

# K9IVB Version Of Sam Wetterlin Calibration Source

This is a brief response to a Yahoo Group Softrock 40 Post referring to one of Sam's original designs.

I have Modified the PCB to fit my needs and posted a link on OSH Park website for sharing the Gerbers or ordering boards.

I have been quite busy and will not get time to assemble my boards until mid September.

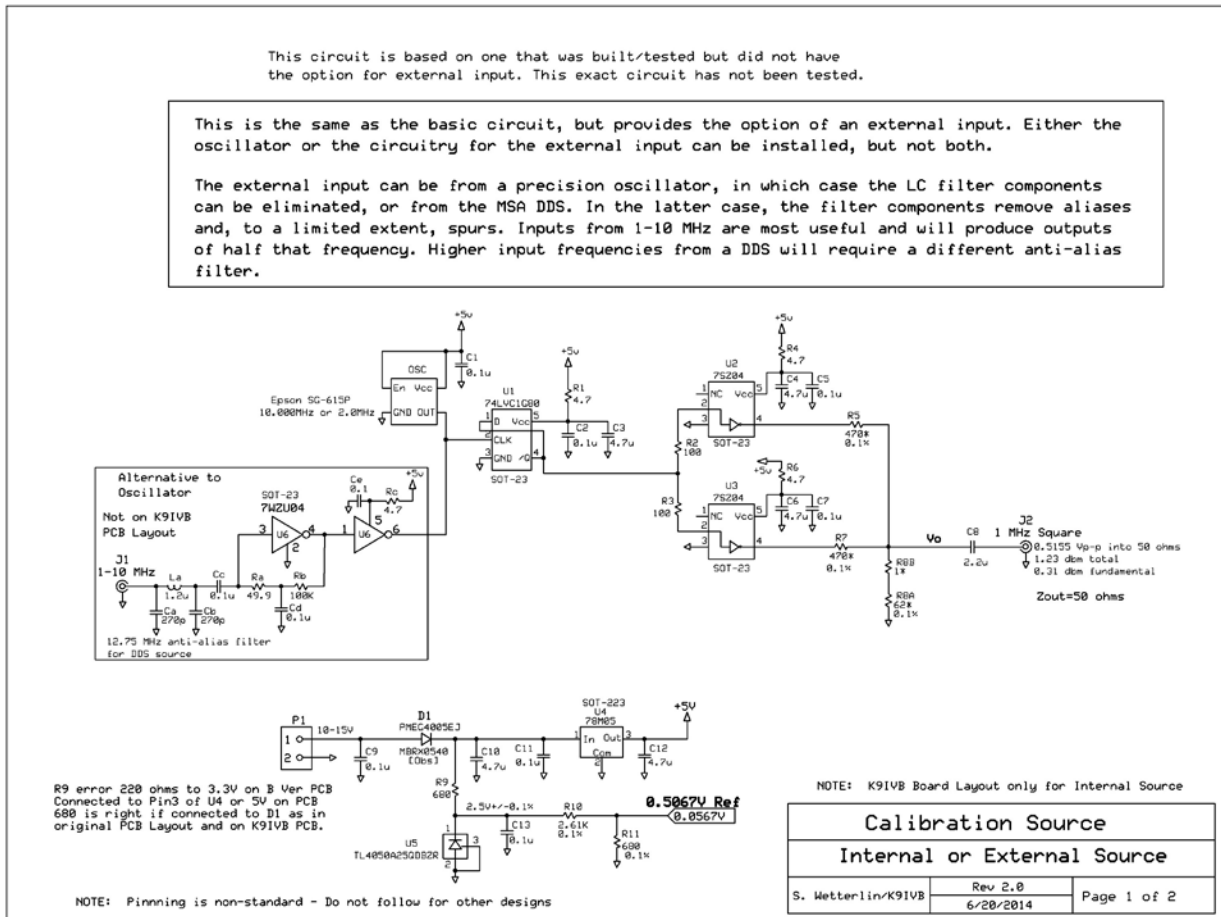
After finishing my build I will update this document.

What Follows is the revised Schematic and BOM.

The OSH Park link is:

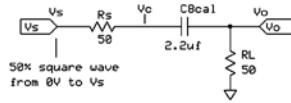
[https://oshpark.com/shared\\_projects/u258Y6mq](https://oshpark.com/shared_projects/u258Y6mq)

Dick K9IVB



**Theory behind using DC output voltage to determine AC peak-to-peak output**

The ideal square wave from the inverters, combined with their actual output impedance and the voltage divider at the output can be combined into a Thevenin equivalent voltage source driving a 50-ohm resistor to the output. (50-ohms is accurate so long as the inverter output impedance is in the range 0-30 ohms.)



DC Analysis: Average value of  $V_o$  will adjust so that current inflow through  $R_s$  during square wave peak will equal current outflow through  $R_s$  during square wave 0V value. Due to 50% duty cycle, the DC value of  $V_c$  will equal  $V_s/2$ . This value is independent of  $R_L$ .

AC analysis:  $V_o$  will always equal  $V_s/2$  because  $R_s=R_L$ .

Therefore square wave peak-to-peak = DC value at  $V_c$

**Calibration Procedure (Use any voltmeter with 5% or better accuracy and 1 mV resolution.)**

Determine the DC voltage at  $V_o$  by measuring the difference between the voltage reference and  $V_o$ . Call that voltage  $V_{dc}$ .  $V_{dc}$  will also turn out to be the peak-to-peak square wave voltage for a 50-ohm load. The stated output levels assume  $V_{dc}=0.5155V$ . Determine the deviation of your  $V_{dc}$  from 0.5155V in millivolts. For each millivolt of deviation adjust all the output values stated in dbm by 0.017 dbm. (This is accurate for deviations of a few percent.)

The adjustment is positive if  $V_{dc}>0.5155$ ; otherwise it is negative. Round results to nearest 0.1 dbm.

As a precaution against the possibility that a voltmeter may give an inaccurate DC reading due to the presence of an AC signal, the output can be shorted at the right side of C8.

<b>Calibration Source</b>		
Analysis and Calibration		
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## Cal Source BOM

REF Des	Value	Description	Mfg	Mfg #	Pkg	Mouser	Qty
1 MHz Square J2 1-10 MHz J1 C1, 2, 5, 7, 9, 11, 13, Ce	0.1u	0.1uF 50volts X7R +/- 10% Multilayer Ceramic Capacitors MLCC - SMD/SMT 4.7UF 50V	TDK	CGJ4J2X7R1H104K	0805	810-CGJ4J2X7R1H104K	8
C3, 4, 6, 10, 12	4.7u	10% 0805 Multilayer Ceramic Capacitors MLCC - SMD/SMT 0805	TDK	C2012X6S1H475K125AC	0805	810-C2012X6S1H475KAC	5
C8	2.2uf	2.2uF 50volts X7R 10% Multilayer Ceramic Capacitors MLCC - SMD/SMT 0805	TDK	C2012X7R1H225K125AC	0805	810-C2012X7R1H225K	1
Ca, Cb	270p	270pF 50volts C0G 1% Multilayer Ceramic Capacitors MLCC - SMD/SMT 0805	Vishay	VJ0805A271FXACW1BC	0805	77-VJ0805A271FXACBC	2
Cc, Cd	0.1u	0.1uF 50volts X7R 5% Schottky Diodes & Rectifiers 40 V 0.5A	AVX	08055C104JAT2A	0805	581-08055C104J	2
D1	MBRX0540	Schottky Diodes & Rectifiers 40V 0.5A	Vishay		SOD-323	OBS	0
D1		Fixed Inductors 1200 nH 2%	NXP	PMEG4005EJ,115	SOD-323	771-PMEG4005EJ-T/R	1
La	1.2u	Standard Clock Oscillators 2MHz	KOA	KQ1008TTE1R2G	Combo	660-KQ1008TTE1R2G	1
OSC P1	Epson SG- 615P	5Volt 100ppm -20C to	Epson	SG-615P2.0000MC3:ROHS		732-SG615P2.0MC3RS	
R1, 4, 6, Rc	4.7	Thick Film Resistors 1/8W 4.7ohm 1%	Yageo	AC0805FR-074R7L		603-AC0805FR-074R7L	4
R2, 3	100	Thick Film Resistors 1/8W 100ohm 1%	Yageo	AC0805FR-07100RL		603-AC0805FR-07100RL	2
R5, 7	470* 0.1%	Res 0.1% - SMD 0805 1/8W 470 ohms	Panasonic	ERA-6AEB471V	0805	667-ERA-6AEB471V	2

			Thick Film Resistors 0805 680ohms 1% Tol	Panasonic	ERJ-6ENF6800V	0805	667-ERJ-6ENF6800V	2
R9, 11	680		Res 0.1% - SMD 0805 1/8W 2.61K ohms					
R10	2.61K 0.1%		25ppm	Panasonic	ERA-6AEB2611V	0805	667-ERA-6AEB2611V	1
R11	680 0.1%		Res 0.1% - SMD 0805 1/8W 680 ohms	Panasonic	ERA-6AEB681V	0805	667-ERA-6AEB681V	1
R8A	62* 0.1%		Res 0.1% - SMD 0805 1/8W 62 ohms	Panasonic	ERA-6AEB620V	0805	667-ERA-6AEB620V	1
			Thin Film Resistors - SMD CHIP RESISTOR - Precision 1 ohm .0.25% 25ppm					
R8B	1* 0.1%			Bourns	CRT0805CY1R00ELF	0805	652-CRT0805CY1R00ELF	1
			Thick Film Resistors 0805 49.9ohms 1% Tol	Panasonic	ERJ-6ENF49R9V	0805	667-ERJ-6ENF49R9V	1
Ra	49.9							
			Thick Film Resistors 1/8W 100K ohm 1%	Yageo	AC0805FR-07100KL	0805	603-AC0805FR-07100KL	1
Rb	100K							
U1	74LVC1G80		Flip Flops SNGL Pos Edge Trigrd DType FlipFlop	TI	74LVC1G80DBVRG4		SOT23-5 Thin Leads SOT-23-5 / DVB	1
			Flip Flops 3.3V D FF +EDGE TRIG	NXP	LVC1G80GW125		SOT-353 / TSSOP-5	
							771-LVC1G80GW125	
U2, 3	7SZ04		Inverters UHS Inverter	Fairchild	NC7SZ04M5X		SOT23-5 Thin Leads SOT-23-5	2
			Inverters 1.65-5.5V CMOS Single	ON Semi	NL17SZ04XV5T2G		SOT-553-5	
							863-NL17SZ04XV5T2G	
			Linear Voltage Regulators 5.0V 500mA Fxd Pos	TI	UA78M05CDCYR		SOT-223-4	1
U4	78M05		Voltage References 2.5V 0.1% precision	TI	TL4050A25QDBZR		SOT-23-3	1
U5	2.5V Ref						595-TL4050A25IDBZR	
U6 [Ua]	7WZU04		Inverters 1.65-5.5V CMOS Dual Unbuffered	On Semi	NL27WZU04DFT2G		SOT-23 6 pin SC-88 / SOT-363 / SC-70	
			Inverters UHS Dual Unbuff Inv	Fairchild	NC7WZU04P6X		863-NL27WZU04DFT2G SC-70-6	1
							512-NC7WZU04P6X	