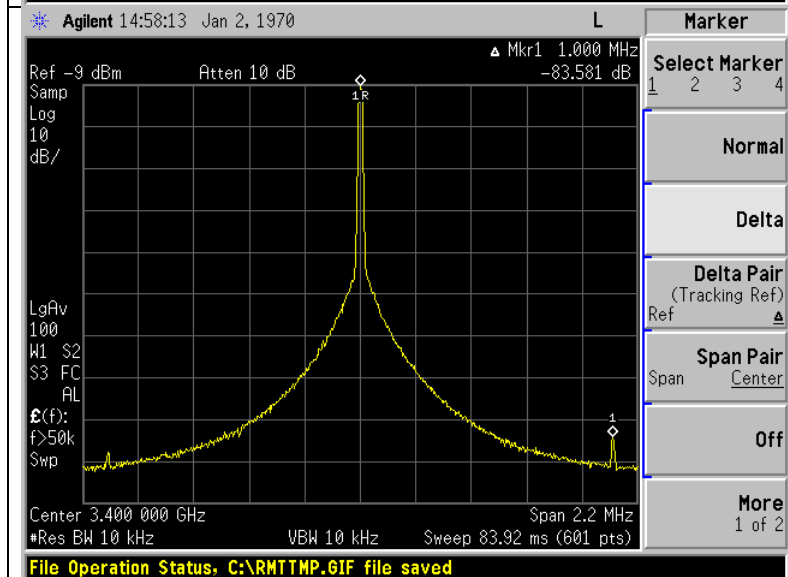
Set RF ATT 0dB | Phase Noise: Meas | Cor | Ctrl 0V | Pow 0V | Attn 5dB | ExtRef | Stop | Svc | 2009-10-14 09:45



Spur at 3200 MHz VCO frequency is below the noise floor.

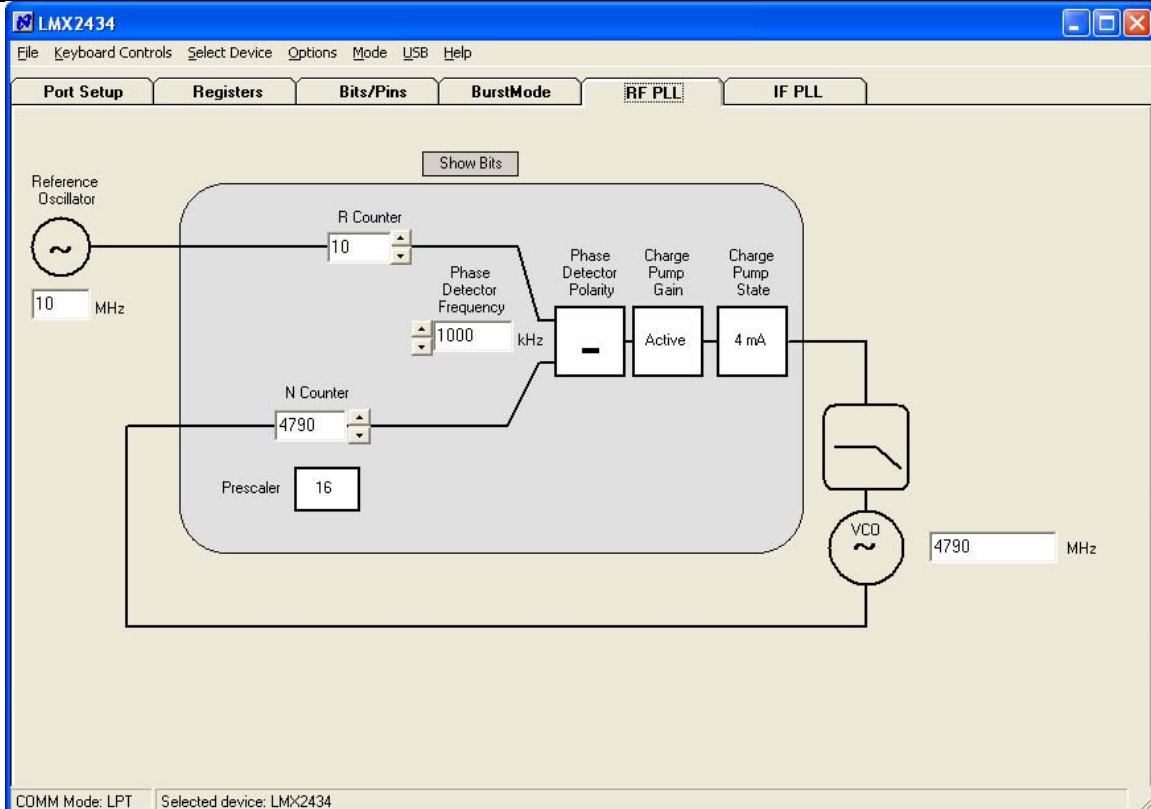


Spur at 3300 MHz VCO frequency is - 83.4 dBc.



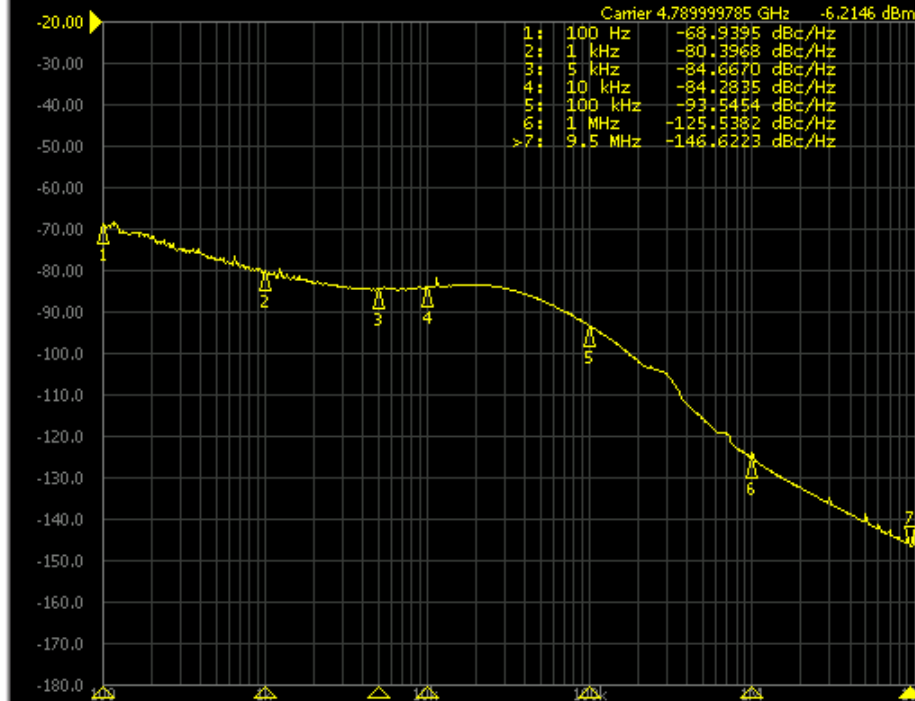
Spur at 3400 MHz VCO frequency is - 83.6 dBc. Note that this spur is not symmetrical.

LMX2434 Measurements



Agilent E5052A Signal Source Analyzer

Phase Noise 10.00dB/ Ref -20.00dBc/Hz



Phase Noise Start 100 Hz

Stop 10 MHz 12/16

Set RF ATT 0dB

Phase Noise: Meas

Cor

Ctrl 0V

Pow 0V

Attn 5dB

ExtRef

Stop

Svc

2009-10-14 10:10

Average

Averaging

Restart

Avg Factor

16

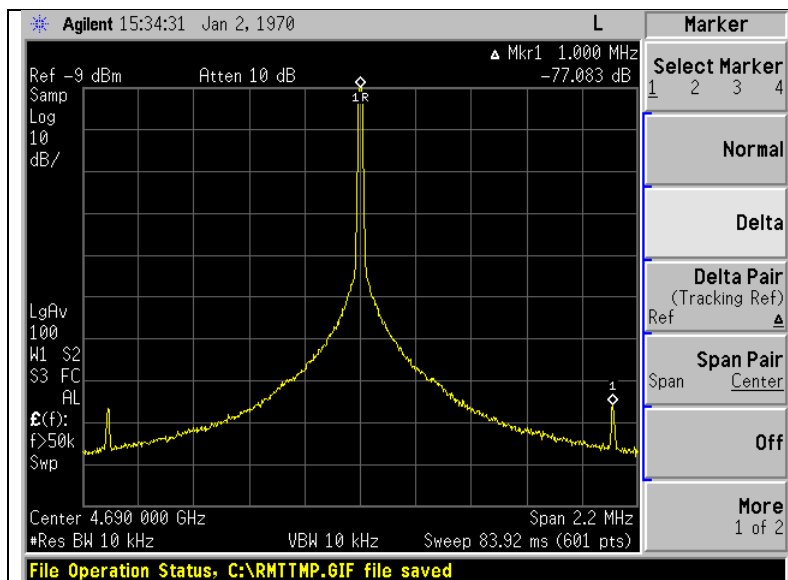
Averaging

ON

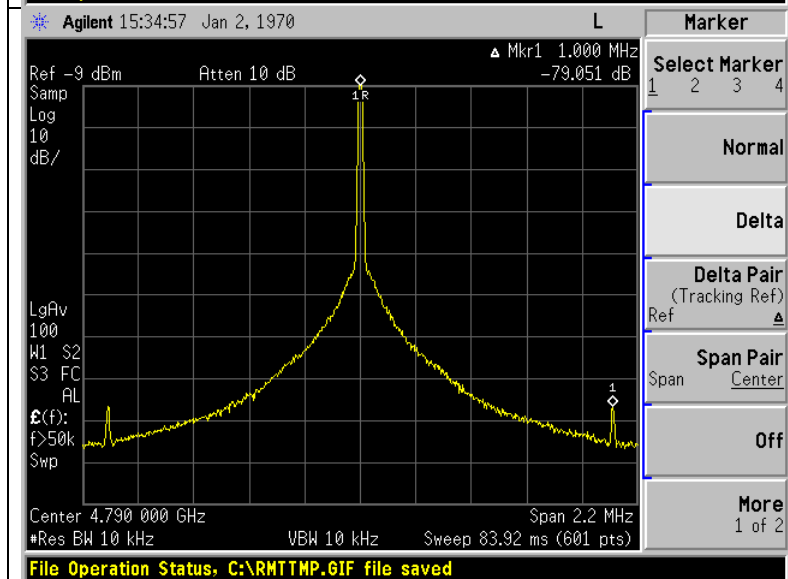
Correlation

10

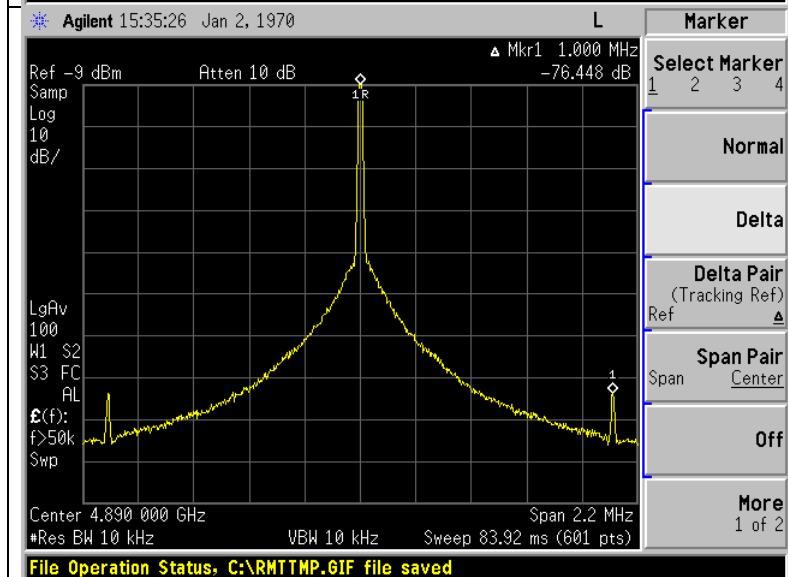
Return



Spur at 4690 MHz VCO is -77.1 dBc.



Spur at 4790 MHz VCO frequency is -79.1 dBc.

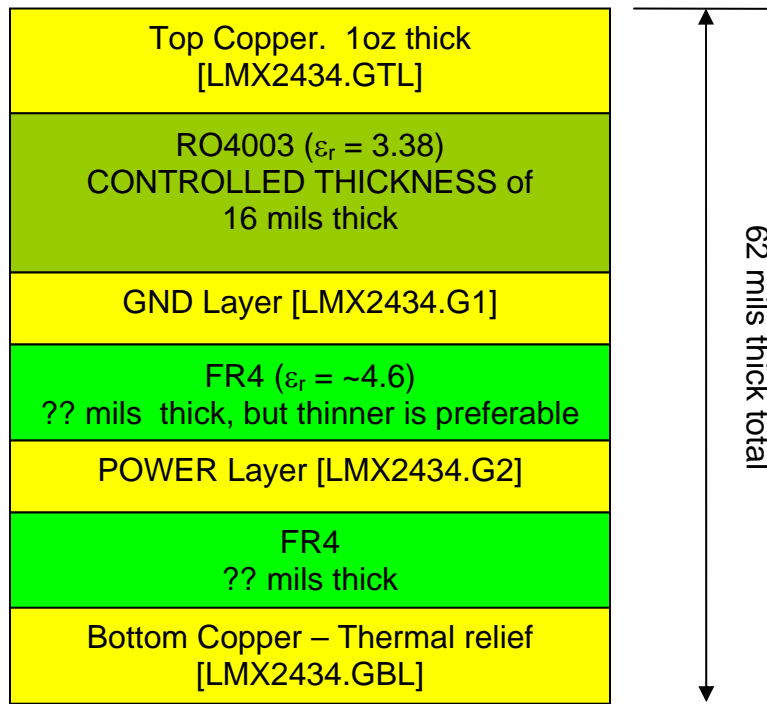


Spur at 4890 MHz VCO frequency is -76.5 dBc.

Fabrication and Assembly

Board Material	Rogers RO4003 (Top Layer to Ground Plane (.G1)) Remaining layers - FR4
Number of Layers	4
Board Thickness	0.062"
Copper Weight	1 oz Finished
Finish	Immersion Gold
Solder Mask Color	Green/Gloss
Testing	100% Electrical Testing

Name	K	Tand
RO4003 (16 mil)	3.38	0.0022



Bill of Materials

Revision	8.19.2009	LMX243X
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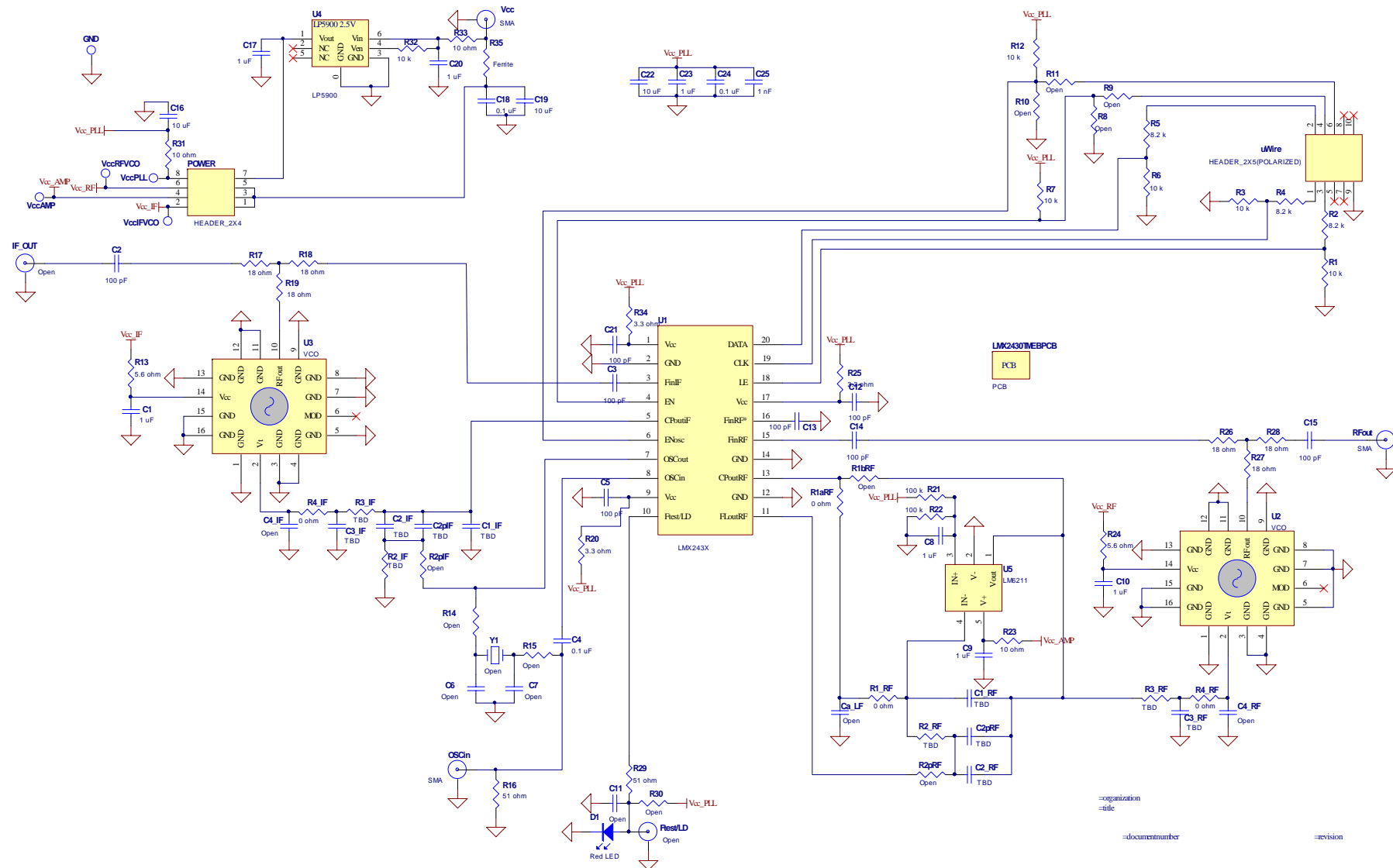
Part	Manufacturer	Part Number	Qty	Identifier
Capacitors				
100 pF	Kemet	C0603C101J5GAC	8	C2, C3, C5, C12, C13, C14, C15, C21
1 nF	Kemet	C0603C102J5GAC	1	C25
0.1 uF	Kemet	C0603C104K5RAC	3	C4, C18, C24
1 uF	Kemet	C0603C105K8VAC	6	C1, C8, C9, C10, C17, C20, C23
10 uF	Kemet	C0805C106K9PAC	3	C16, C19, C22
Resistors				
0 ohm	Vishay/Dale	CRCW06030000Z0EA	4	R1_RF, R1aRF, R4_IF, R4_RF
3.3 ohm	Vishay/Dale	CRCW06033R3JNEA	3	R20, R25, R34
5.6 ohm	Vishay/Dale	CRCW06035R6JNEA	2	R13, R24
10 ohm	Vishay/Dale	CRCW060310R0JNEA	3	R23, R31, R33
18 ohm	Vishay/Dale	CRCW060318R0JNEA	3	R17, R18, R19, R26, R27, R28
51 ohm	Vishay/Dale	CRCW060351R0JNEA	2	R16, R29
8.2 k	Vishay/Dale	CRCW06038K20JNEA	3	R2, R4, R5
10 k	Vishay/Dale	CRCW060310K0JNEA	6	R1, R3, R6, R7, R12, R32
100 k	Vishay/Dale	CRCW0603100KJNEA	2	R21, R22
Other				
Ferrite	Digikey	490-1015-1-ND	1	R35
HEADER_2X4	Comm Con Connectors	HTSM3203-8G2	1	POWER
HEADER_2X5 (POLARIZED)	FCI Electronics	52601-S10-8	1	uWire
Red LED	Lumex	SML-LX2832IC-TR	1	D1
SMA	Johnson Components	142-0701-851	4	IF_OUT, OSCin, RFout, Vcc
Op AMP	National Semiconductor	LM6211	1	U5
LDO	National Semiconductor	LP5900-2.5	1	U4
Standoff	SPC Technology	SPCS-6	4	Place in 4 holes in corners of board
Jumper	Sullins Electronics Corp.	S9000	4	Place on the POWER header
Open				
Open Capacitors	Open	Open	6	C4_RF, C6, C7, C11, Ca_LF, C2pRF
Open Resistors	Open	Open	9	R1bRF, R2pRF, R8, R9, R10, R11, R14, R15, R30
Open IF Loop Filter			10	C1_IF, C2_IF, C2pIF, C3_IF, C4_IF, R2_IF, R2pIF, R3_IF, R4_IF, U3
Open Other	-	Open	2	Y1, Ftest/LD

LMX2430 Build Only				
PLL	National Semiconductor	LMX2430TM	1	U1
VCO	RF Microdevices/VARIL	VCO190-1650T(Y)	1	U2
180 pF	Kemet	C0603C181J5GAC	1	C1_RF
6.8 nF	Kemet	C0603C682J5GAC	1	C2_RF
1 nF	Kemet	C0603C102J5GAC	1	C3_RF
2.2 k	Vishay/Dale	CRCW06032K20JNEA	1	R2_RF
820 ohm	Vishay/Dale	CRCW0603820RJNEA	1	R3_RF

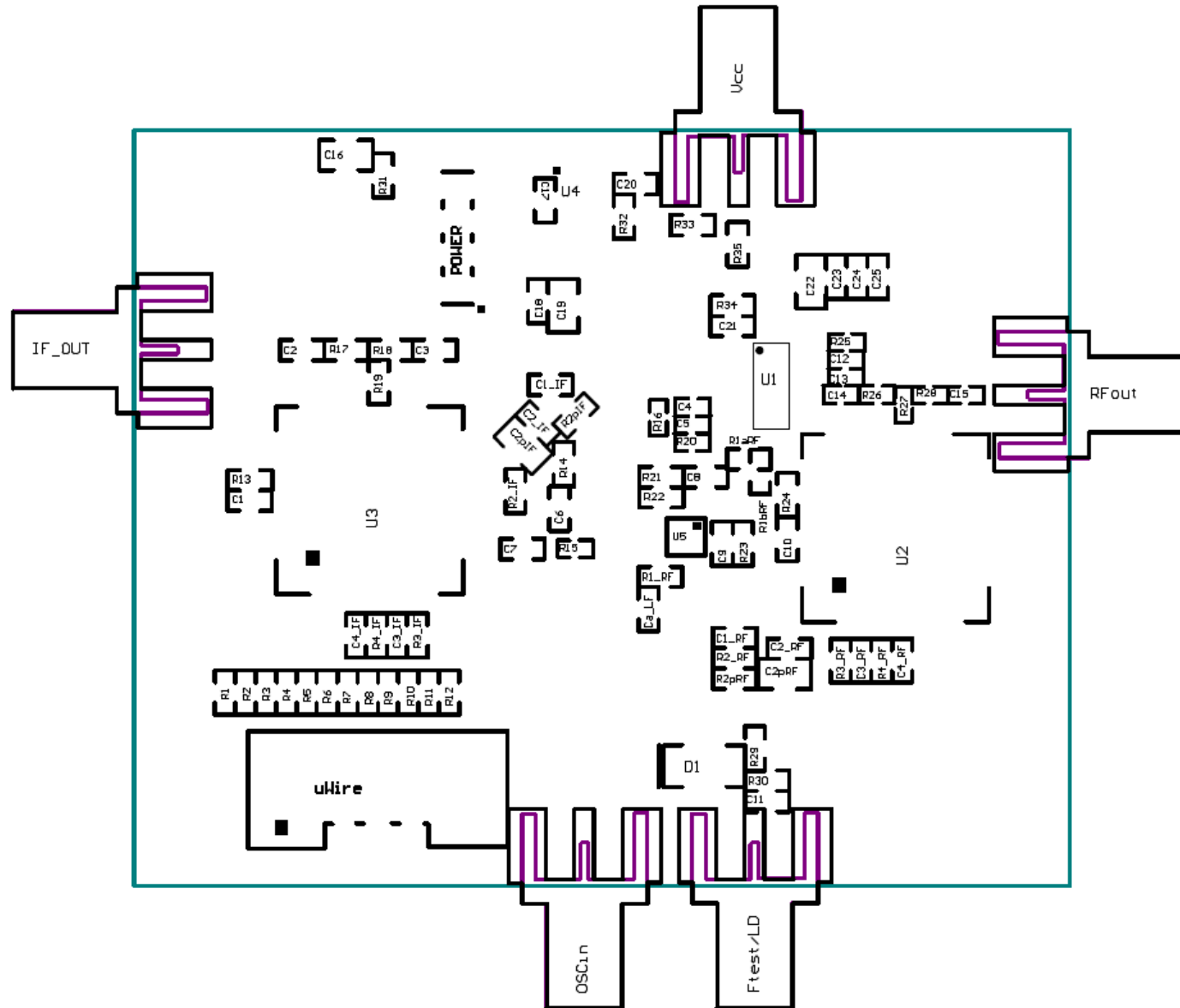
LMX2433 Build Only				
PLL	National Semiconductor	LMX2433TM	1	U1
VCO	RF Microdevices/VARIL	VCO690-3300T	1	U2
270 pF	Kemet	C0603C271J5GAC	1	C1_RF
10 nF	Kemet	C0603C103J3GAC	1	C2_RF
1 nF	Kemet	C0603C102J5GAC	1	C3_RF
1.8 k	Vishay/Dale	CRCW06031K80JNEA	1	R2_RF
820 ohm	Vishay/Dale	CRCW0603820RJNEA	1	R3_RF

LMX2434 Build Only				
PLL	National Semiconductor	LMX2434TM	1	U1
VCO	RF Microdevices/VARIL	VCO690-4790T	1	U2
100 pF	Kemet	C0603C101J5GAC	1	C1_RF
3.9 nF	Kemet	C0603C392J5GAC	1	C2_RF
1 nF	Kemet	C0603C102J5GAC	1	C3_RF
3.3 k	Vishay/Dale	CRCW06033K30JNEA	1	R2_RF
680 ohm	Vishay/Dale	CRCW0603680RJNEA	1	R3_RF

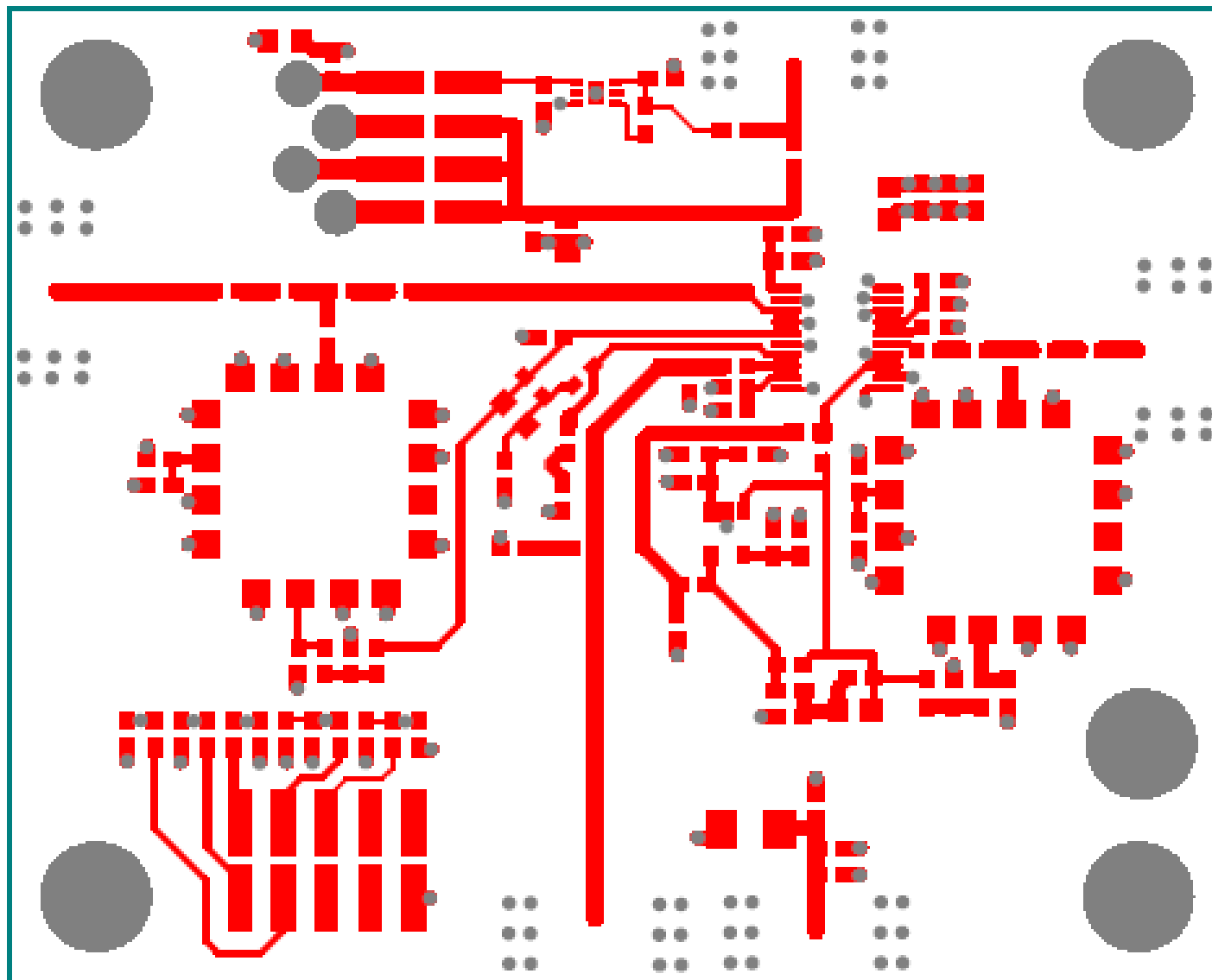
Schematic



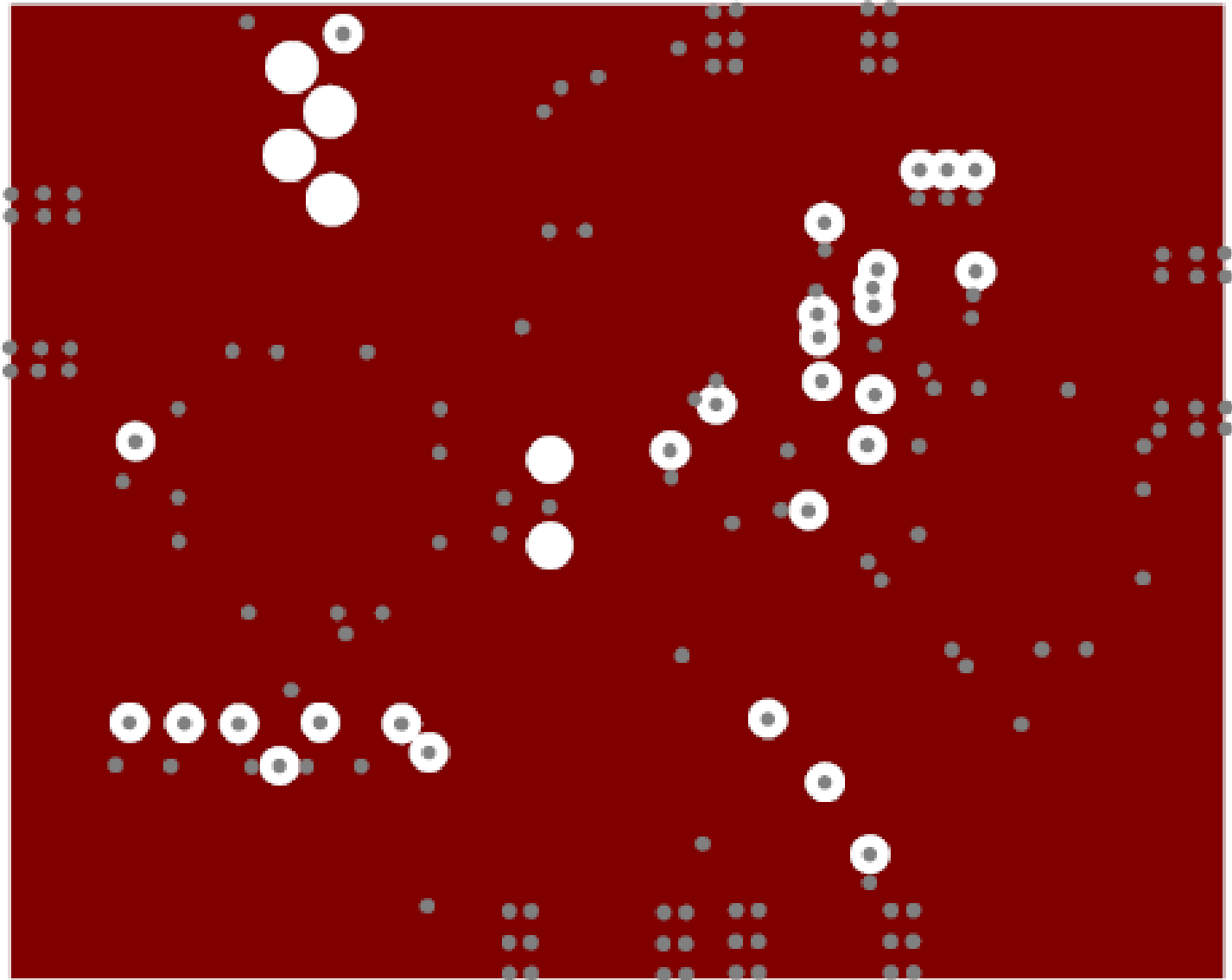
Top Build Diagram



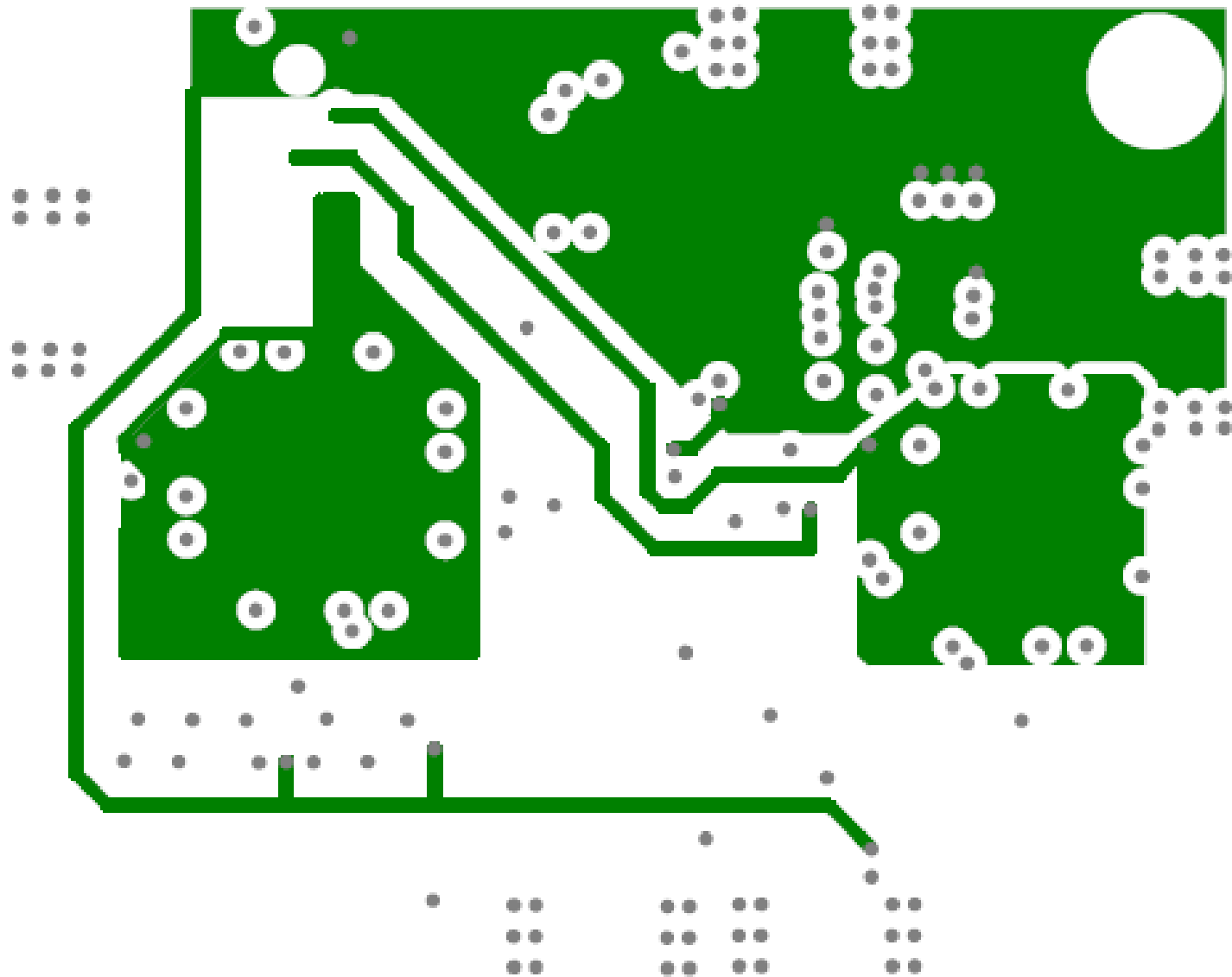
Top Layer



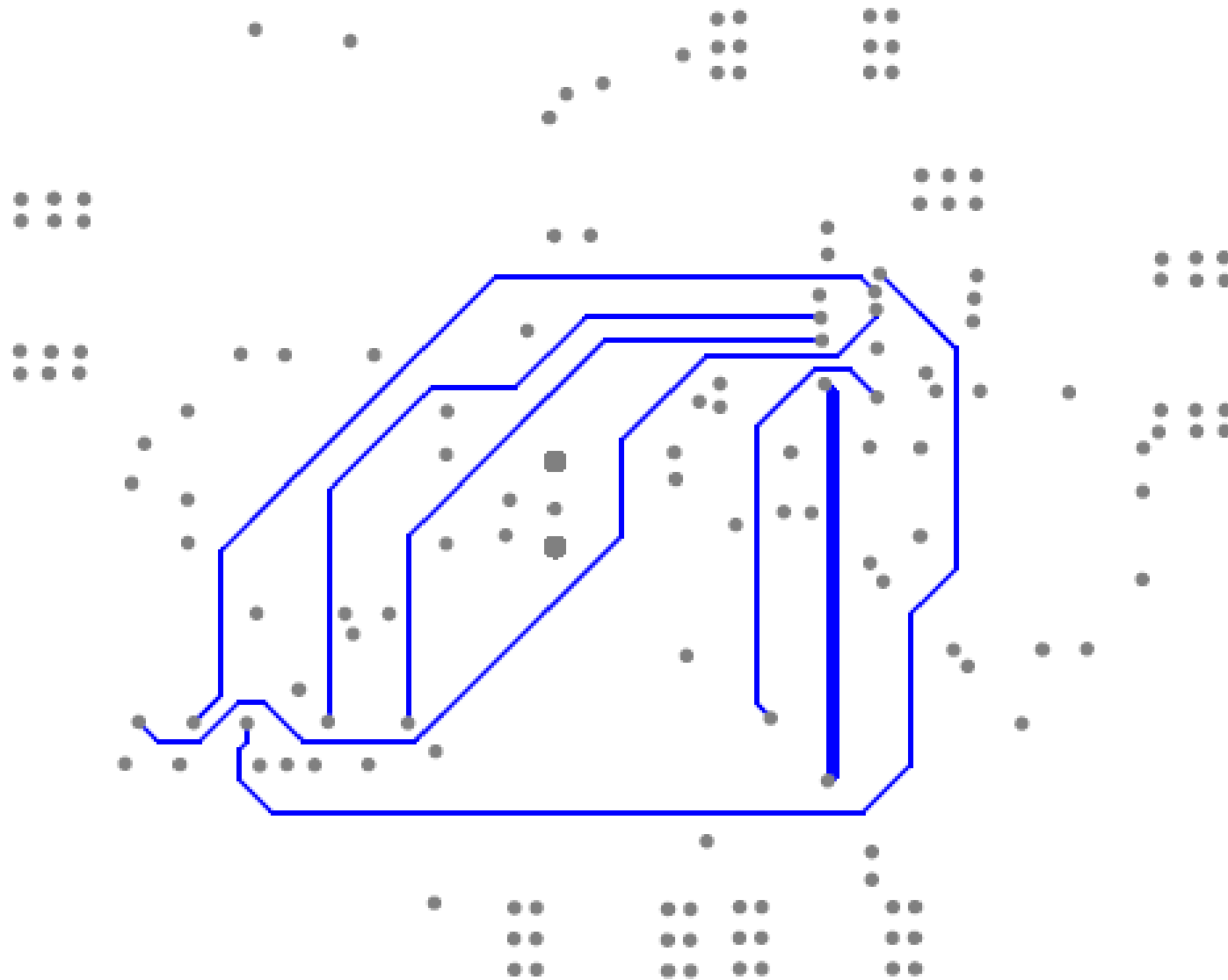
GND Layer



POWER Layer



Bottom Copper



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