

LMX2541-xxxx Evaluation Board

User's Guide



September 2004
Literature Number SNAU067A
Revised – January 2014



LMX2541xxxx

Ultra Low Noise PLLatinum™ Frequency Synthesizer with Integrated VCO
Evaluation Board Operating Instructions



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Equipment

Power Supply

The Power Supply should be a low noise power supply. An Agilent 6623A Triple power supply with LC filters on the output to reduce noise was used in creating these evaluation board instructions.

Signal Generator

The Signal Generator should be capable of frequencies and power level required for the part. A Rohde & Schwarz SML03 was used in creating these evaluation board instructions.

Phase Noise / Spectrum Analyzer

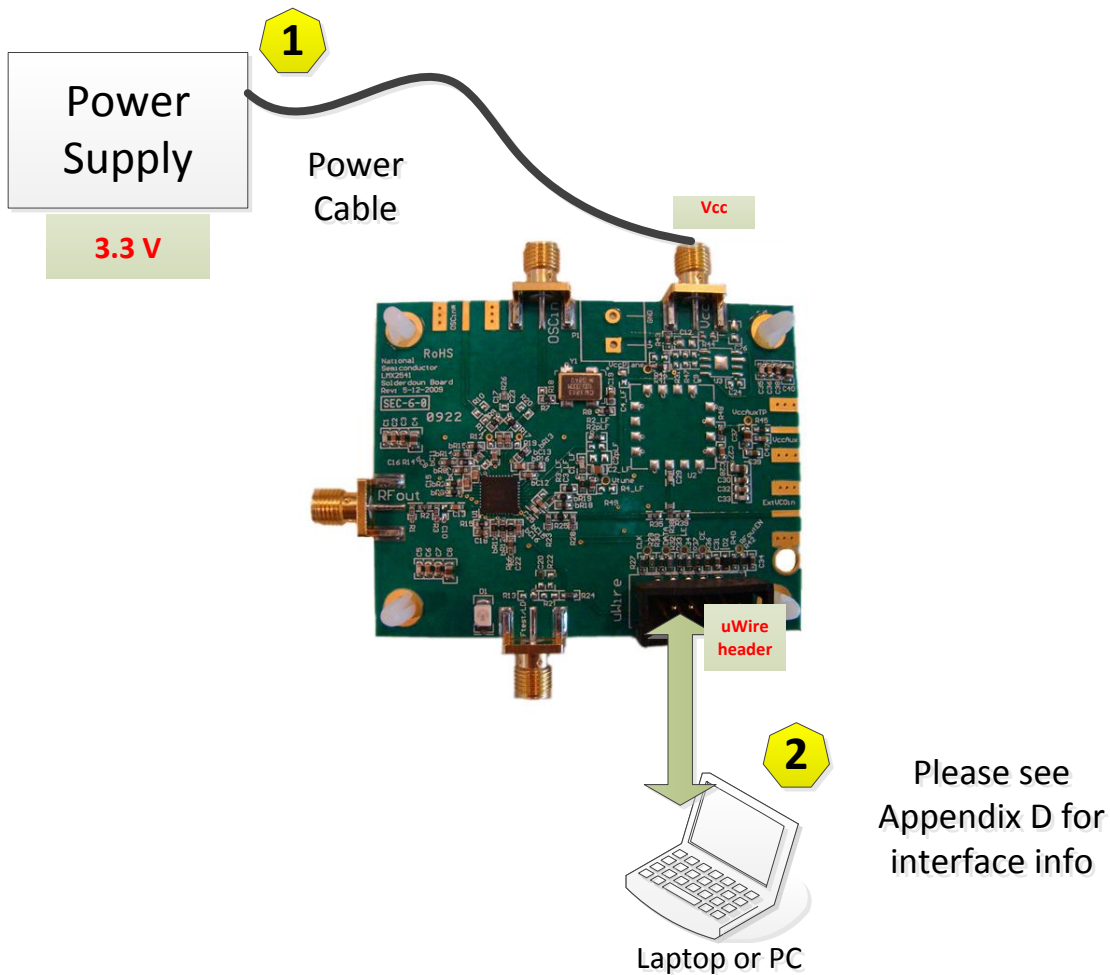
For measuring phase noise an Agilent E5052A is recommended. An Agilent E4445A PSA Spectrum Analyzer with the Phase Noise option is also usable although the architecture of the E5052A is superior for phase noise measurements. At frequencies less than 100 MHz the local oscillator noise of the PSA is too high and measurements will be of the local oscillator, not the device under test.

Oscilloscope

The oscilloscope and probes should be capable of measuring the output frequencies of interest when evaluating this board. The Agilent Infiniium DSO81204A was used in creating these evaluation board instructions.

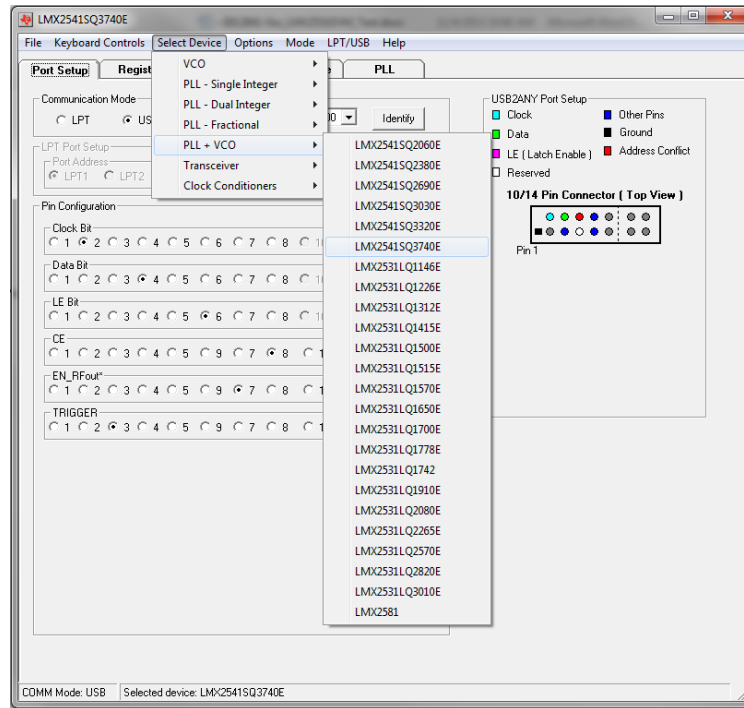
Basic Operation

1. Connect a low noise **3.3 V** power supply to the **Vcc** connector located at the top left of the board.
2. Please see **Appendix D** for quick start on interfacing the board. Connect PC to the **uWire** header.

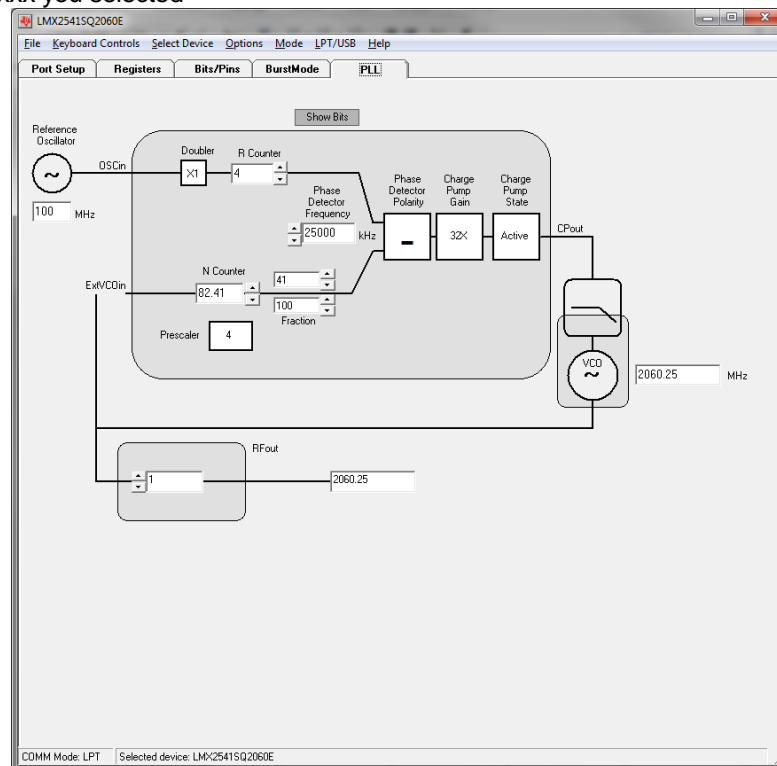


3. Start CodeLoader4.exe.
4. Select USB or LPT Communication Mode on the Port Setup tab as appropriate.

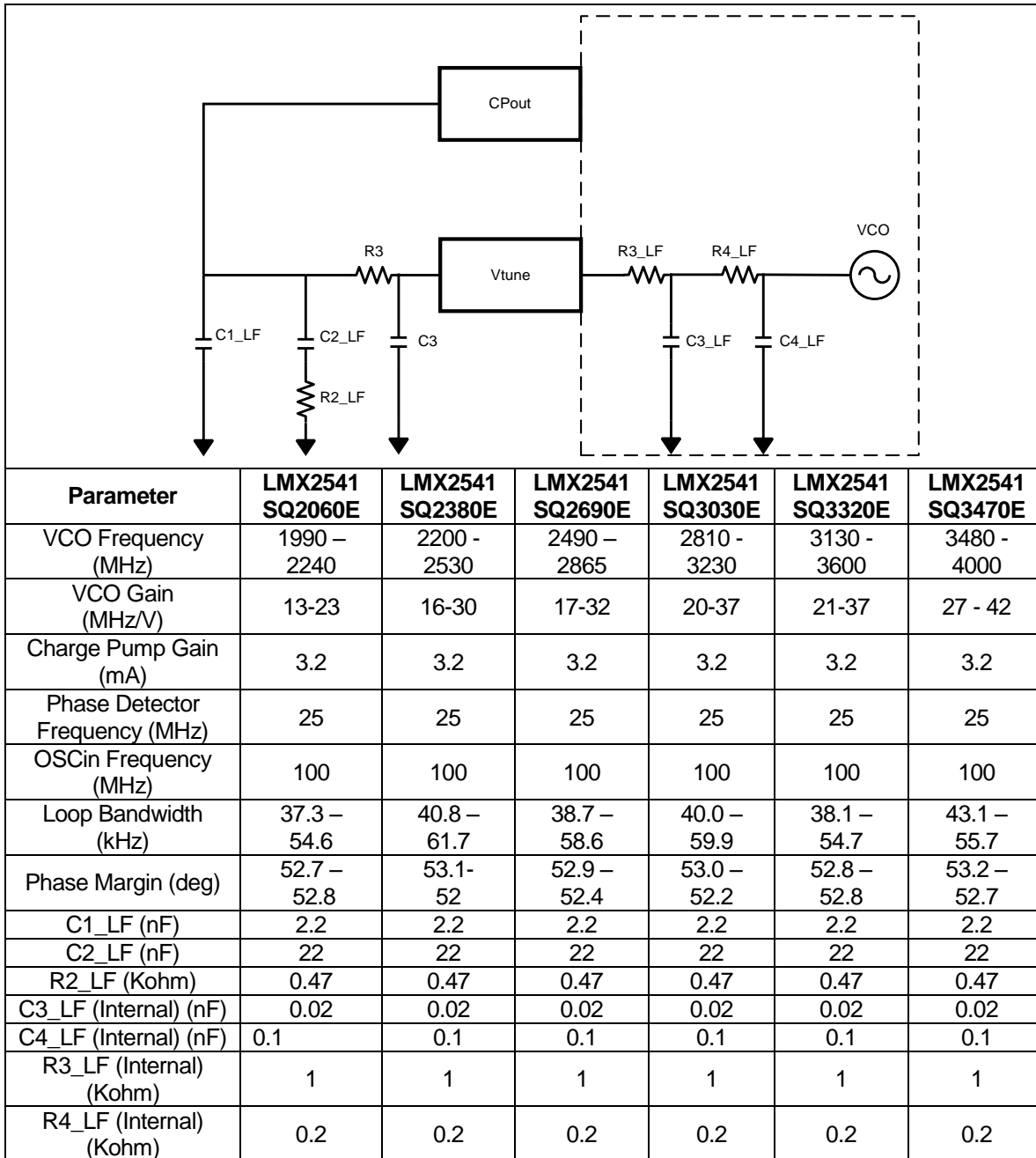
- Click "Select Device" → "PLL-VCO" → LMX2531xxxx depending on which chip is on your board.



- Check your window with "PLL/VCO" Tab screenshot, 100 MHz input, but VCO output will be different depending on which LMX2541xxxx you selected

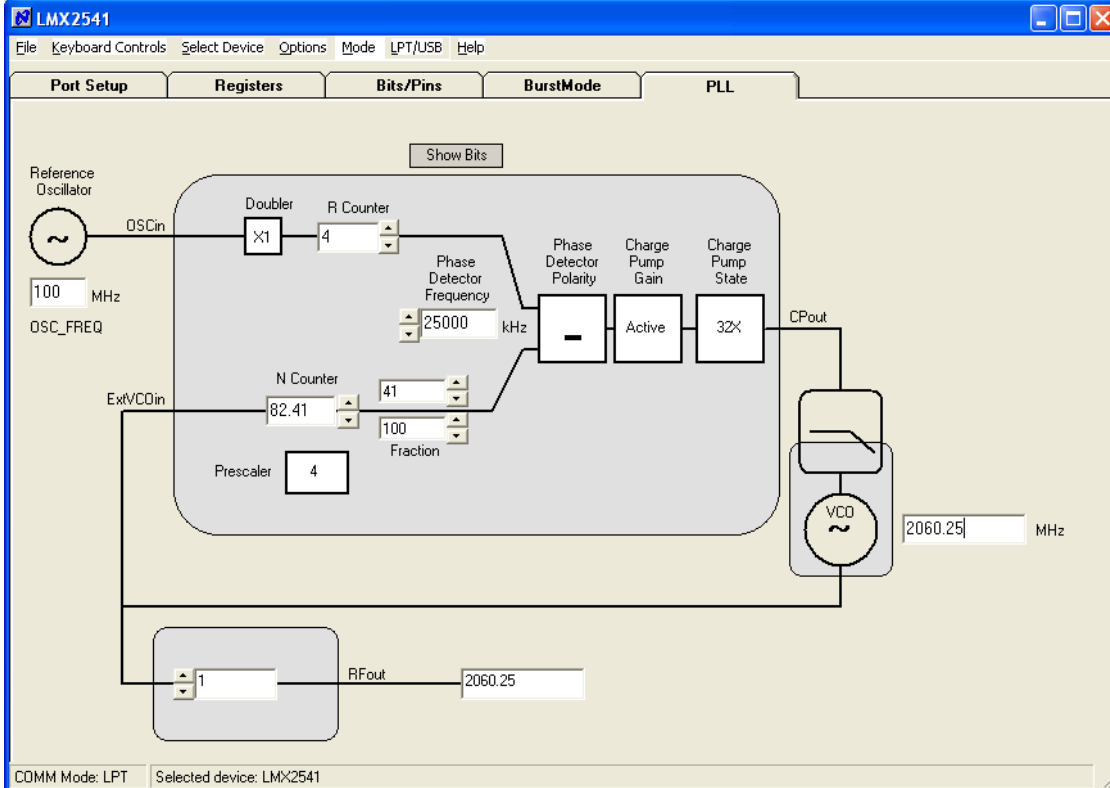


LMX2541-xxxx Board Information

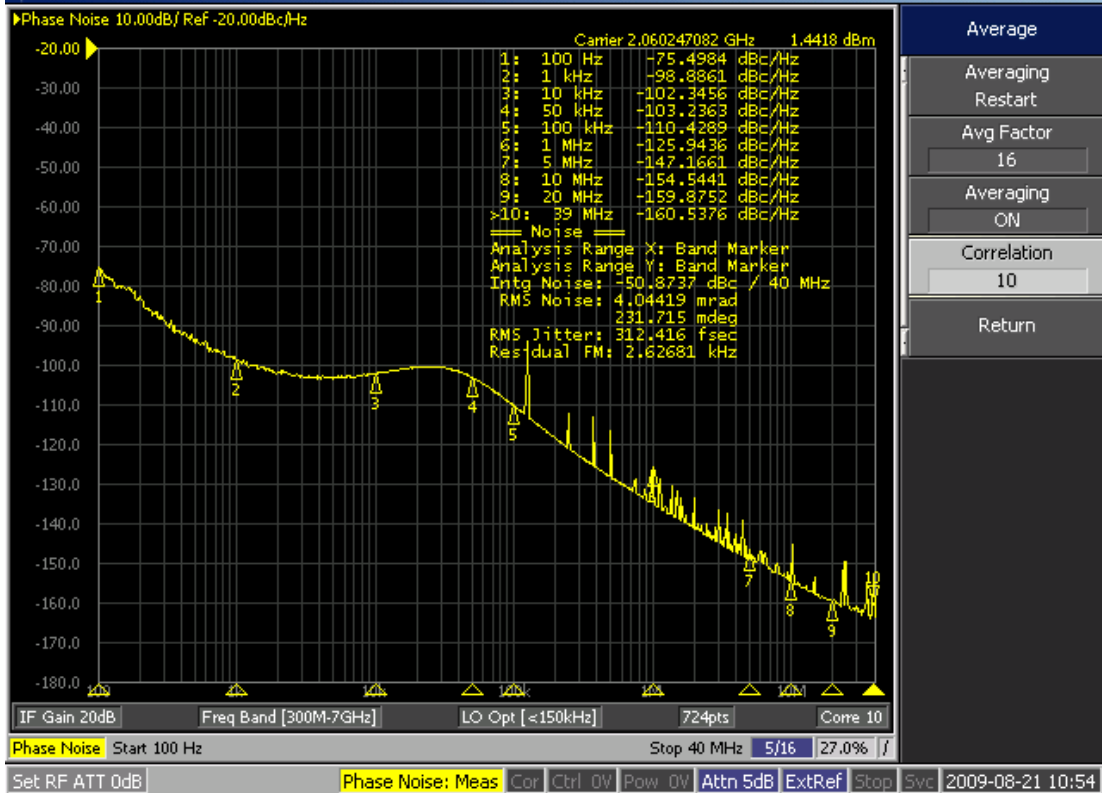


* Note that the VCO gain does change a fair amount. Although not demonstrated in these instructions, the charge pump gain could be adjusted to account for this variation.

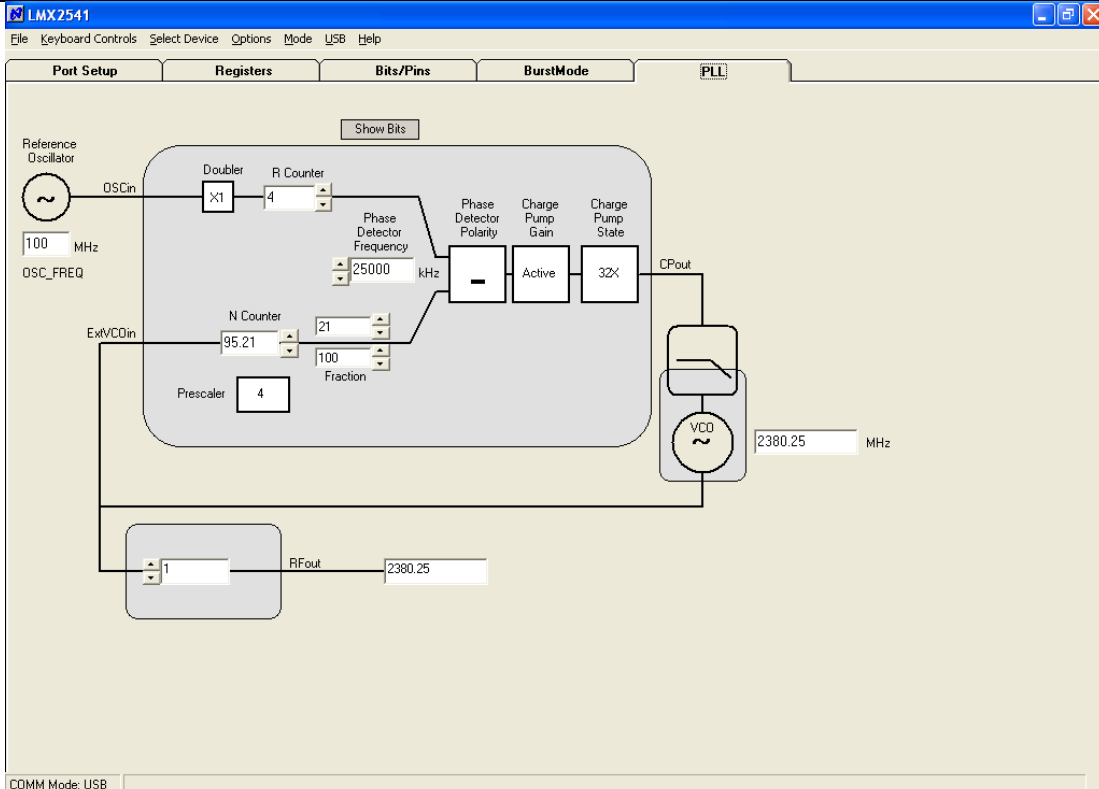
LMX2541SQ2060E Setup and Measured Performance



Agilent E5052A Signal Source Analyzer



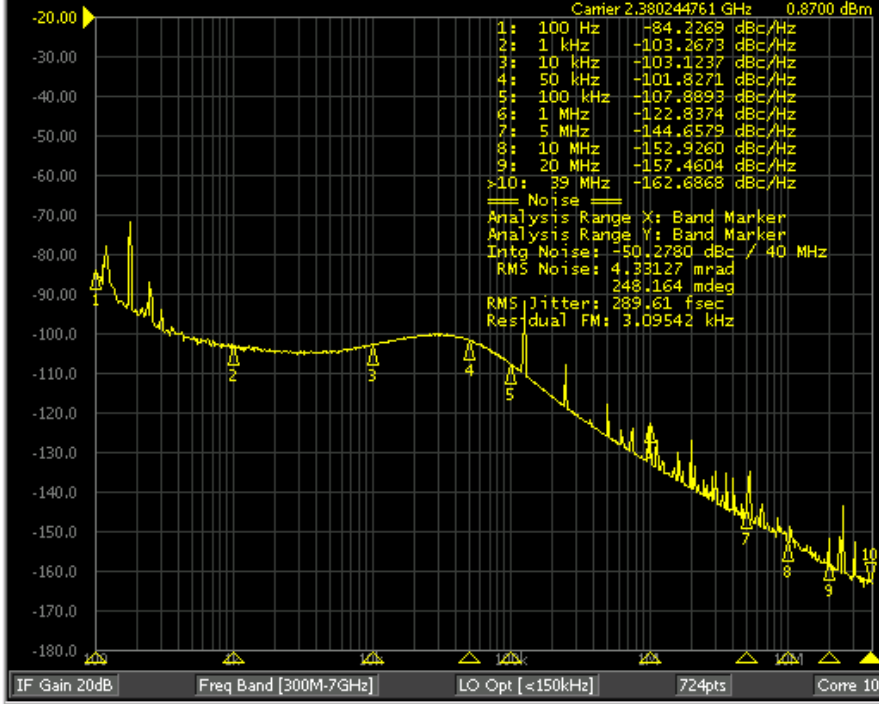
LMX2541SQ2380E Setup and Measured Results



COMM Mode: USB

Agilent E5052A Signal Source Analyzer

Phase Noise 10.00dB/ Ref -20.00dBc/Hz



Average

Averaging
Restart

Avg Factor
16

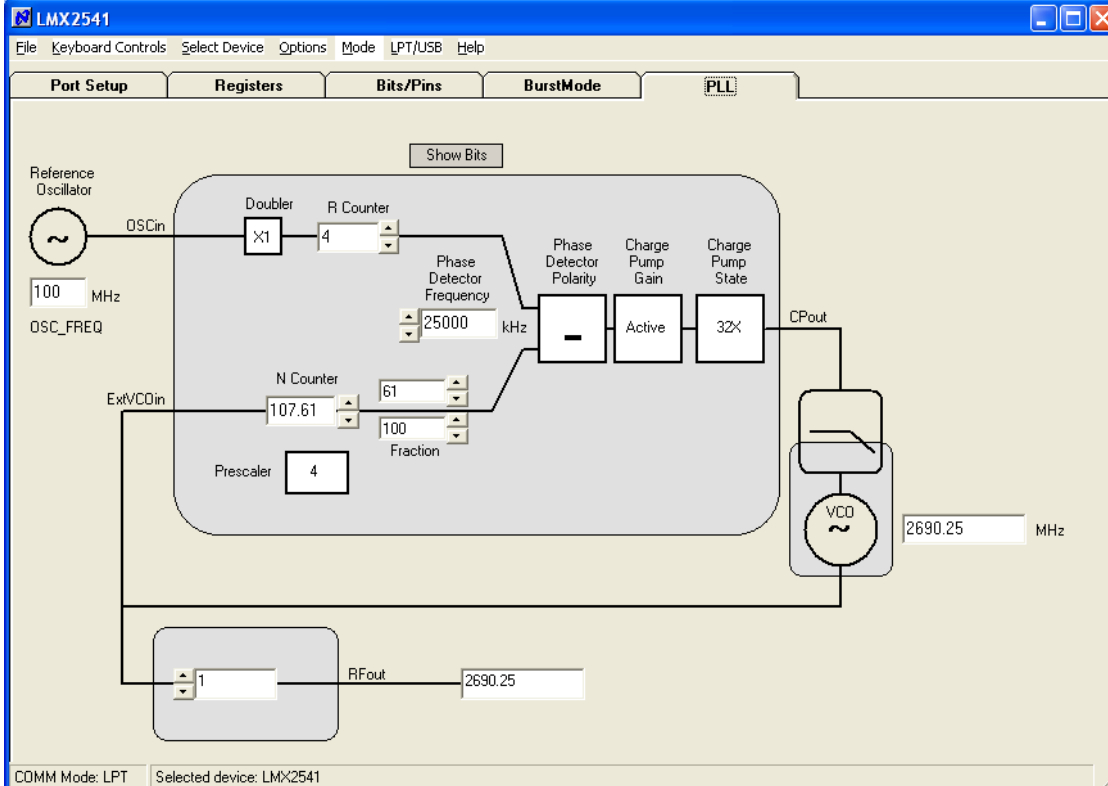
Averaging
ON

Correlation
10

Return

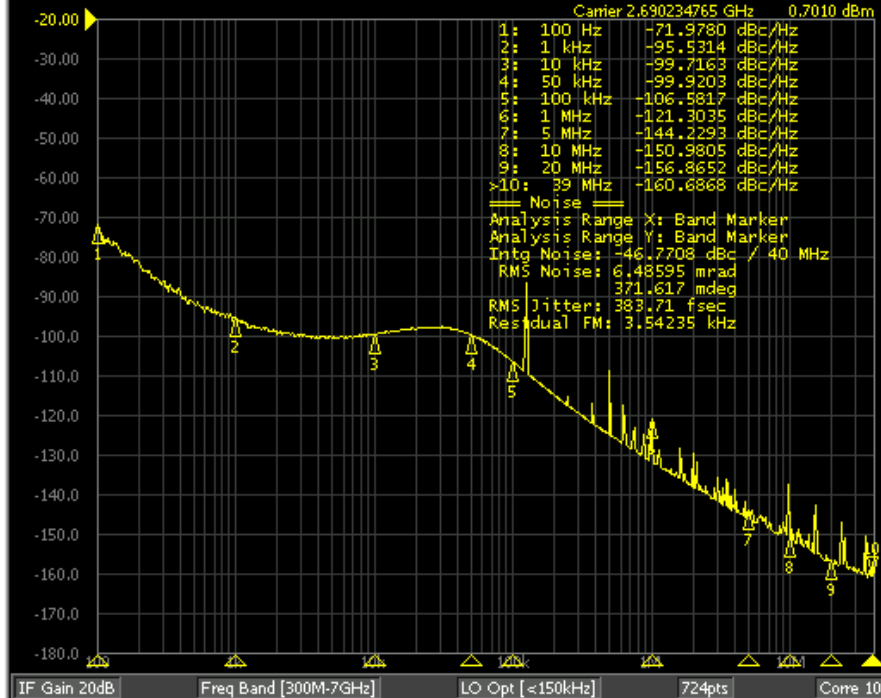
IF Gain 20dB Freq Band [300M-7GHz] LO Opt [<150kHz] 724pts Corre 10
 Phase Noise Start 100 Hz Stop 40 MHz 5/16 26.9% | f
 Set RF ATT 0dB Phase Noise: Meas Cor Ctrl 0V Pow 0V Attn 5dB ExtRef Stop Svc 2009-08-21 11:02

LMX2541SQ2690E Setup and Measured Results



Agilent E5052A Signal Source Analyzer

Phase Noise 10.00dB/ Ref -20.00dBc/Hz



Average

Averaging

Restart

Avg Factor

16

Averaging

ON

Correlation

10

Return

IF Gain 20dB

Freq Band [300M-7GHz]

LO Opt [<150kHz]

724pts

Core 10

Phase Noise Start 100 Hz

Stop 40 MHz 5/16 26.9%

Set RF ATT 0dB

Phase Noise: Meas

Cor

Ctrl 0V

Pow 0V

Attn 5dB

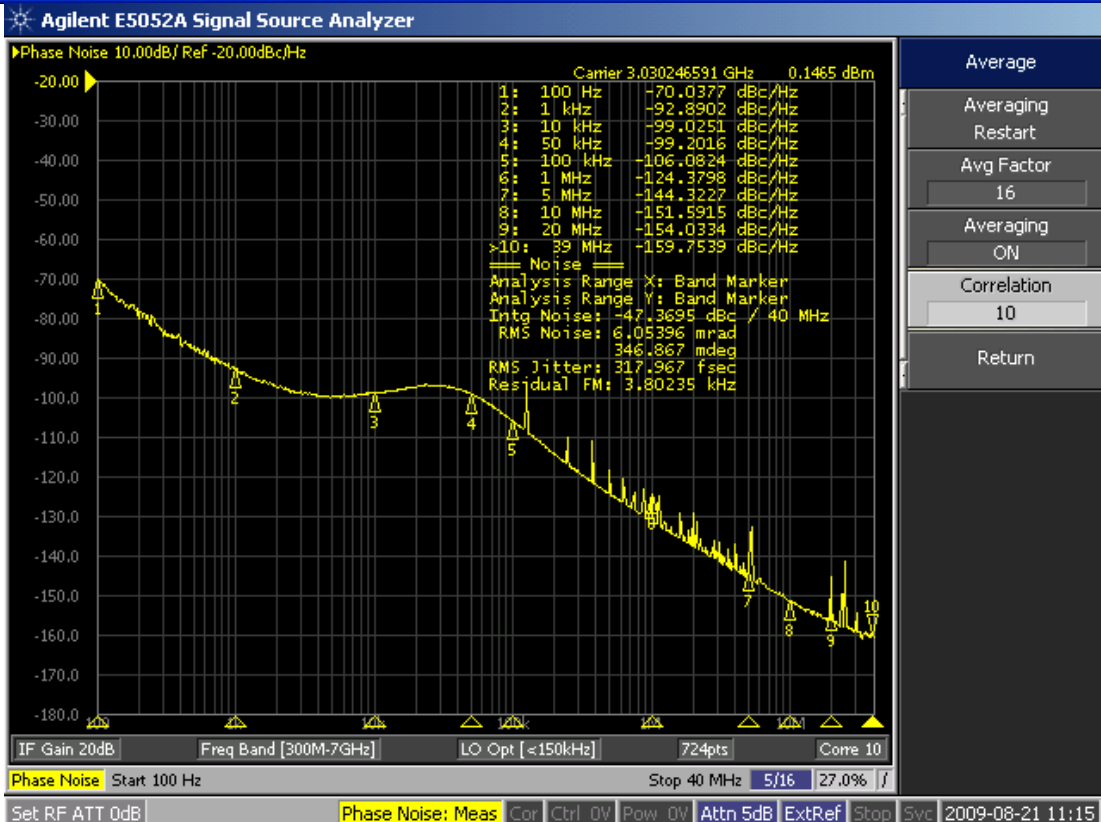
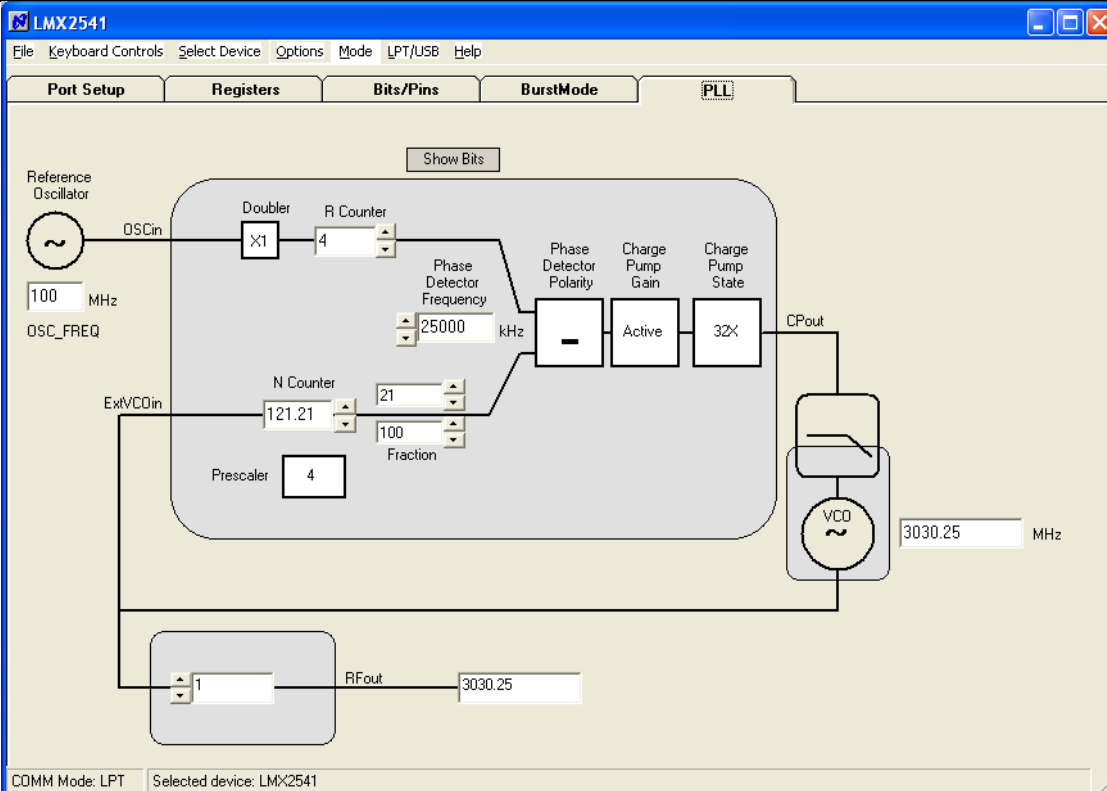
ExtRef

Stop

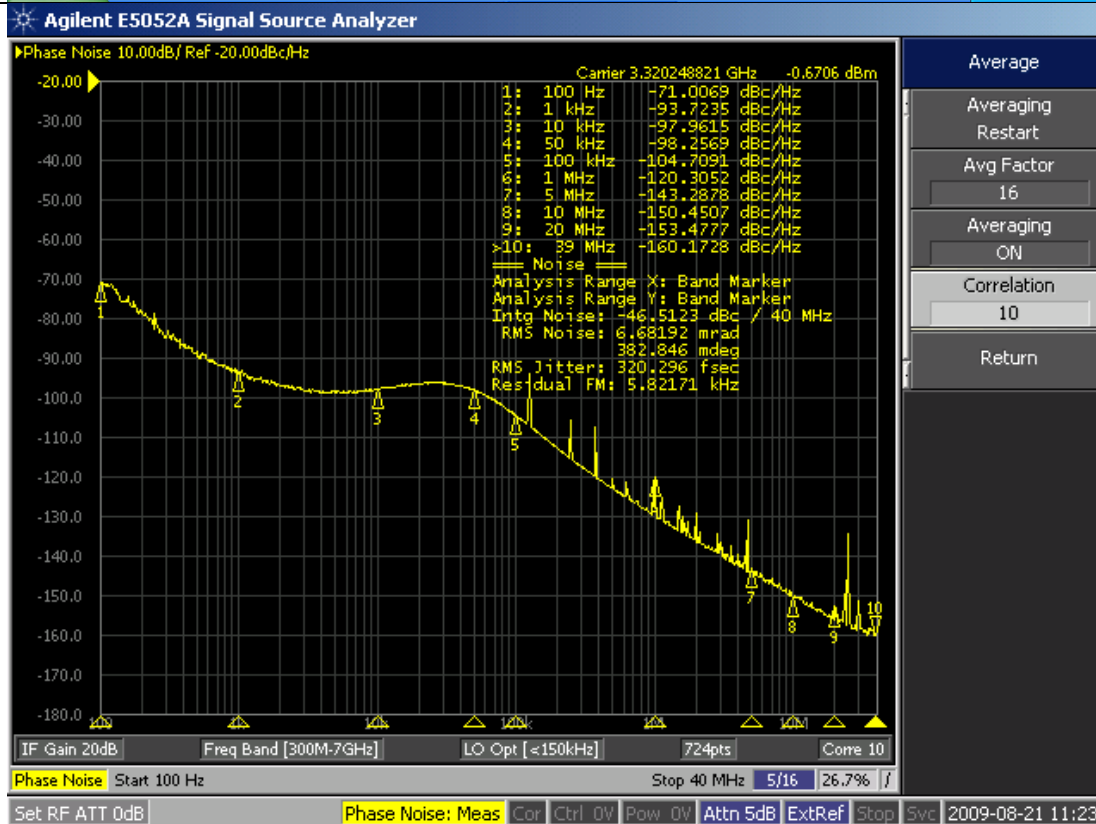
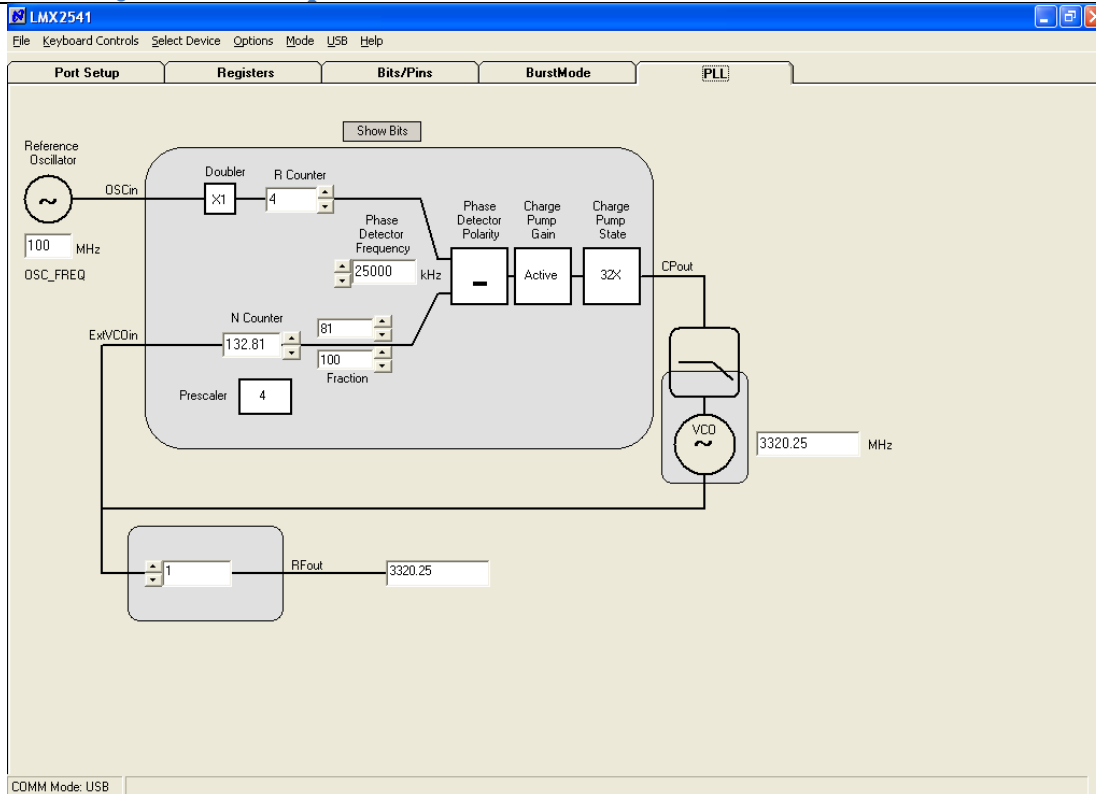
Svc

2009-08-21 11:09

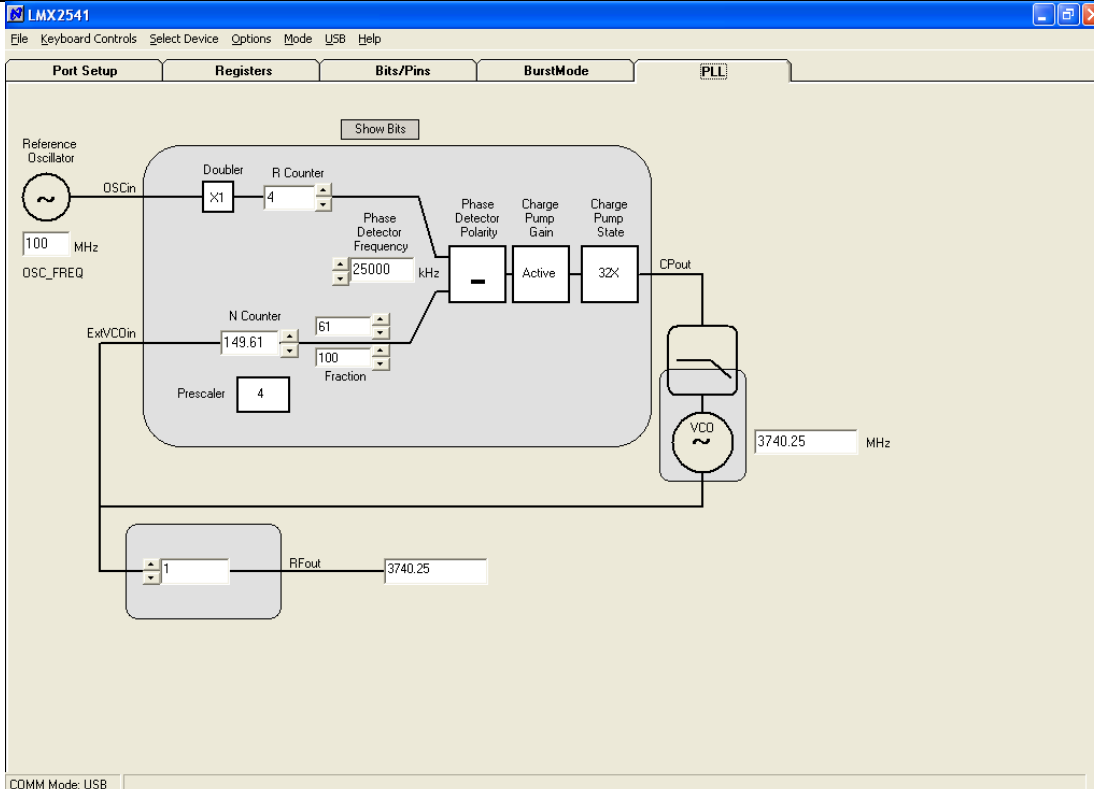
LMX2541SQ3030E Setup and Measured Results



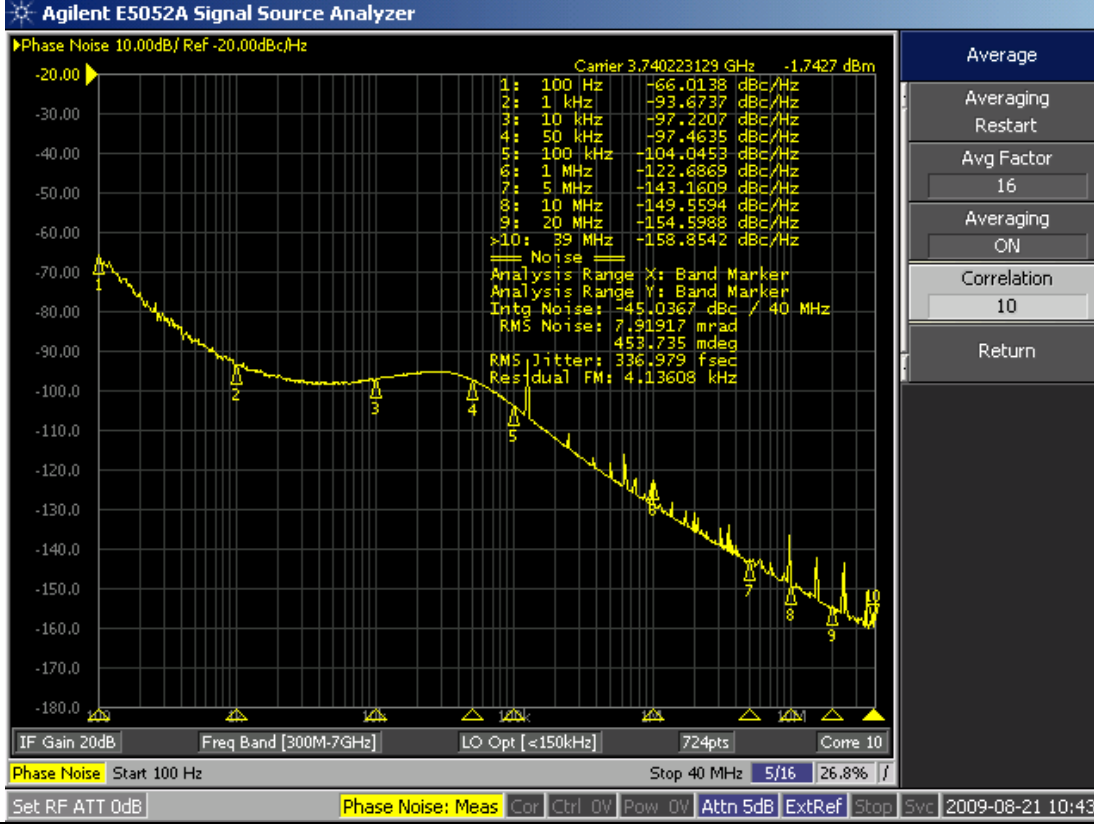
LMX2541SQ3320E Setup and Measured Results



LMX2541SQ3740E Setup and Measured Results



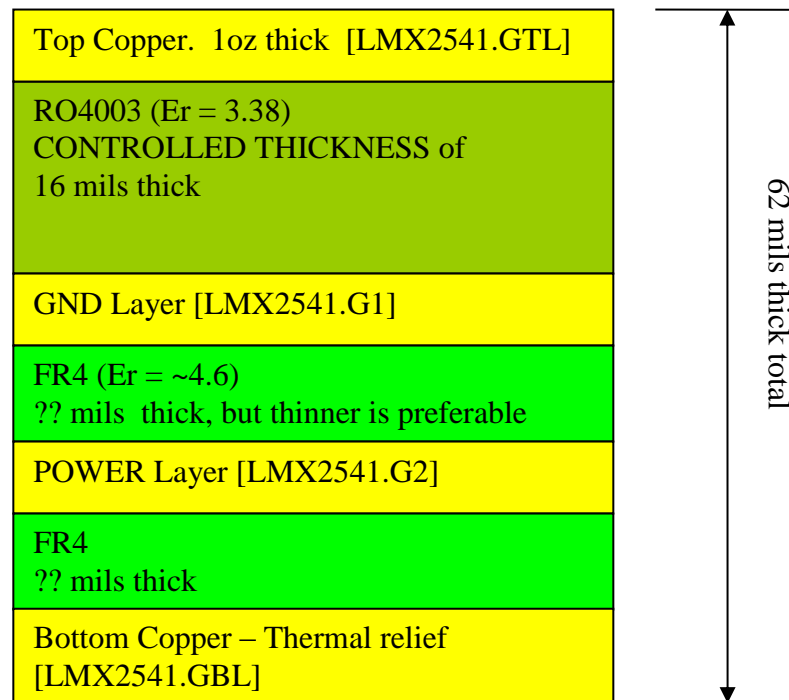
COMM Mode: USB



Appendix A: Board Stackup Layers

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

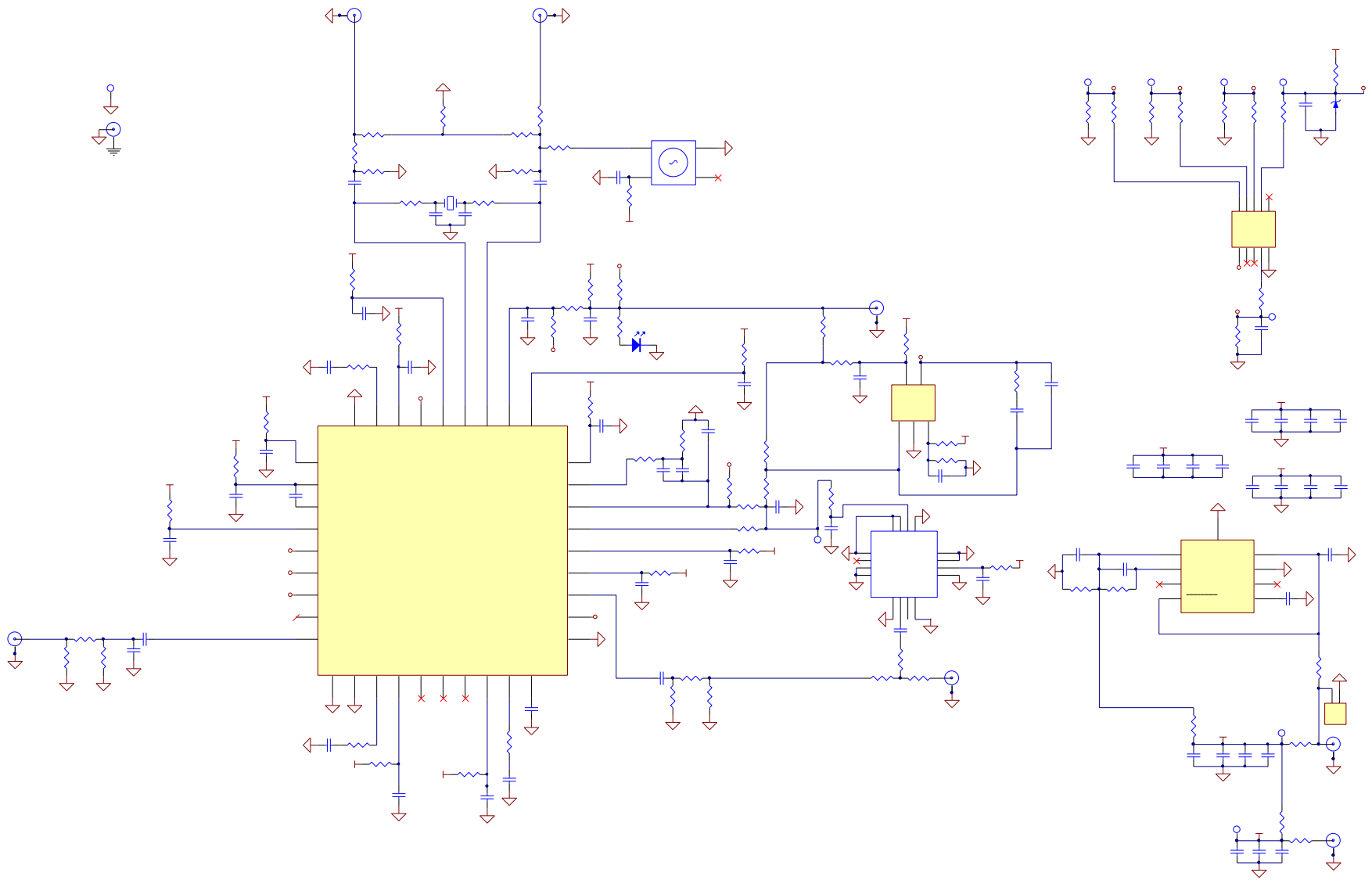
Name	K	Tand
RO4003 (16 mil)	3.38	0.0022



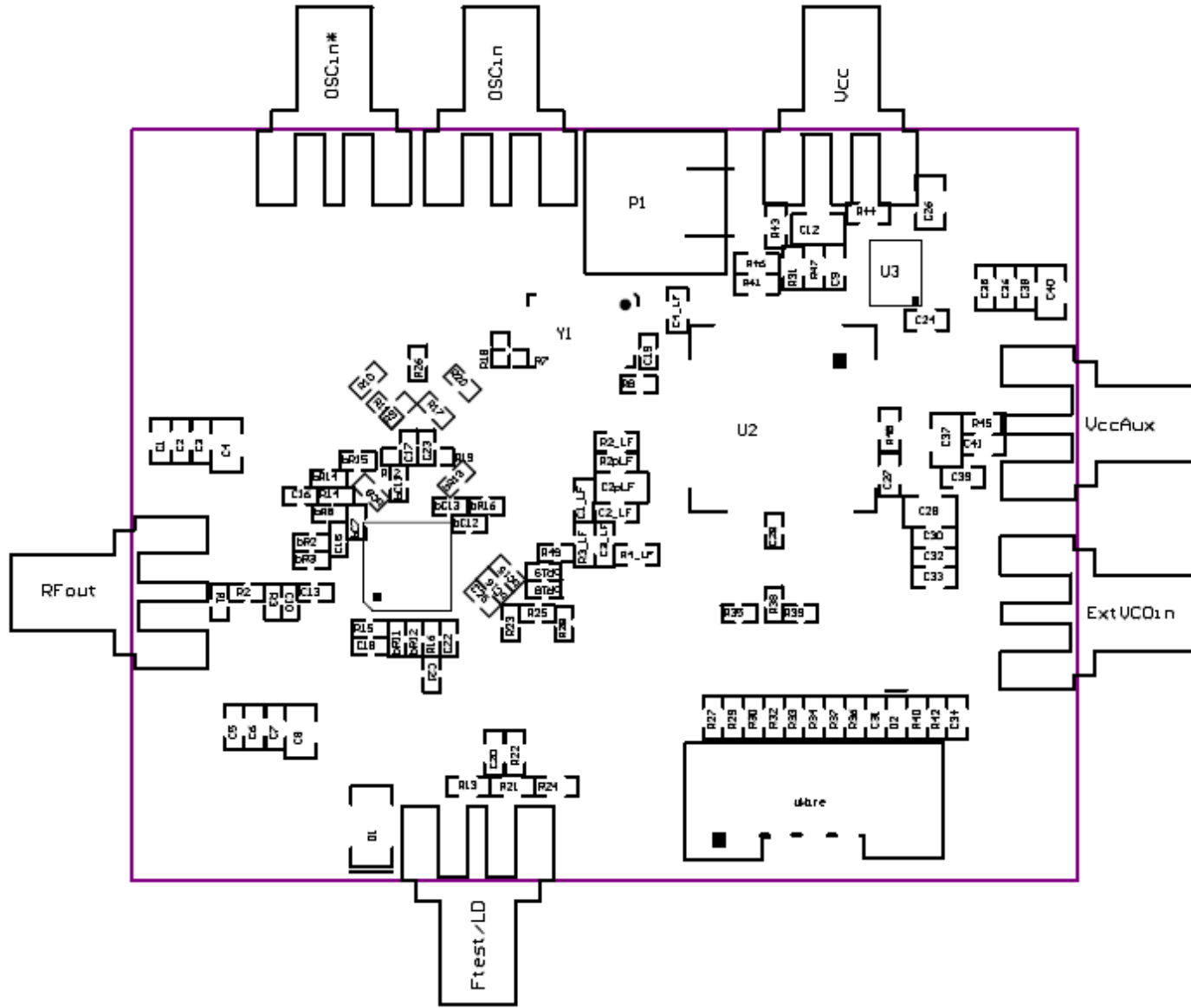
Appendix B: Bill of Materials

Version	7-27-2009			
Qty	Part	Manufacturer	Part Number	Identifier
Capacitors				
4	100 pF	Kemet	C0603C101J5GAC	C1, C5, C33, C35
1	2.2 nF	Kemet	C0603C222J5GAC	C3_LF
1	22 nF	Kemet	C0603C223K5RAC	C2_LF
16	0.1 uF	Kemet	C0603C104K5RAC	bC7, bC12, bC13, bC15, bC16, C13, C15, C17, C22, C23 C2, C6, C27, C32, C36, C41
10	1 uF	Kemet	C0603C105K8VAC	C3, C7, C16, C18, C19, C30, C31, C34, C38, C39
1	4.7 uF	Kemet	C0603C475K9PAC	C21
5	10 uF	Kemet	C0805C106K9PAC	C4, C8, C28, C37, C40
Resistors				
10	0 ohm	Vishay/Dale	CRCW06030000Z0EA	bR2, bR3, bR11, bR12, R49, R3_LF, R21, R41, R43, R45
2	4.7 ohm	Vishay/Dale	CRCW06034R7JNEA	R14, R16, R48
2	10 ohm	Vishay/Dale	CRCW060310R0JNEA	R8, R15
1	18 ohm	Vishay/Dale	CRCW060318R0JNEA	R2
3	51 ohm	Vishay/Dale	CRCW060351R0JNEA	R7, R9, R17
1	180 ohm	Vishay/Dale	CRCW0603180R0JNEA	R36
2	330 ohm	Vishay/Dale	CRCW0603330R0JNEA	R1, R3
1	470 ohm	Vishay/Dale	CRCW0603470R0JNEA	R2_LF
1	2.2 k	Vishay/Dale	CRCW06032K20JNEA	R37
3	15 k	Vishay/Dale	CRCW060315K0JNEA	R29, R32, R34
5	27 k	Vishay/Dale	CRCW060327K0JNEA	R27, R30, R33, R40, R42
Other				
7	Ferrite	Digikey	490-1015-1-ND	bR8, bR13, bR14, bR15, bR16, bR18, bR19
1	3.3 V zener	Comchip	CZRU52C3V3	D2
1	HEADER_2X5(POLARIZED)	FCI Electronics	52601-S10-8	uWire
1	Green LED	Lumex	SML-LX2832GC-TR	D1
5	SMA	Johnson Components	142-0701-851	Ftest/LD, OSCin, OSCin*, RFout, Vcc
1	TCXO	Connor-Winfield	CWX813	Y1
1	LMX2541	National Semiconductor	LMX2541	U1
Open				
36	Open	-	Open	bC1, bC2, bC3, bC5, bC6, bC9, bC10, bC14, bC17, bC18, bR1, bR4, bR5, bR6, bR7, bR9, bR10, bR17, bR20, bR21, C1_LF, C4_LF, C9, C20, C24, R2pLF, R4_LF, R22, R24, R31, R44, R46, R47, C2pLF, C12, C26
20	Open	-	Open	bC4, bC8, bC11, C10, C25, C29, R10, R11, R12, R13, R18, R19, R20, R23, R25, R26, R28, R35, R38, R39
7	Open	-	Open	U2, U3, bU1, bY1, ExtVCOin, VccAux, P1

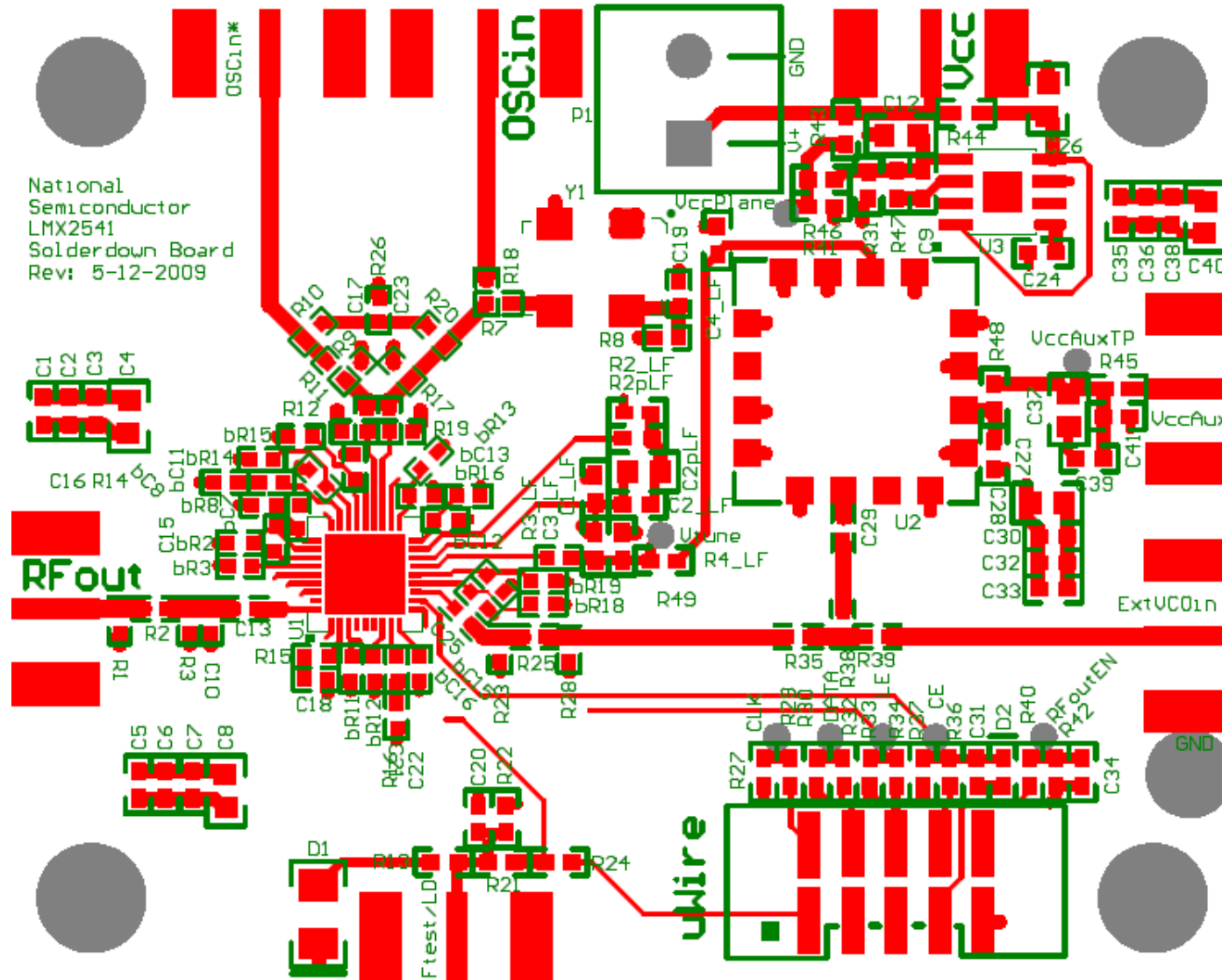
Appendix C: Schematics



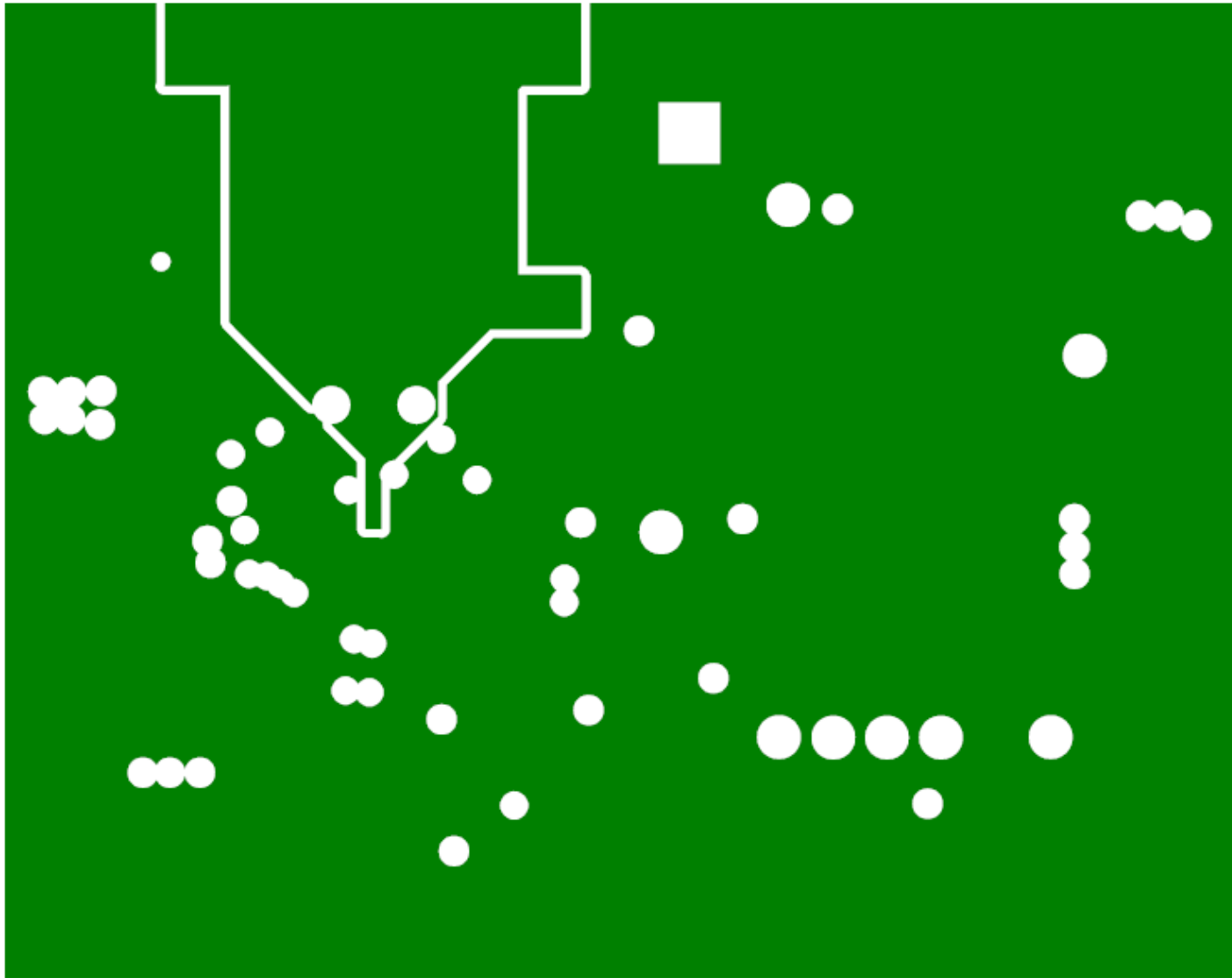
Appendix D: Assembly Drawing



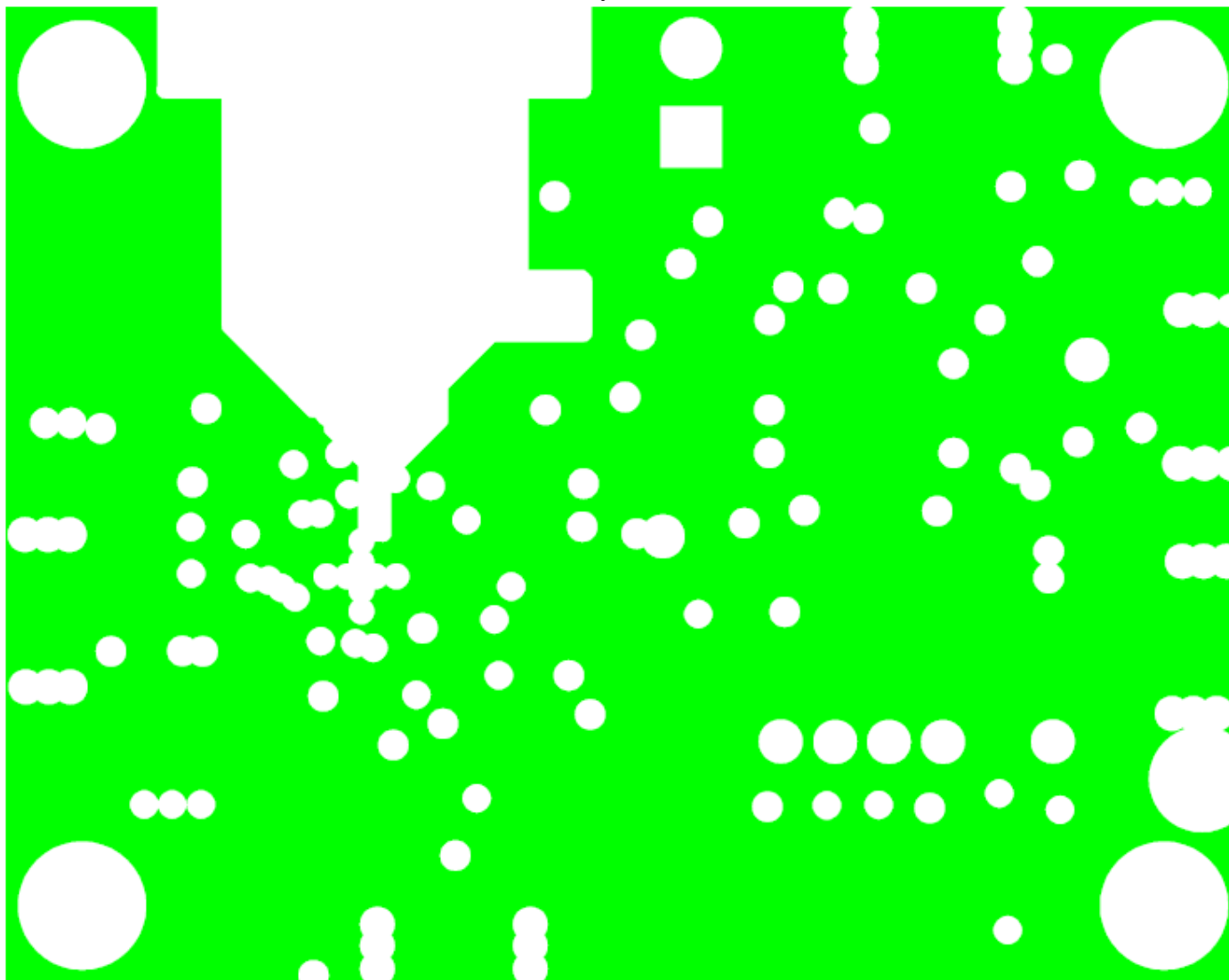
Top Layer and Silkscreen



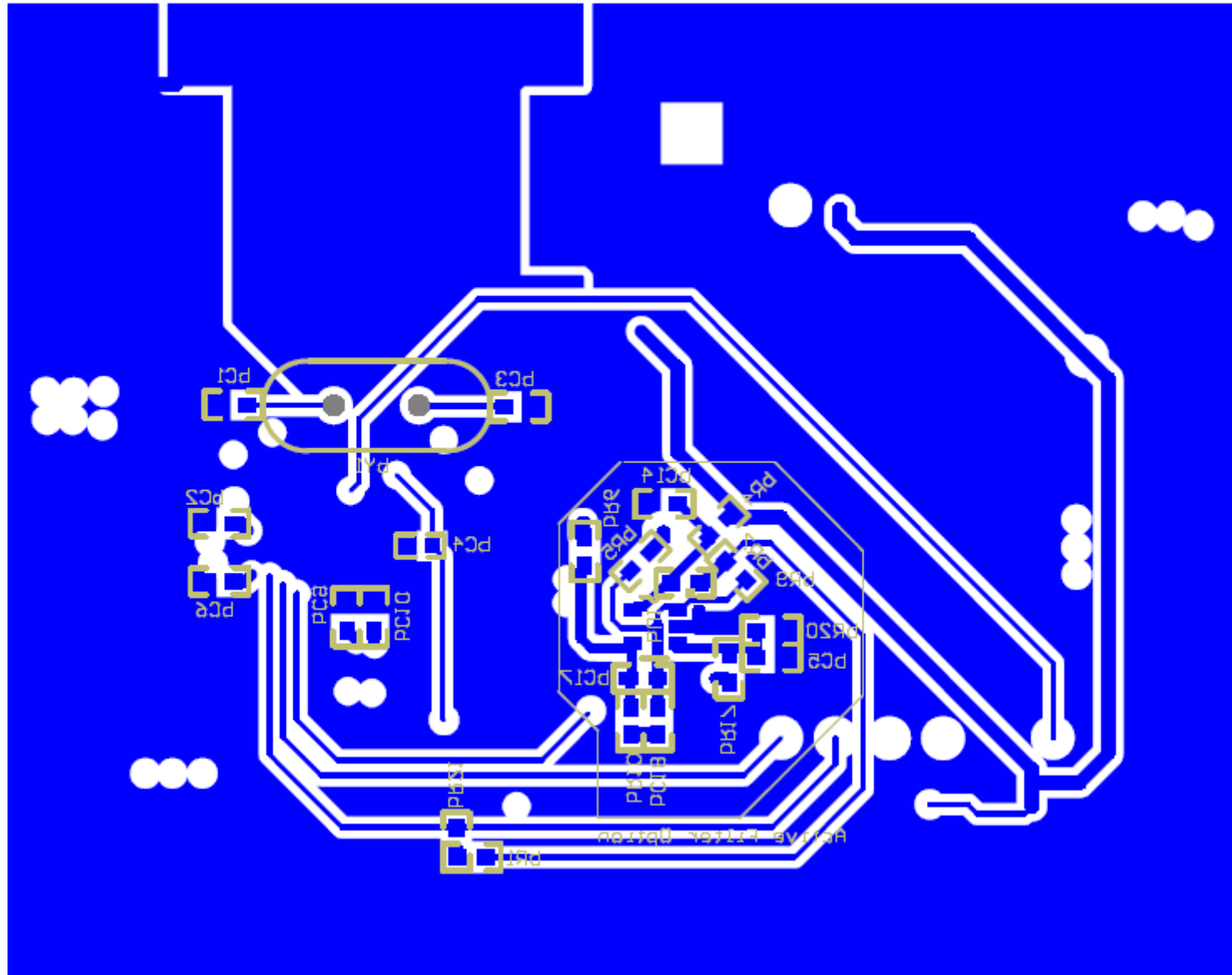
Mid Layer 1 (GND)



Mid Layer 2 (Vcc)



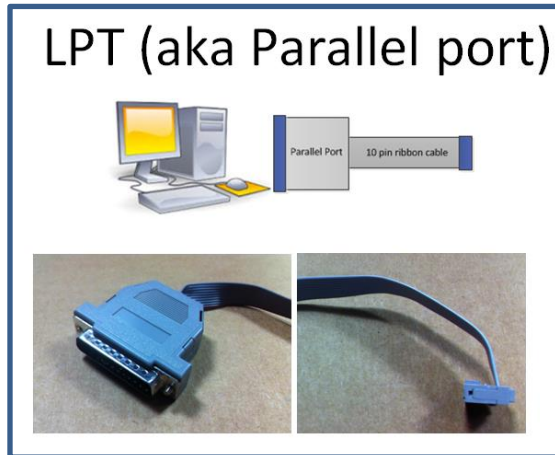
Bottom Layer and Silkscreen



Appendix E: Quick Start on EVM Communication

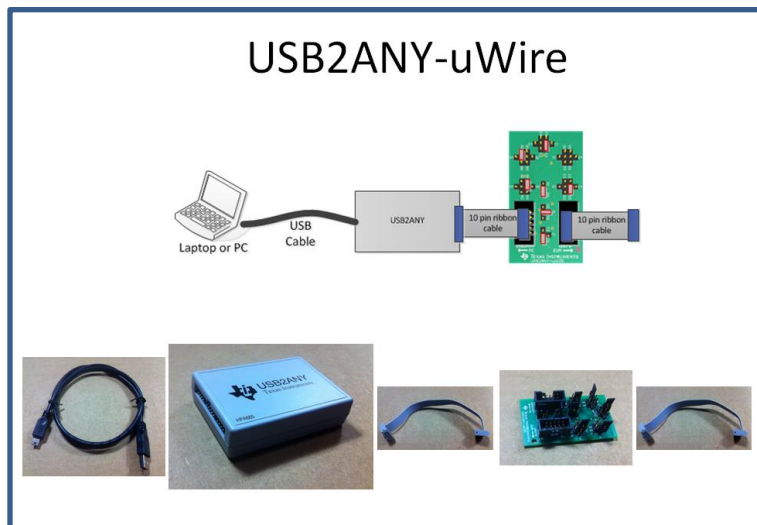
Codeloader is the software used to communicate with the EVM (Please download the latest version from TI.com - <http://www.ti.com/tool/codeloader>). This EVM can be controlled through the uWire interface on board. There are two options in communicating with the uWire interface from the computer.

OPTION 1



Open Codeloader.exe → Click “Select Device” → Click “Port Setup” tab → Click “LPT” (in Communication Mode)

OPTION 2

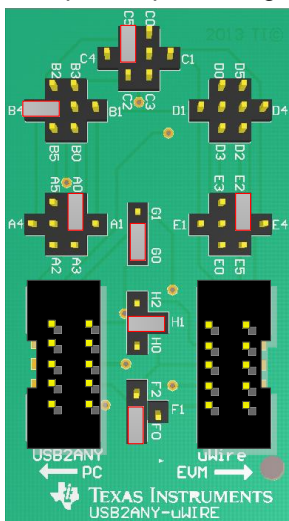


The Adapter Board

This table describes the pins configuration on the adapter board for each EVM board (See examples below table)

EVM	Jumper Bank								Code Loader Configuration
	A	B	C	D	E	F	G	H	
LMX2581	A4	B1	C2		E5	F1	G1	H1	BUFEN (pin 1), Trigger (pin 7)
LMX2541	A4		C3		E4	F1	G1	H1	CE (pin 1), Trigger (pin 10)
LMK0400x	A0		C3		E5	F1	G1	H1	GOE (pin 7)
LMK01000	A0		C1		E5	F1	G1	H1	GOE (pin 7)
LMK030xx	A0		C1		E5	F1	G1	H1	SYNC (pin 7)
LMK02000	A0		C1		E5	F1	G1	H1	SYNC (pin 7)
LMK0480x	A0	B2	C3		E5	F0	G0	H1	Status_CLKin1 (pin 3)
LMK04816/4906	A0	B2	C3		E5	F0	G0	H1	Status_CLKin1 (pin 3)
LMK01801	A0	B4	C5		E2	F0	G0	H1	Test (pin 3), SYNC0 (pin 10)
LMK0482x (prelease)	A0	B5	C3	D2	E4	F0	G0	H1	CLKin1_SEL (pin 6), Reset (pin 10)
LMX2531	A0				E5	F2	G1	H2	Trigger (pin 1)
LMX2485/7	A0		C1		E5	F2	G1	H0	ENOSC (pin 7), CE (pin 10)
LMK03200	A0				E5	F0	G0	H1	SYNC (pin 7)
LMK03806	A0		C1		E5	F0	G0	H1	
LMK04100	A0		C1		E5	F1	G1	H1	

Example adapter configuration (LMK01801)



Open Codeloader.exe → Click “Select Device” → Click “Port Setup” Tab → Click “USB” (in Communication Mode)
**Remember to also make modifications in “Pin Configuration” Section according to Table above.*

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