From: http://www.eecis.udel.edu/~hanavin/chuck/w3fjj/synch/synch.htm

W3FJJ SYNCHRONOUS DETECTOR

Here is a schematic and pics of a synchronous detector, I designed and built back in 1992. It works pretty good, but has a little bit of hiss, probably with some better low noise op amps, it would help this. I get approximately 20-30 db unwanted sideband rejection with the all pass filter.

I never did implement the 386 audio amp, as they are crap, I use an external hi-fi amp. I like to up grade it and add an auto tune circuit to it, This way when you tune around it uses an envelope detector, and you don't get annoying hetrodyne of the phase lock loop trying to lock. Once you stop tuning and the PLL locks, (low dc error voltage on output of phase detector) it will switch to the synch detector automatically. The switches on front panel are; capture range wide/narrow, middle switch is a three position (USB/BOTH/LSB), Fine tuning VCO, and power. On the back panel, I have four outputs; Synch out, I out, Q out, and USB/BOTH/LSB out.

Parts List

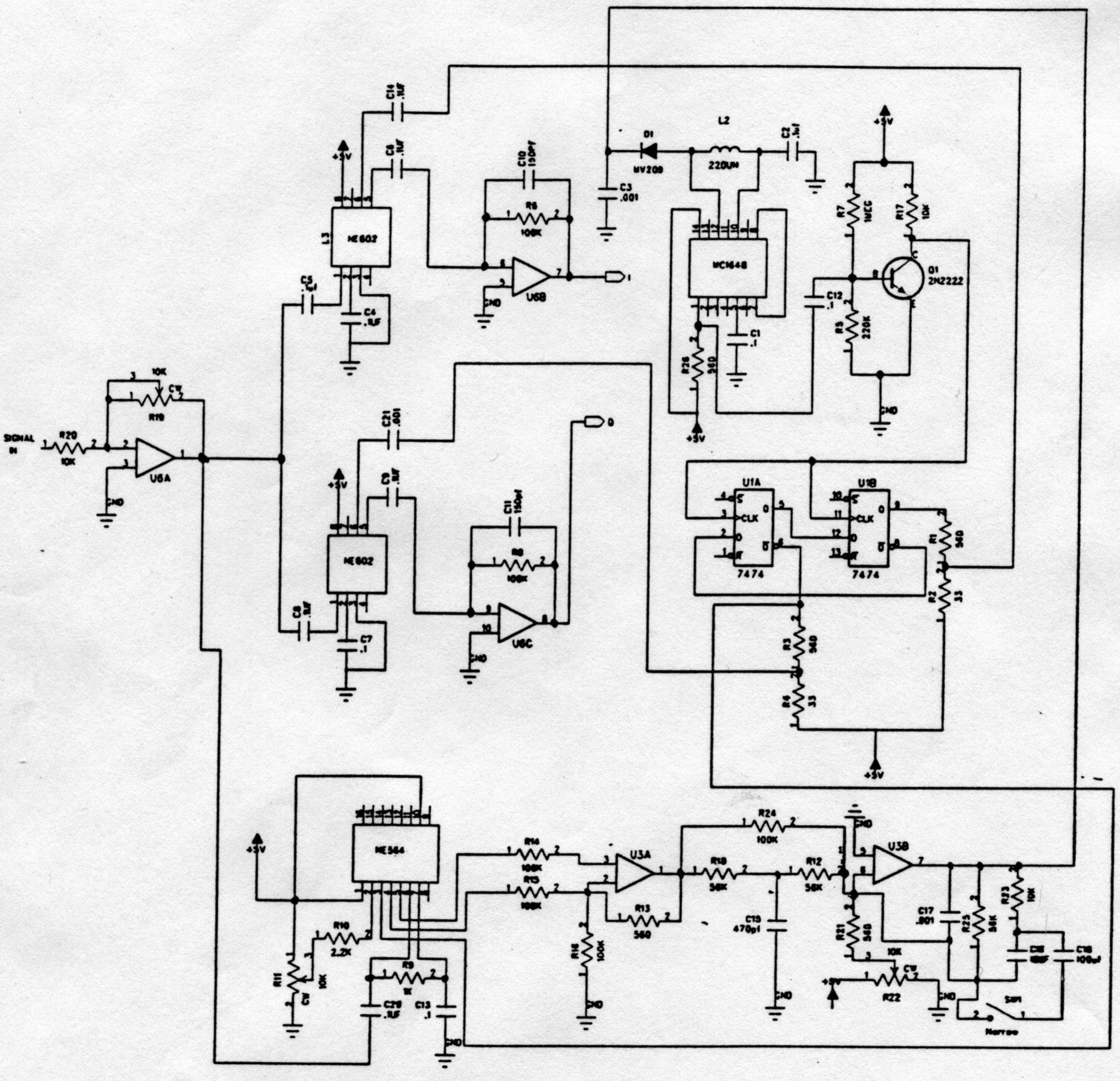
U1	74LS74 Dual D-Type Flip-Flop
U3,U6,U8,U9	TL074CN Quad OP-Amp
U10	TL072CN Dual Op-Amp
U4,U5	NE602N Double Balance Mixer
U7	NE564N Phase Lock Loop
U2	MC1648P Voltage Control Oscillator
D1	MV209 Varactor Diode
Q1	2N2222 General Purpose NPN Transistor

Circuit Description

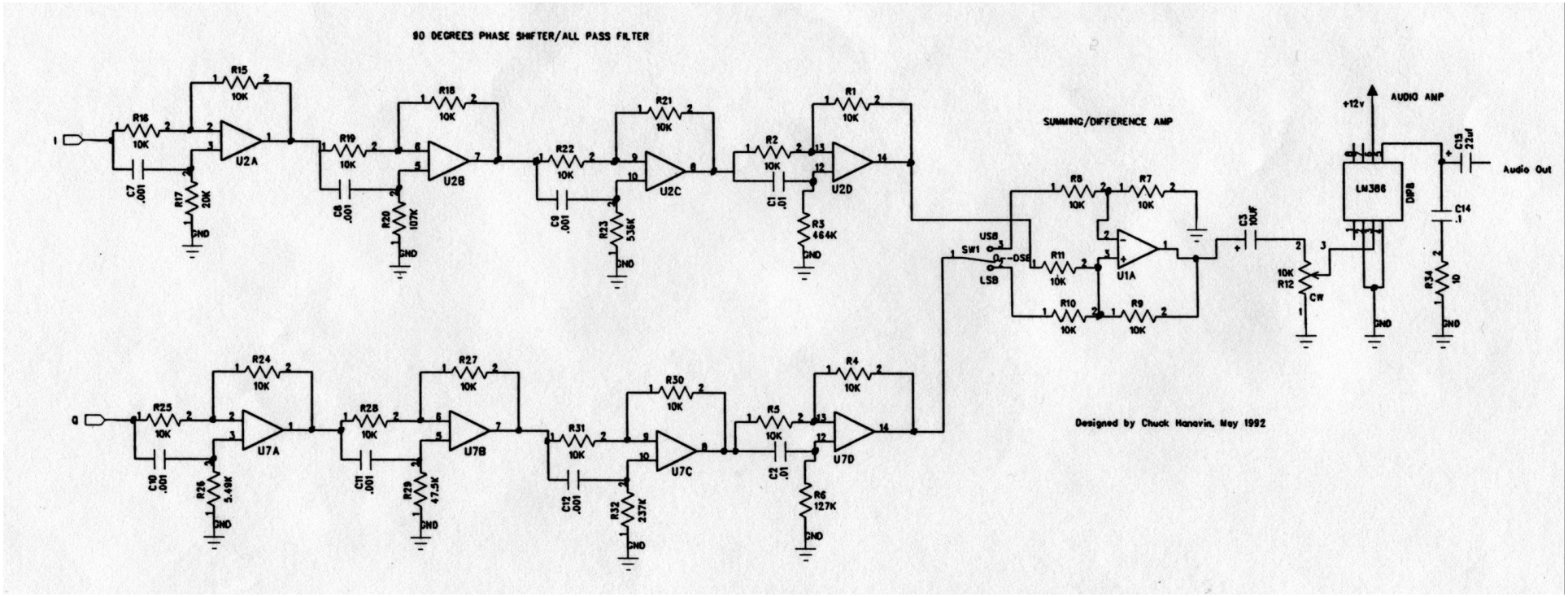
U6A is an adjustable gain buffer. Its output is fed to double balanced mixers, U4, U5 and to phase detector U7. Only the phase detector of u7 is used. R11 adjust the conversion gain of the phase detector.

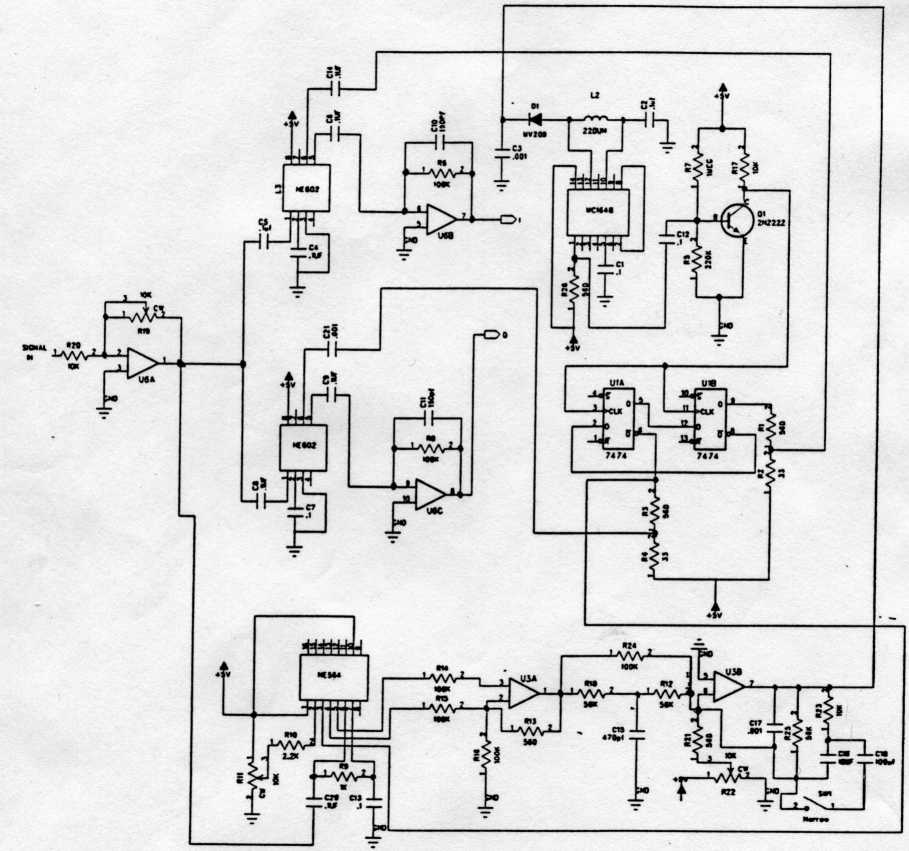
U3A converts the balance output to single ended. U3B serves two purposes; It provides low pass filtering and an adjustable dc bias level (R22) to control the VCO frequency. SW1 controls the response of the filter, allowing a wide or narrow capture range. U2, with varactor Diode, D1 form a VCO operating at a frequency of 1820 Khz, Its output is boosted to a TTL level by Q1, and its frequency divided by four (455khz) by U1. U1 has two outputs, an in-phase and quadrature (-90 degree) signal. These signals are fed to balance mixers U4 and U5, where they mix with the incoming signal. U6B and U6C are low pass filters to remove the sum frequencies of the mixers. The I signal at this point is the synchronous detected output and can be fed to a line level input on a high-fi amplifier. If selectable output is desired, the I and Q signals are fed to an all-pass phase shift filter, U2 and U7. The amplitude response is with flat from 100hz to 10khz, with a 90 degree phase shift within 1 degree. U10 is a summing/difference amplifier. Adding the two audio signals, attenuates the lower sideband, subtracting the two, will attenuate the upper sideband.

SYNCHRONOUS DEMODULATOR PART 1

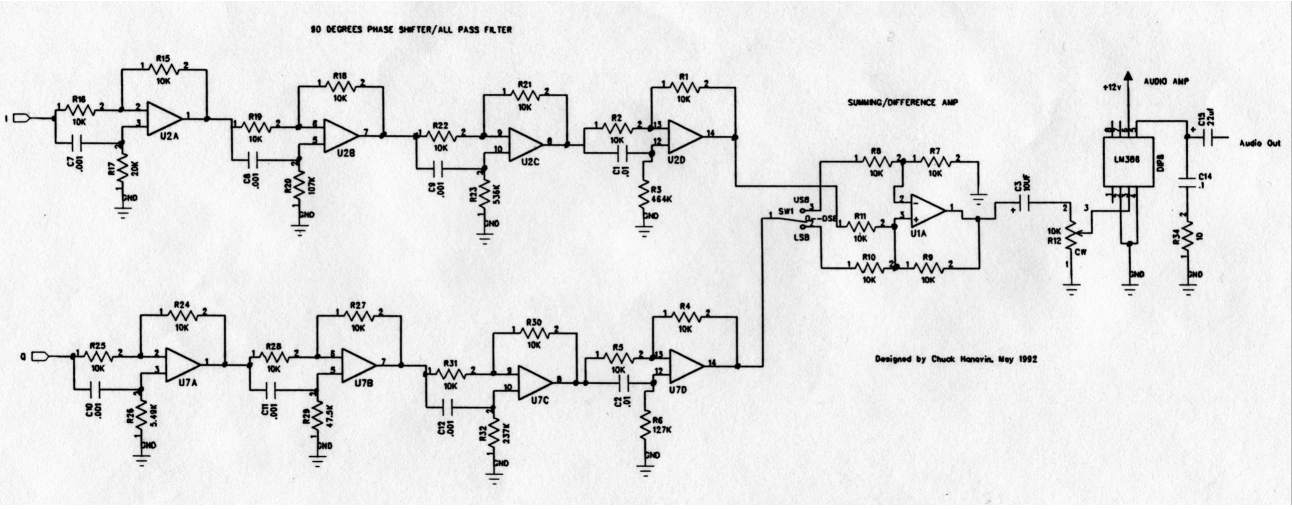

SIGNAL IN
R20
10K
R19
10K
CW
U6A
GND
NE602
L3
C14
C6
C5
C4
C10
150pf
R6
100K
U6B
I
Q
C21
.001
C9
C8
C7
.1
C11
150pf
R8
100K
U6C
D1
MV209
L2
220UH
C2
C3
.001
MC1648
C12
.1
C1
.1
R26
560
+5V
R7
R17
10K
Q1
2N2222
R5
220K
GND
U1A
U1B
CLK
7474
R1
560
R2
33
R3
560
R4
33
NE564
R14
100K
R15
100K
U3A
R24
100K
R18
56K
R12
56K
U3B
R13
560
R16
100K
C15
470pf
R10
2.2K
R11
10K
R9
1K
C20
C13
.1
R21
560
R22
10K
C17
.001
R25
56K
R23
10K
C18
100uf
SW1
Narrow

DESIGNED BY CHUCK MARAVIN, MAY 1992


90 DEGREES PHASE SHIFTER/ALL PASS FILTER
SUMMING/DIFFERENCE AMP
AUDIO AMP
+12v
Audio Out
Designed by Chuck Hanavin, May 1992
I
Q
U2A
U2B
U2C
U2D
U7A
U7B
U7C
U7D
U1A
LM386
SW1
USB
LSB
R15 10K
R16 10K
R17 20K
R18 10K
R19 10K
R20 107K
R21 10K
R22 10K
R23 536K
R1 10K
R2 10K
R3 464K
R24 10K
R25 10K
R26 5.49K
R27 10K
R28 10K
R29 47.5K
R30 10K
R31 10K
R32 237K
R4 10K
R5 10K
R6 127K
R8 10K
R7 10K
R11 10K
R10 10K
R9 10K
R12 10K CW
C7 .001
C8 .001
C9 .001
C1 .01
C10 .001
C11 .001
C12 .001
C2 .01
C3 10UF
C13 22uf
C14 .1
R34 10
GND



DESIGNED BY CHUCK HARAVEN, MAY 1982


90 DEGREES PHASE SHIFTER/ALL PASS FILTER
I
Q
R15 10K
R16 10K
C7 .001
R17 20K
2ND
U2A
R18 10K
R19 10K
C8 .001
R20 107K
2ND
U2B
R21 10K
R22 10K
C9 .001
R23 53.6K
2ND
U2C
R1 10K
R2 10K
C1 .01
R3 464K
2ND
U2D
R24 10K
R25 10K
C10 .001
R26 5.46K
2ND
U7A
R27 10K
R28 10K
C11 .001
R29 47.5K
2ND
U7B
R30 10K
R31 10K
C12 .001
R32 237K
2ND
U7C
R4 10K
R5 10K
C2 .01
R6 127K
2ND
U7D
SUMMING/DIFFERENCE AMP
USB
SW1
DSB
LSB
R8 10K
R7 10K
R11 10K
R10 10K
R9 10K
U1A
C3 .005F
10K R12 CW
+12v
AUDIO AMP
LM386
DPB
C13 22uf
Audio Out
C14 .1
R34 10
2ND
Designed by Chuck Hanavin, May 1992