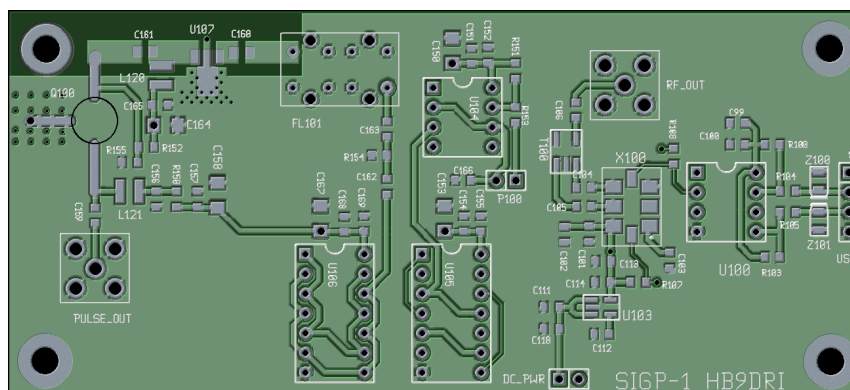# SIGP-1

V1.1 (08.04.2014)

Signal and Pulse Generator for I/Q image
Rejection and Noise Blanker calibration
(Special for Linrad Smart Blanker)

LinkRF

HB9DRI

SIGP-1

Signal and Pulse Generator for I/Q image
Rejection and Noise Blanker calibration
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INTRODUCTION

This small project is oriented to do properly calibrations in Linrad (Image rejection and Smart Blanker). Without these two calibrations Linrad cannot be exploited at the maximum performance, specially fighting against the noise. The most attractive part probably will be the Pulse Generator; the circuit was publish by Leif, SM5BSZ on his Linrad page and was implemented on the SIGP-1 board together with a si570 oscillator. Circuits are independent, means you don't need to populate both, you decide which you implement and just ignore and keep blank the circuit you don't need.

This is a very simple project but some parts could be a little difficult or expensive to buy in small qty, for that reason I will provide "some" parts but not all, this is an open project with no commercial orientation, is mainly to help those who until now didn't calibrate properly Linrad. Diagrams, Gerbers files (for build pcb) and BOM list with details are publish on *www.linkrf.ch*

The pcb was created by George Boudreau (Yoyodyne Counsulting) totally for "free", George help me a lot on my IQ+ projects, he design almost all pcb's I use and I'm very happy for his high quality job.

Fully assembled and populated boards will be available time to time but not at regular intervals, those with limited capacity or skills to populate the boards can ask me but keep in mind the extra cost for assembling the boards probably will elevate the cost too high for a simple project and will not be attractive for those who always claim "HAM PRICE".

Both diagrams are well tested and implemented; I use the Pulse generator to calibrate the smart Blanker in Linrad with IQ+ receptors (revA and B) and WSE boxes, audio cards tested was DELTA44, EMU1616, MTrack-Quad and MAYA44.
The signal generator was tested for the I/Q image rejection, the results are excellent, never the less; depending on the si570 chip you will use, the Signal Gen can be used up to 1.4GHz with extraordinary low phase noise and stability, the RF output decrease with the frequency increment but at 144Mhz the power is 0dBm (+/- 0.5dBm). This is a lot of power and you will need properly attenuators to use the Signal Generator.

An extensive material exist on internet with videos and documents how to calibrate both parts: I/Q image rejection and Smart Blanker, never the less if you have any question just contact me and depending on my free time (the IQ+ project is priority 1 for me) I can help you in an interactive connection with your PC via TeamViewer and I can help to do the calibration process in minutes.

73 de Alex, HB9DRI

BEFORE START

The PCB Host all necessary parts for both circuits (signal Gen and pulse Gen) both circuits share just the 5VDC line. SMA connectors are used for outputs but you can avoid and solder direct coax to the pcb.

The board is 5VDC, you will need to provide a very clean 5VDC /250ma power supply, a 7805 will do the job but with a properly filtering and decoupling (to avoid noise), the 7805 need to be mounted in a heat sink.

To change the PRF (**P**ulse-**R**epetition-**F**requency) you need to install a 10K potentiometer on the box and cable to the board, connections need to be as short as possible.

Near the potentiometer you will need to install 2 switches to replace/add extra capacity to the 555 to change the range of the PRF, with a properly combination you can change from 10Hz to 5Khz PRF (enough for almost all HW available) in different ranges.

The Pulse Generator NEEDS a BPF before the mmic amplifier; the purpose of the filter is to convert the pulse to a pulse train of several but smaller pulses. If you remove the filter you cannot amplify the pulse. For a wideband receiver one would need a wider filter and/or another kind of pulse generator. This BPF has a BW of 4Mhz and is center in 144.1 MHz, but can be retuned up to 146MHz, that means, the Pulse Generator will work ONLY for the band you have the filter, if you plan to use in 432Mhz then you need to ask for the properly filter (I have both in stock 144 and 432 MHz). If you want to have both then you will need to create a separate pcb and link with coax and small relays, I didn't design the pcb in that way because the interest today in 432MHz is almost inexistent unfortunate.

I propose to do a small trace cut to split the VDC for both circuits, in that way if you run the Pulse Generator the Signal Generator is not running and vice versa. This mod is important to avoid the 56.32 MHz internal reference clock on the si570 introduce some noise in to the pulse generator and to keep the RF Signal free of any possible pulse .interference.

Is recommended you install sockets for the IC's, in that way will be easy to replace one IC's if becomes damage.

Most of the resistors and capacitors are SMD parts 0805, I have in excess thousand of this parts and I will include someone's "for free" with the pcb, that parts are the excess parts from the IQ+ project

To solder parts on the PCB a 25 watts Iron solder is convenient, excess of heat will destroy parts and traces, a medium skills are required to assembling the board properly.

The Signal Generator needs a USB connection, I provide the pcb with 4 pins header, you will select you convenient way to interface the cable, is just +VDC, GND, +sig and –sig

Regarding the si570 chip, exist several options, the cheapest si570 cost aprox, 10.00 EUR; (part Si570CAC000141DG CMOS) has 50ppm stability and runs up to 160MHz, this are the normal chip used in Softrocks and small cheap SDR projects, but is limited on the range and stability and has more phase noise than other ones. The option I recommend is the Si570 BBB000141DG LVDS (this is the model used on the IQ+ Local oscillator), has extraordinary stability (20ppm) very low phase noise and runs up to 945MHz, this chip cost aprox. 46.00 EUR, very expensive!! But the best!!. The best source for the si570 is https://www.sdr-kits.net/

The Signal Generator level output will vary depending on the si570 chip, the CMOS version (the cheap one) will give you aprox +8 to +10dBm), the LVDS version will give you aprox 0dBm @ 144MHz in a 50ohm load but with a lot of previous mention advantages.

The Signal Generator output needs a properly filter before used, the si570 will produce a forest of harmonics, you will need to add a LPF or BPF for the frequency you want to use, for 144Mhz I recommend build a simple LPF with a cutoff in 160MHz, then your signal will be very clean. I didn't include a filter on the design to avoid increasing the cost and tie the Signal Generator to a particular frequency range, the user will decide what is more convenient.)

THE PULSE GENERATOR
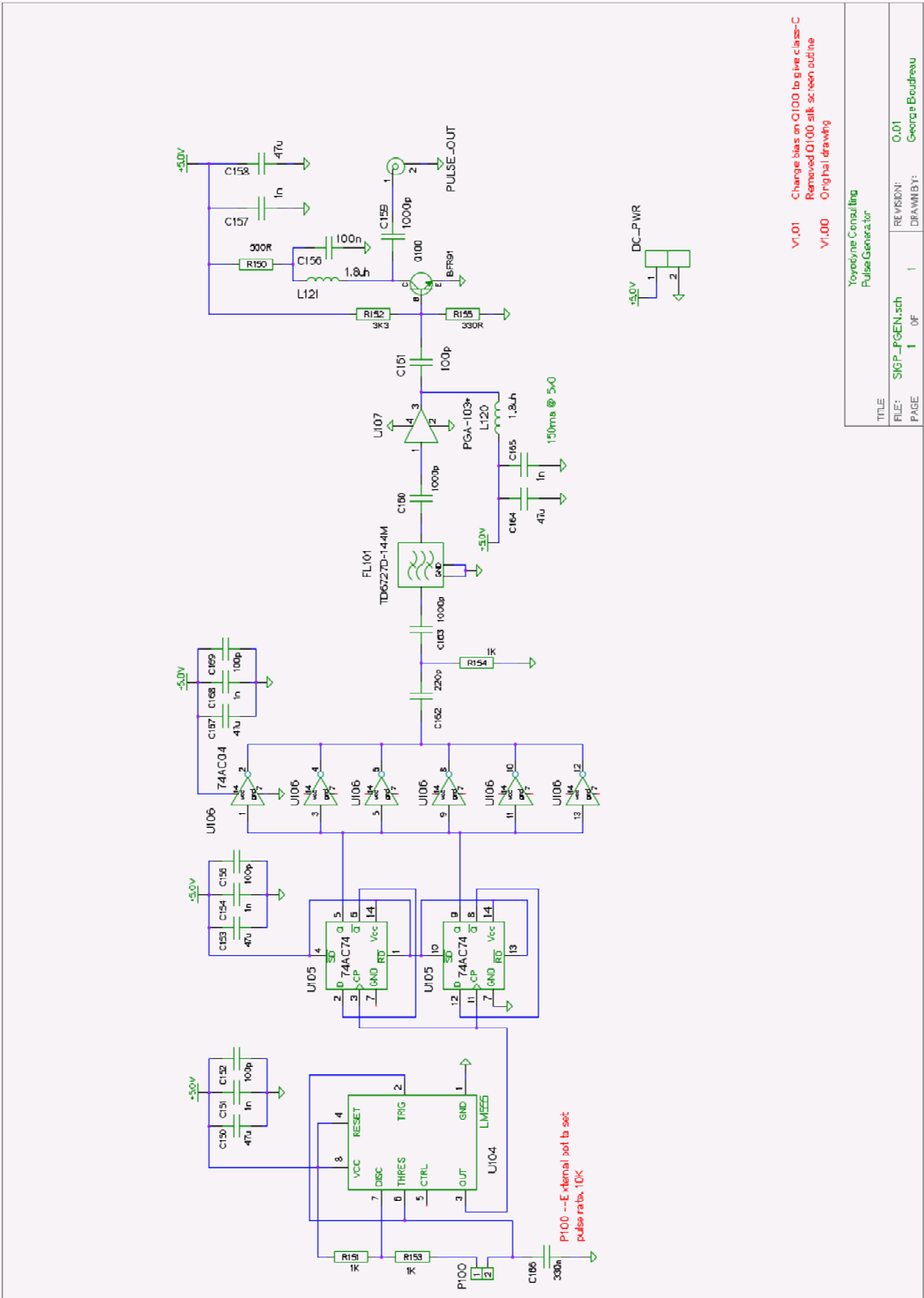
B.O.M list:
In yellow the parts I can provide at cost,
In green parts I can provide for FREE with the PCB
In gray parts you need to find by yourself

QTY	part	part Nr	USD
1	PCB	PCB1	17.00
1	Timer 555	U104	2.50
1	74AC74	U105	1.50
1	74AC04	U106	2.50
1	PGA-103+ mmic amp.	U107	5.00
1	BFR91	Q100	3.00
2	1.8uH	L120, 121	4.00
3	1K (0805)	R151,R154, R159	0.06
1	500 (0805)	R150	0.02
1	3K3 (0805)	R152	0.02
1	330 (0805)	R155	0.02
5	47uF/10v(1206)	C150, 153,158,164,167	12.50
6	1n (0805)	C151, 154, 157, 159, 165, 168	2.50
6	100pF (0805)	C152, 155, 160, 161, 163,169	3.00
1	270pF (0805)	C162)	0.50
1	8pin socket		1.00
2	14pin socket		4.00
1	10K potentiometer	P100	5.00
1	knob for potetiometer		2.00
8	pin headers		0.80
2	sma female pcb connec.		6.00
1	TD6727D-144M	FL101	15.00
		Aprox, TOTAL USD	87.92

What is not included on the BOM?

- Metal box
- Power supply, with a 7805 voltage regulator and 3 filter caps you can feed the unit with 12VDC
- External connectors (sma, BNC, N, depends on what you have)
- 1 power external Switch (3 positions: center OFF, up Sig Gen ON, down Pulse Gen ON)
- 2 external Switches (2 positions to add capacitors to change PRF)
- 1 cap 1uF (normal not smd)
- 1 cap 0.47uF (normal not smd)
- 1 cap 0.33uF (normal not smd)

Toyodyne Consulting
Pulse Generator

TITLE:

FILE: SIGP_PGEN.sch
PAGE: 1 OF 1

REVISION: 0.01
DRAWN BY: George Boudreau

V1.01   Charge bias on Q100 to give class-C
         Removed Q100 silk screen outline
V1.00   Original drawing

PULSE_OUT

DC_PWR

P100 -- External pot to set
pulse rate, 10K

THE SIGNAL GENERATOR

B.O.M list

<mark>In yellow the parts I can provide at cost,</mark>

<mark>In green parts I can provide for FREE with the PCB</mark>
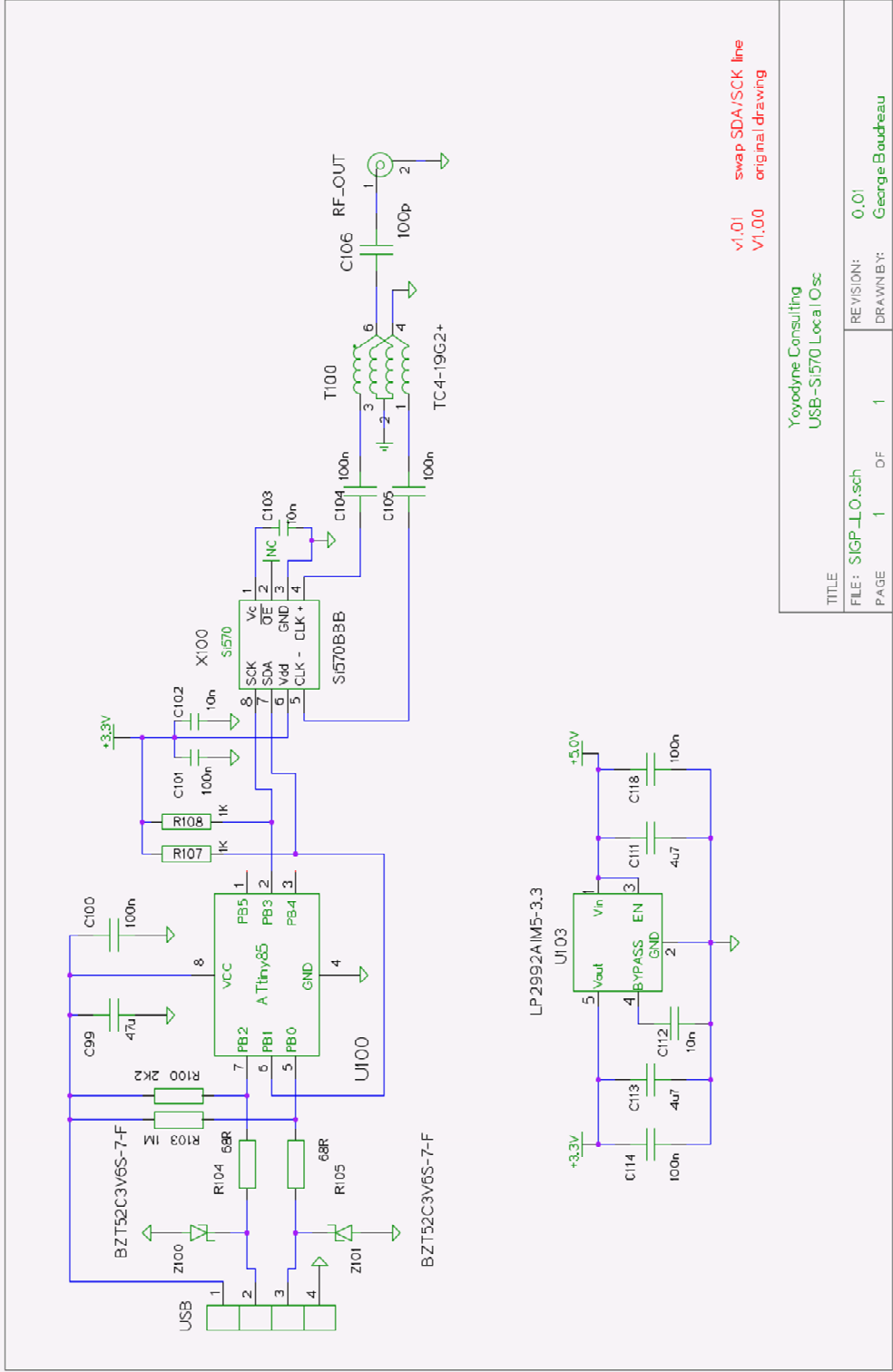
<mark>In gray parts you need to find by yourself</mark>

QTY	part	part Nr	USD
2	68 (0805)	R104, 104	0.80
2	BZT52C3V6S-7-F	Z100, 101	1.50
1	1M (0805)	R103	0.03
2	2K2 (0805)	R100	0.03
1	Atinny85	U100	5.00
2	1k (0805)	R107, 108	0.06
6	100n (0805)	C100, 102,104, 105, 114, 118	2.50
3	10n	C102, 103, 112	1.50
1	100pF (0805)	C106	0.50
1	8pin socket		1.00
1	TC4-19G2+	T100	8.00
2	4u7 (0805)	C113, 111	2.50
1	LP2992AIM5-3.3	U103	4.00
1	47uF	C99	2.50
1	sSi570BBB (up to 945MHz)	X100	62.00
		TOTAL	91.92

What is not included on the BOM?

Have a look on the Pulse Generator B.O.M

NOTE: ALL THE PARTS MARK IN GREEN I CAN PROVIDE FOR "FREE" INCLUDED ON THE PCB ORDER ONLY, NO GURANTEE THAT PARTS WILL BE AVAILABLE ALWAYS, IS JUST UNTIL STOCK IS EMPTY, THE COST OF THAT PARTS ARE NOT DEDUCTIBLE FROM THE PCB COST BECAUSE ARE FREE PARTS..

RF_OUT

C106 100p

T100 TC4-19G2+

C104 100n
C103 10n
C105 100n

NC

X100 Si570
Vc
OE
GND
CLK +
SCK
SDA
Vdd
CLK -
Si570BBB

1
2
3
4
8
7
6
5

+3.3V

C102 10n
C101 100n

R108 1K
R107 1K

C100 100n

U100
PB5
PB3
PB4
VCC
ATTiny85
GND
PB2
PB1
PB0

1
2
3
8
4
7
6
5

C99 47u

R100 2K2
R103 1M

R104 68R
R105 68R

BZT52C3V6S-7-F

Z100
Z101

BZT52C3V6S-7-F

USB
1
2
3
4

+5.0V

C118 100n
C111 4u7

U103
Vin
EN
GND
Vaut
BYPASS
LP2992AIM5-3.3

1
3
2
5
4

C112 10n
C113 4u7

+3.3V

C114 100n

SIGP-1 PRE-KIT (17.00 USD + shipping)

The pre-kit include:

QTY	part	part Nr	USD
1	PCB	PCB1	17.00
1	BFR91	Q100	free
2	1.8uH	L120, 121	free
5	1K (0805)	R151,R154, R159, R107, 108	free
6	1n (0805)	C151, 154, 157, 159, 165, 168	free
7	100pF (0805)	C106, 152, 155, 160, 161, 163,169	free
2	68 (0805)	R104, 104	free
1	1M (0805)	R103	free
2	2K2 (0805)	R100	free

What is not included on the SIGP-1 pre-kit?

- All items mark in Yellow on the BOM list for both circuits but you can order with me.
- All items mark in gray on the BOM list of both circuits. You cannot order these items with me.

The FREE items are available for limited time (until stock is empty) and are not deductible from the PCB cost