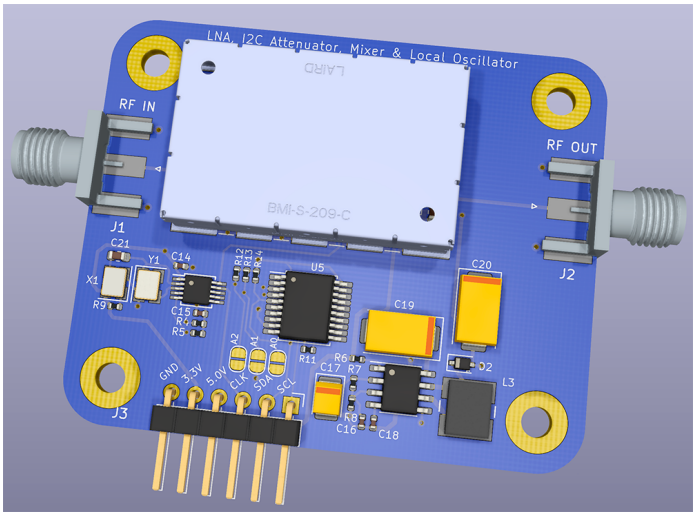
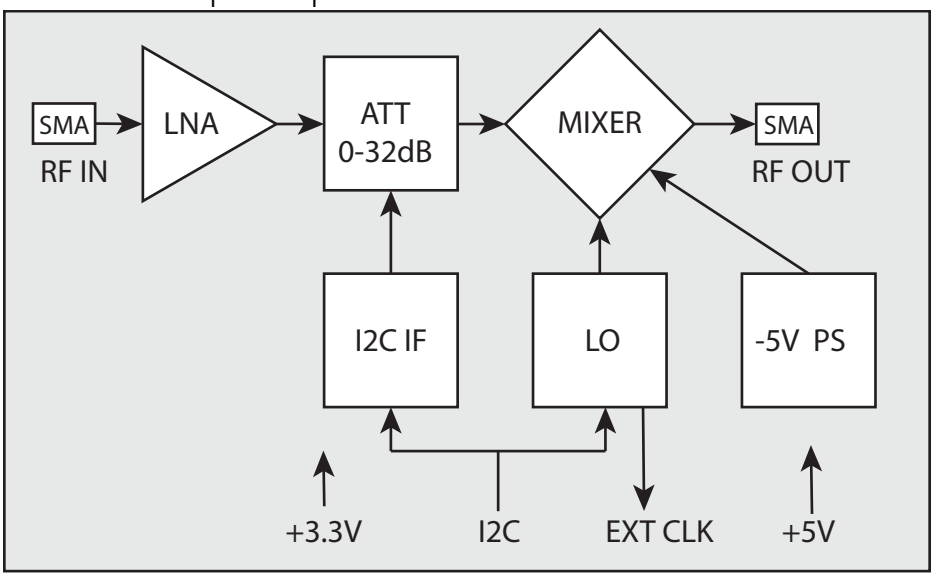
Low Noise Amplifier (LNA), Digital Attenuator, Mixer & Local Oscillator VHF Front End for Si473x Radios

Nancy Gail Daniels – AD5EU

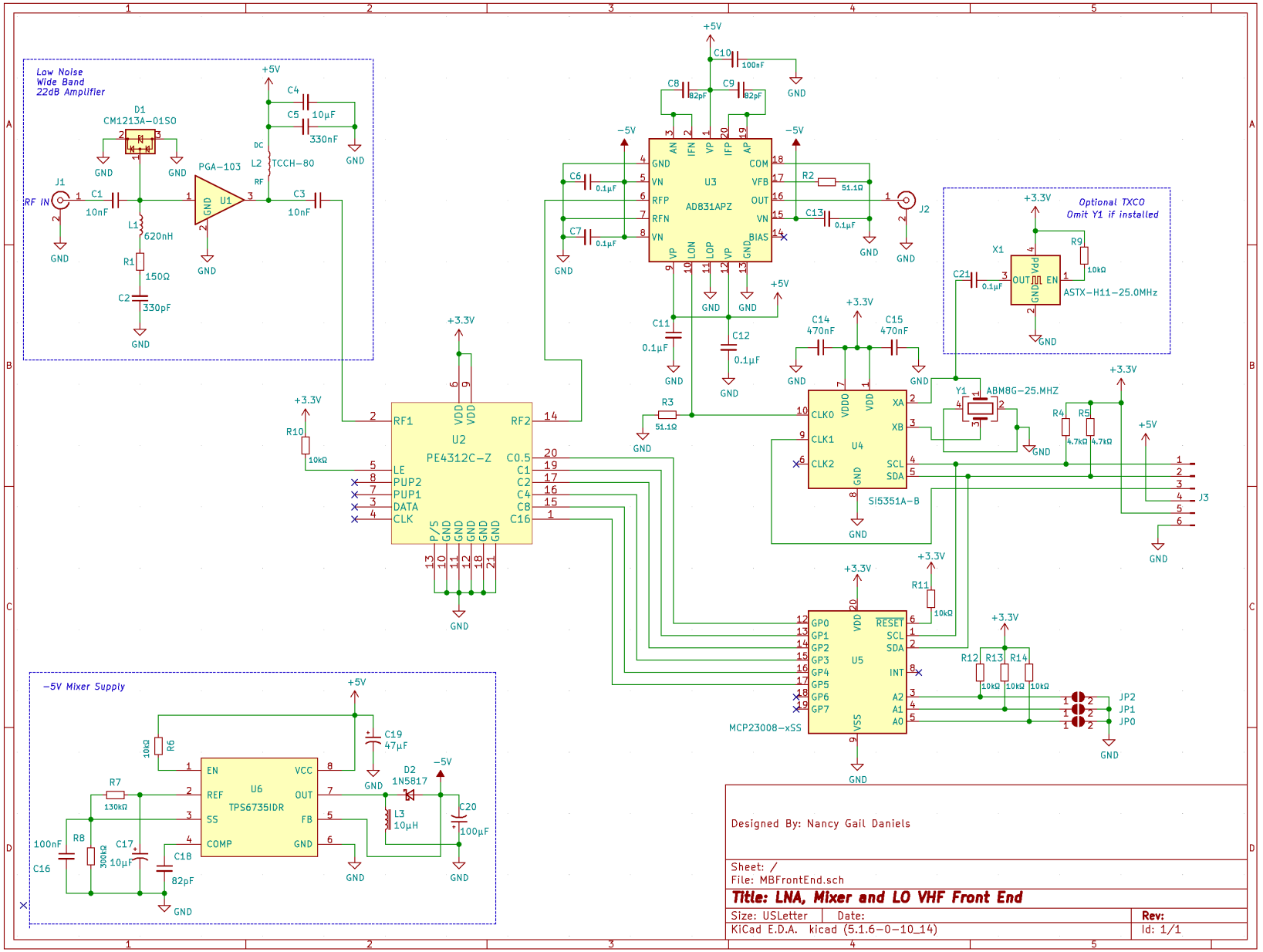
This module is intended as a VHF (from 30MHz – 210MHz) front end to Si473x based radios. It incorporates a 22db low noise amplifier (Mini-Circuits PGA-103), a digital RF attenuator (Peregrine PE4312), a mixer (Analog Devices AD831) and a local oscillator (Silicon Labs Si5351). RF inputs and outputs utilize SMA connectors and system interface is provide by a 6 pin 0.1" (2.5mm) Dupont style header. The module is 55mm x 45mm with four M3 mounting holes



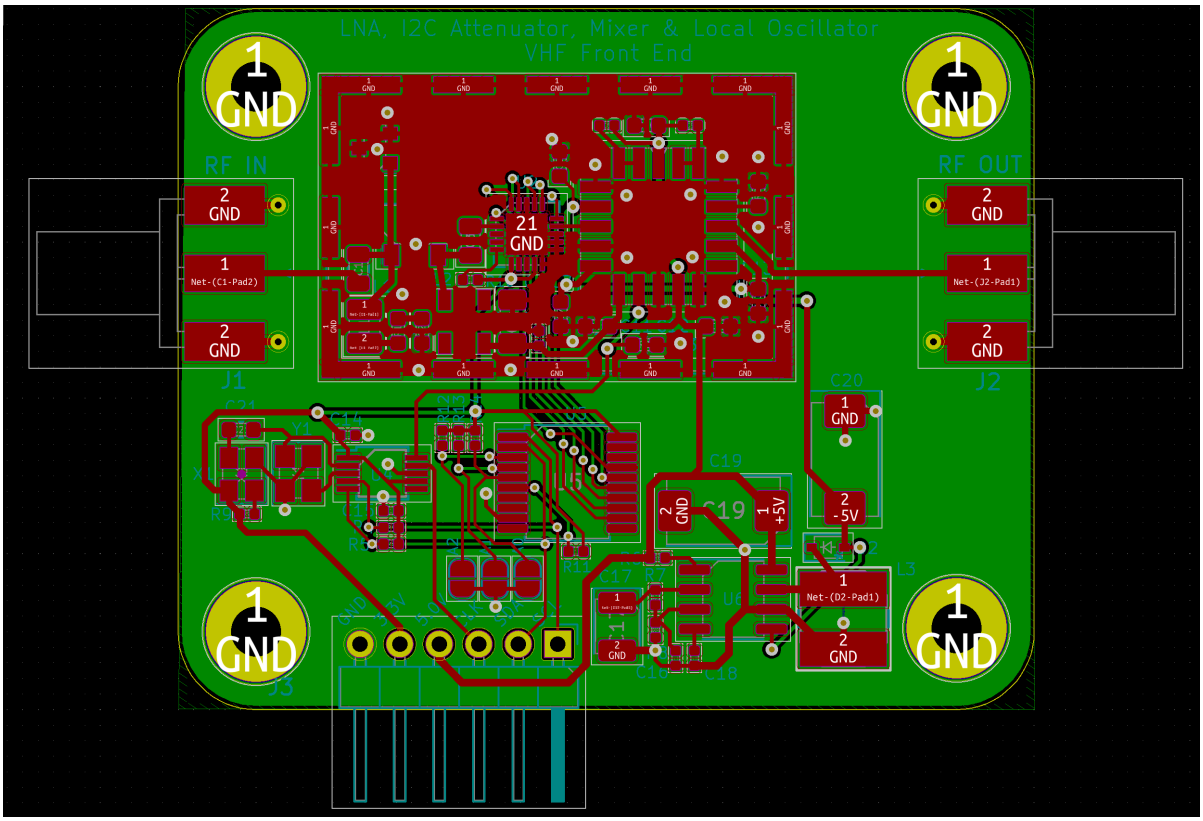
The LNA front end incorporates ESD protection at the antenna and stabilizing network. The attenuator provides from 0-32 dB of attenuation in 0.5 dB steps. The attenuator is controlled via I2C utilizing a MCP23008 I2C to parallel expander with selectable I2C address. The local oscillator supports either a standard 25MHz crystal and/or optional TXCO. It also provides an external user programmable clock. An on board power supply provides -5V for bipolar operation of the mixer.



Block Diagram


Low Noise
Wide Band
22dB Amplifier
D1
CM1213A-01SO
PGA-103
L2
TCCH-80
J1
RF IN
C1
10nF
L1
620nH
R1
150Ω
C2
330pF
C4
C5
10µF
330nF
C3
10nF
U1
+5V
GND
U3
AD831APZ
C6
C7
0.1µF
C8
C9
82pF
C10
100nF
C11
C12
R2
51.1Ω
C13
J2
U2
PE4312C-Z
RF1
RF2
LE
PUP2
PUP1
DATA
CLK
C0.5
C1
C2
C4
C8
C16
R10
10kΩ
+3.3V
R3
U4
Si5351A-8
CLK0
CLK1
CLK2
XA
XB
SCL
SDA
C14
470nF
C15
470nF
Y1
ABM8G-25.MHZ
R4
R5
4.7kΩ
J3
Optional TXCO
Omit Y1 if installed
X1
ASTX-H11-25.0MHz
C21
R9
10kΩ
U5
MCP23008-xSS
GP0
GP1
GP2
GP3
GP4
GP5
GP6
GP7
RESET
INT
A2
A1
A0
R11
R12
R13
R14
JP2
JP1
JP0
−5V Mixer Supply
U6
TPS6735IDR
EN
REF
SS
COMP
VCC
OUT
FB
R6
R7
130kΩ
R8
300kΩ
C16
100nF
C17
10µF
C18
82pF
C19
47µF
D2
1N5817
L3
10µH
C20
100µF
Designed By: Nancy Gail Daniels
Sheet: /
File: MBFrontEnd.sch
Title: LNA, Mixer and LO VHF Front End
Size: USLetter
Date:
Rev:
KiCad E.D.A. kicad (5.1.6-0-10_14)
Id: 1/1

PCB Front Side



PCB Rear Side