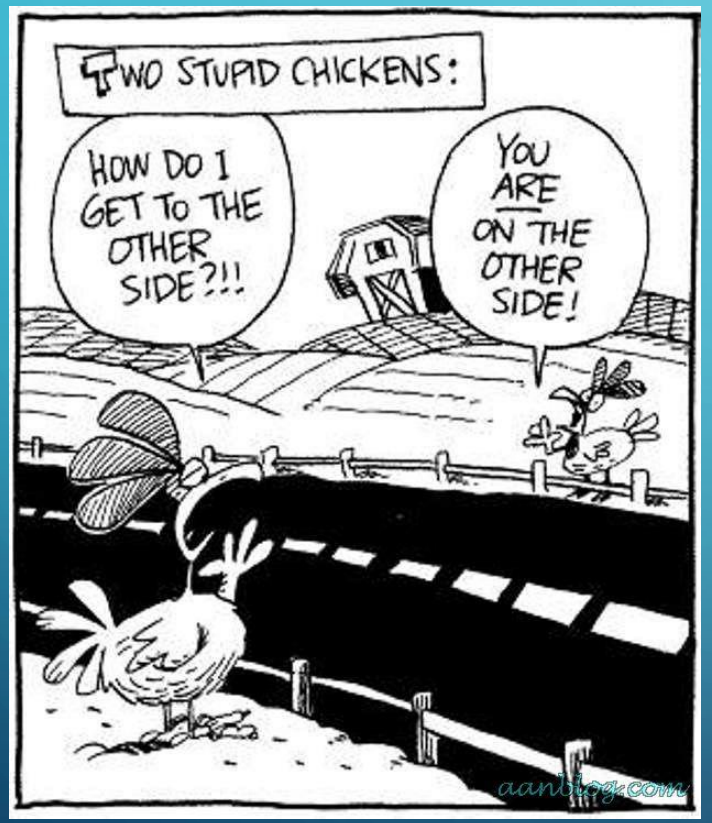
PARC SIGNAL GENERATOR (SIG GEN)

HOW IT WORKS

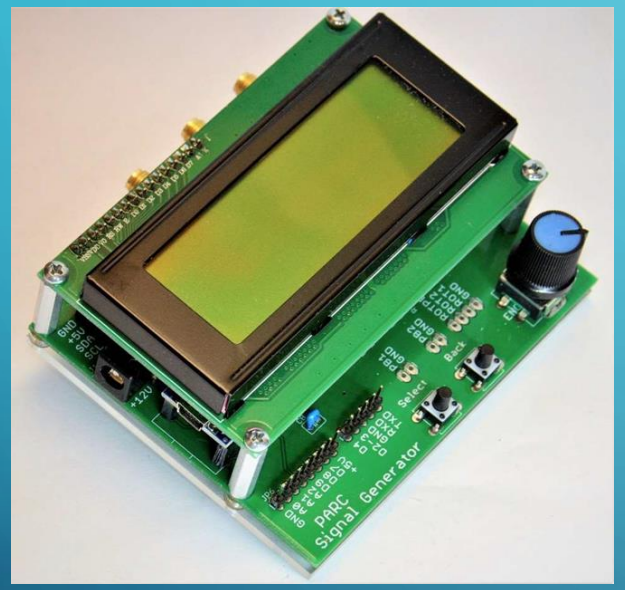
DAVE VE3OOI

DANGER WILL ROBINSON...



WHAT IS A SIG GEN.

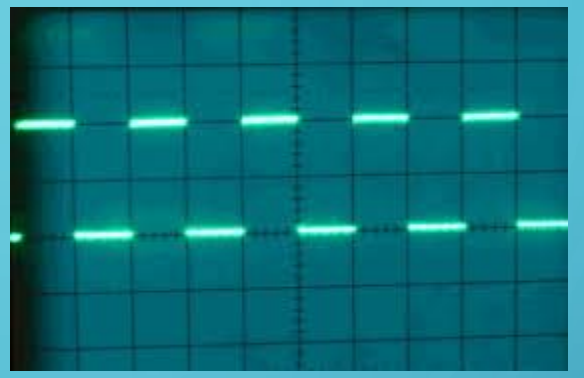
A Basic Introduction

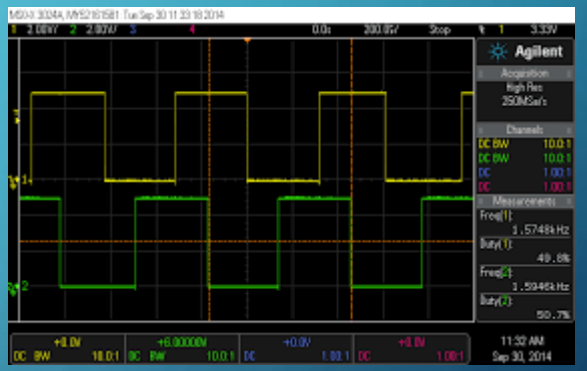


Generates

Signals

(Square Waves)





FREQUENCY INJECTION

- Use frequency generator as a signal source
  - i.e. inject a signal of known frequency and amplitude into something
- Examples:
  - Signal source to experiment with
  - A quick and dirty oscillator
  - Feed signal to a Mixer to modulate it.
  - I/Q source for SDR

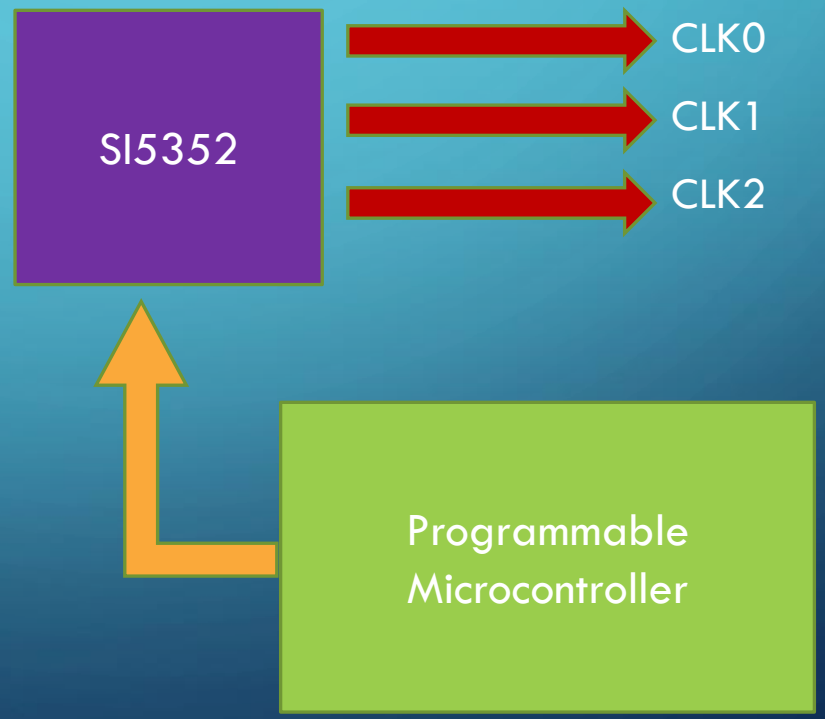
GENERATOR

Si5351 Module:

- Si5351 is a PLL Square Oscillator
- Three cloud outputs. +7 dBm into a 50R load
- Two PLL for 3 outputs. Each PLL Uses a 25 MHz Crystal with a Multiplier and a Divider
- Multiplier: 600 to 900 MHz
- Divider: 8 KHz to 160 MHz (advertised)
- Actual is 1.5 KHz to 225Mhz!!!

Issues:

- Square waves with harmonics
- Signal Amplitude varies with frequency
- Some Phase Noise (Jitter)



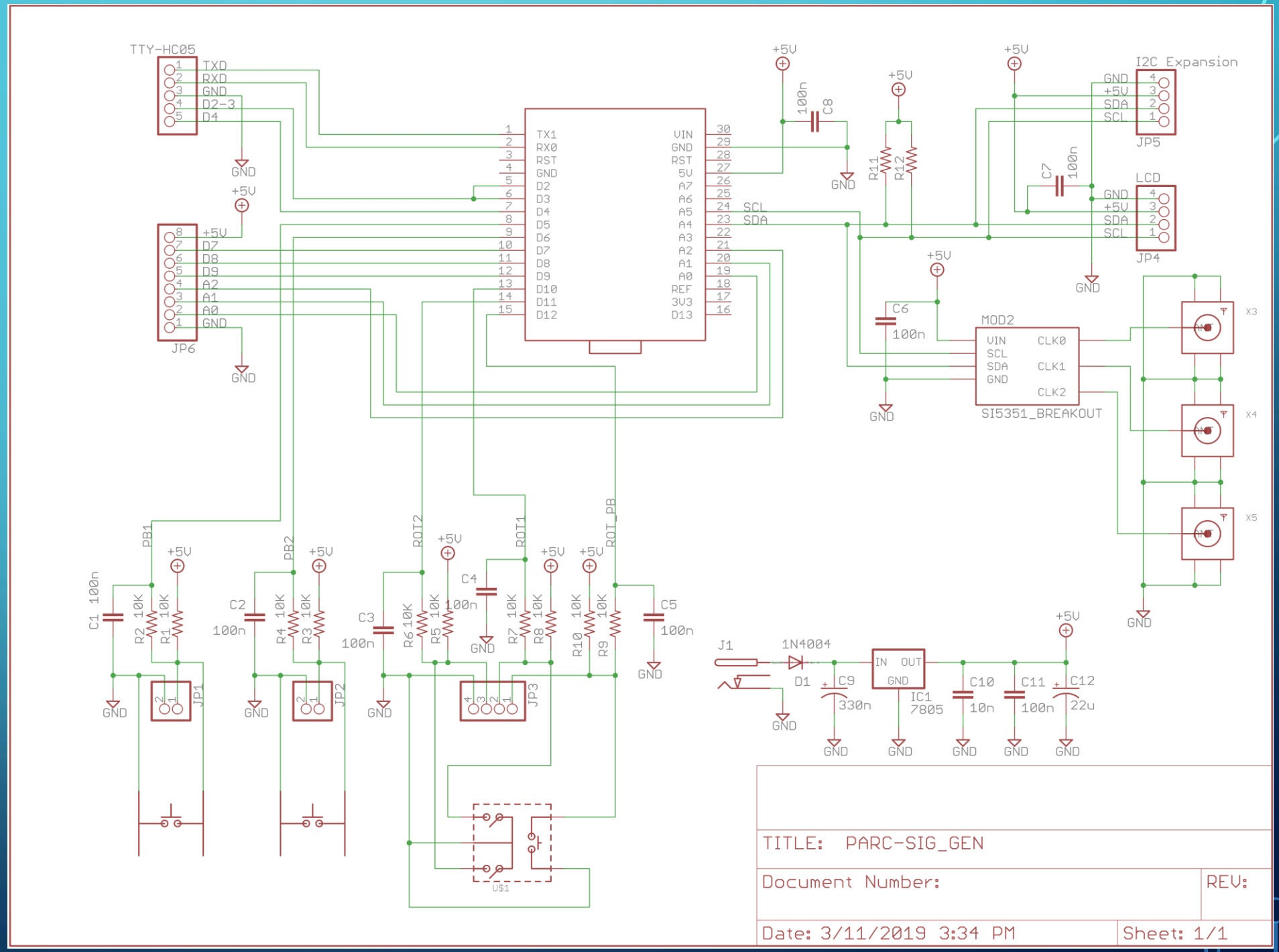
HARDWARE FEATURES

- Arduino Nano
  - Load your own software
- 4x20 LCD (Reversible)
- Rotary Encoder and 2 Push Buttons
- I2C Expansion Header (e.g. Programmable attenuator)
- 8 Pin Expansion (+5, Gnd, 3xDIO, 3xADC)

SOFTWARE FEATURES

- Calibration
- 4 Memory Recall
- CLK0 and CLK2: 1.5 KHz to 225 MHz
- CLK1: 8 KHz to 110 MHz
- I/Q: CLK0/CLK2: 3 MHz to 80 MHz
- IF Mode or Offset Mode
  - Display Frequency (accounts for IF offset)

SCHEMATIC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TXD
RXD
GND
D2-3
D4
JP6
+5V
D7
D8
D9
A2
A1
A0
GND
TX1
RX0
RST
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
VIN
GND
RST
5V
A7
A6
A5
A4
A3
A2
A1
A0
REF
3V3
D13
SCL
SDA
I2C Expansion
JP5
LCD
JP4
C6
100n
MOD2
VIN
SCL
SDA
GND
CLK0
CLK1
CLK2
SI5351_BREAKOUT
X3
X4
X5
PB1
PB2
ROT2
ROT1
ROT_PB
C1 100n
C2 100n
C3 100n
C4 100n
C5 100n
R1 10K
R2 10K
R3 10K
R4 10K
R5 10K
R6 10K
R7 10K
R8 10K
R9 10K
R10 10K
JP1
JP2
JP3
U$1
J1
1N4004
D1
C9 330n
IC1 7805
C10 10n
C11 100n
C12 22u
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THE GENESIS

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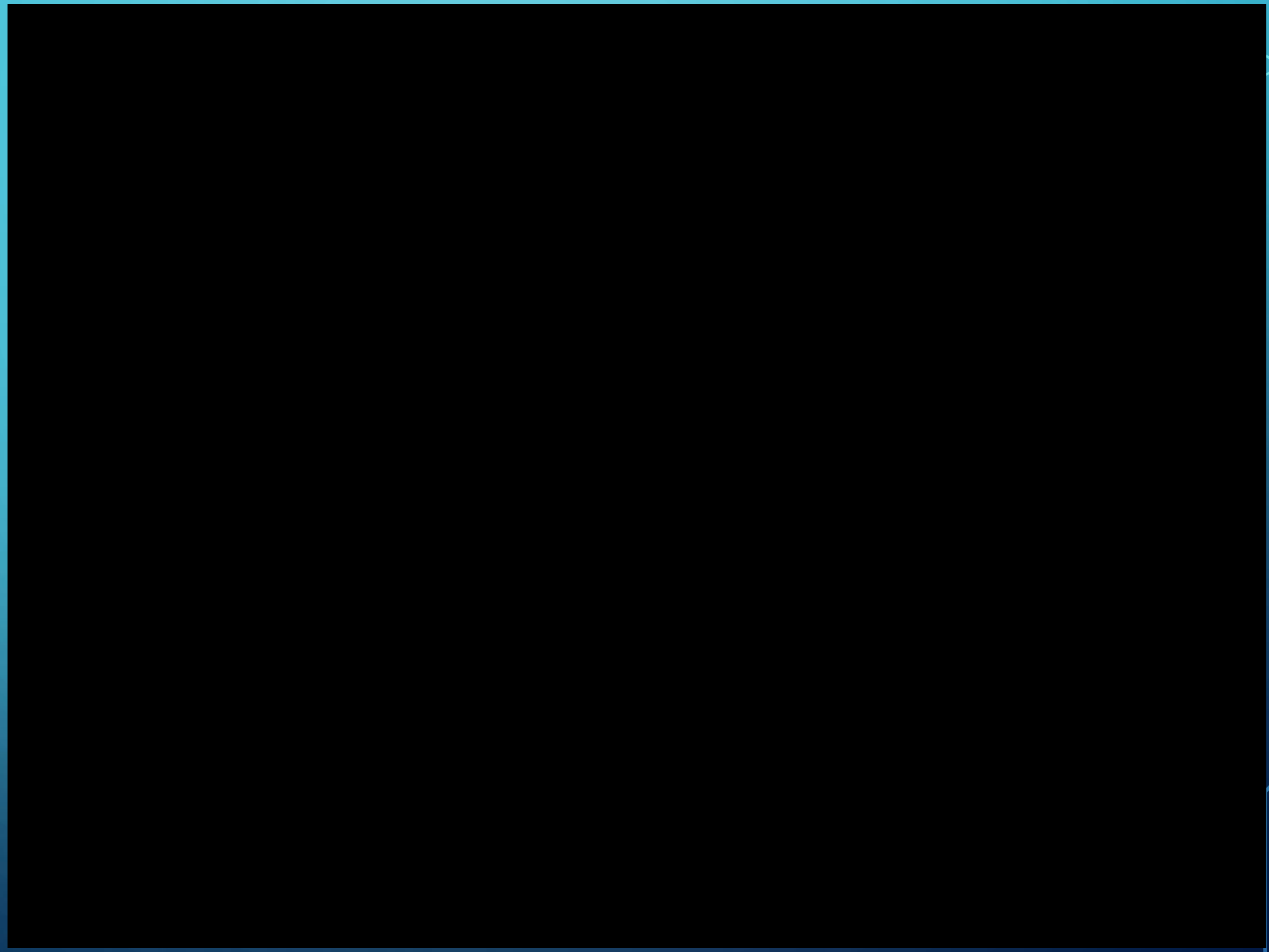

FEATURES

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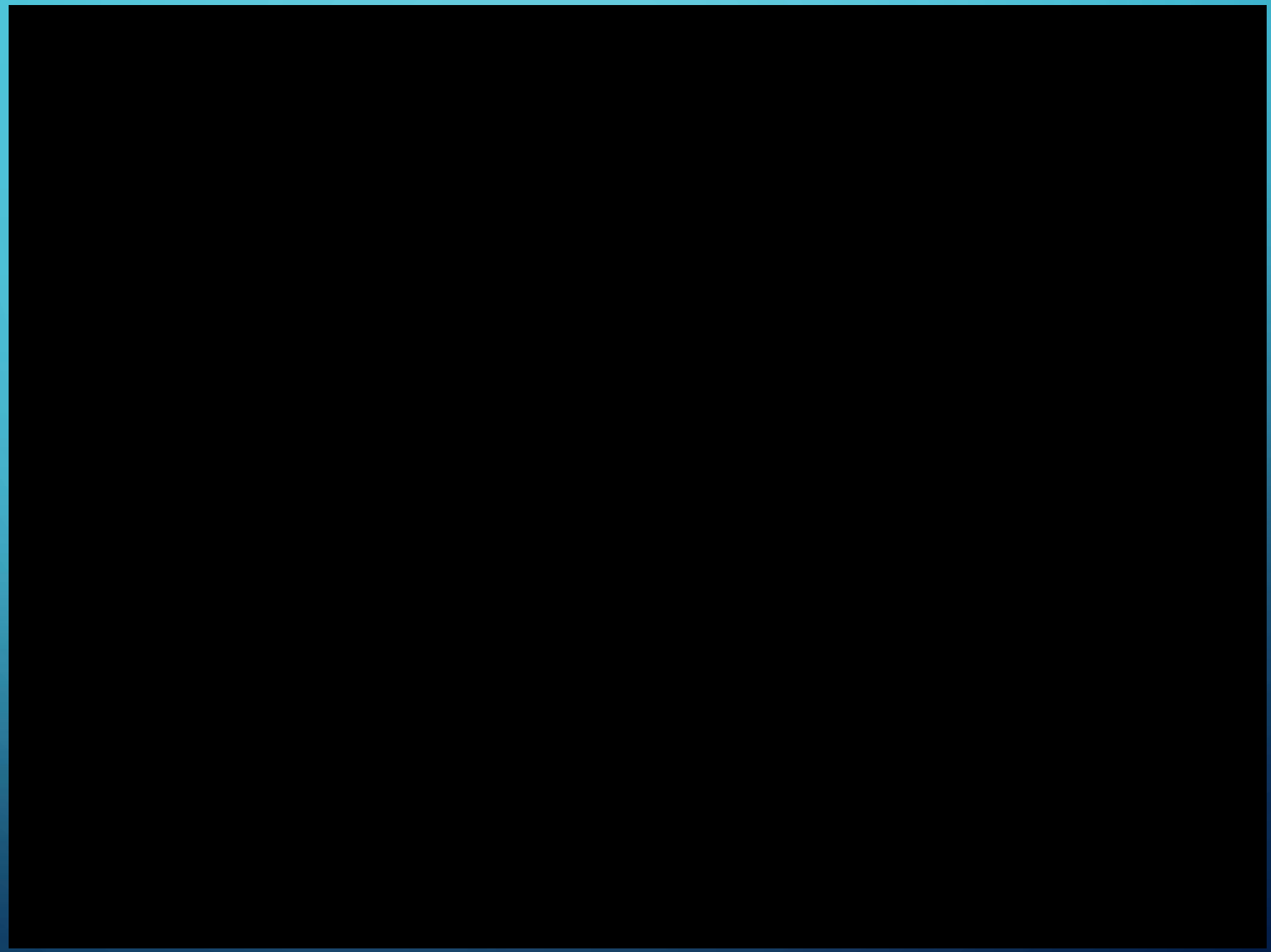
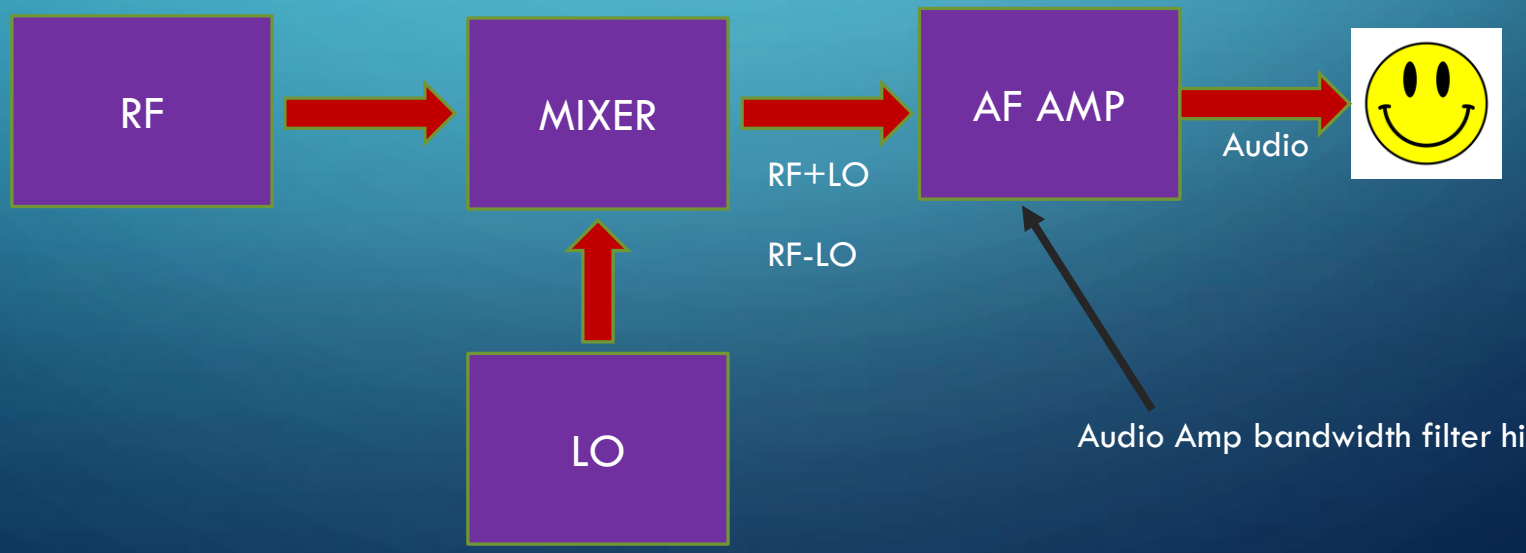


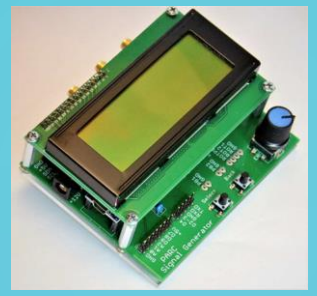
OFFSET MODE (IF OFFSET)

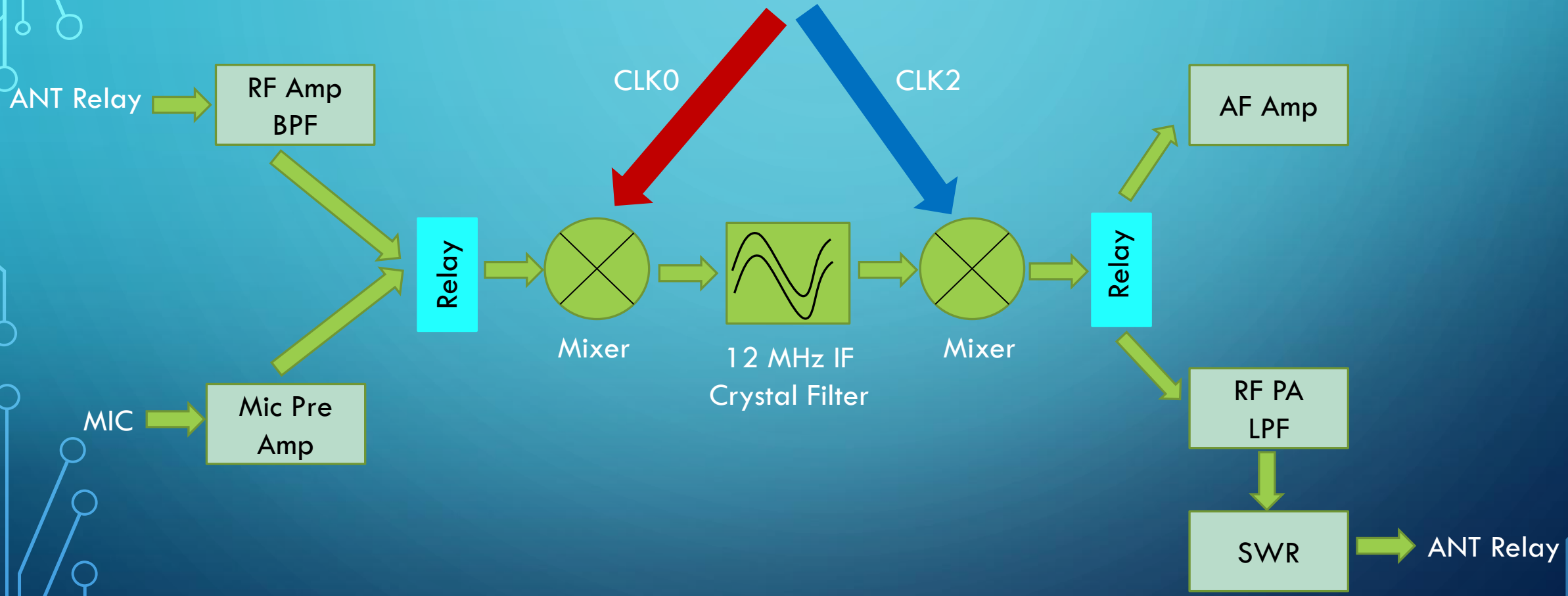
Consider a DC Receiver

- RF from Ant 7.100.000 Hz
- If Audio Center is 1.500 Hz
  - ✓ Need LO of 7.100.000 – 1.500 = 7.098.500 Hz
- Use Sig Gen and set CLK0 Frequency to 7.098.500
- In Offset mode, set offset to -1500 Hz and 1500 Hz is automatically subtracted from frequency display
  - i.e. LCD displays 7.100.000 but Sig Gen outputs 7.098.500



EXAMPLE: D612





D612 SOFTWARE

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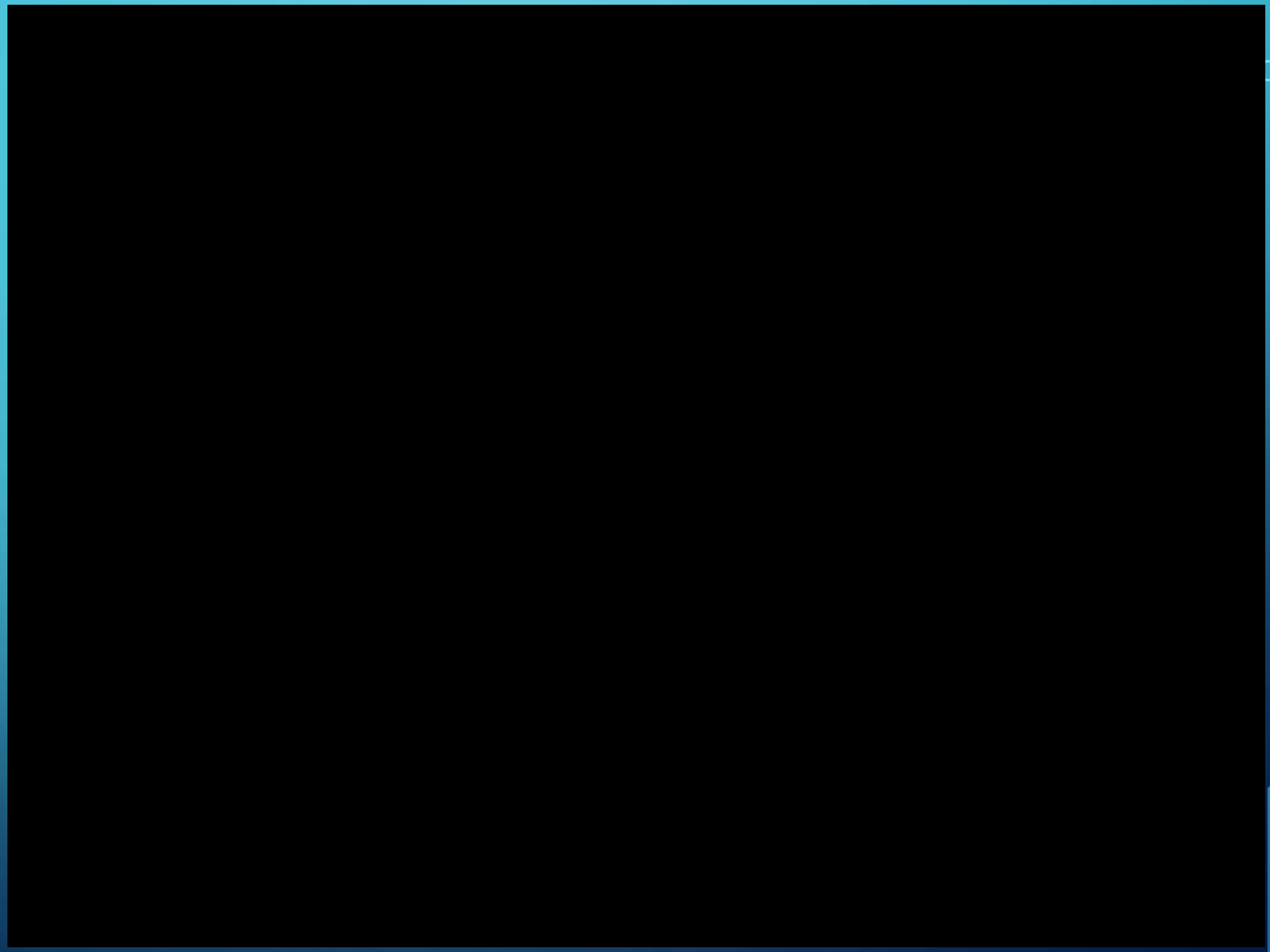

D612 CONTACTS

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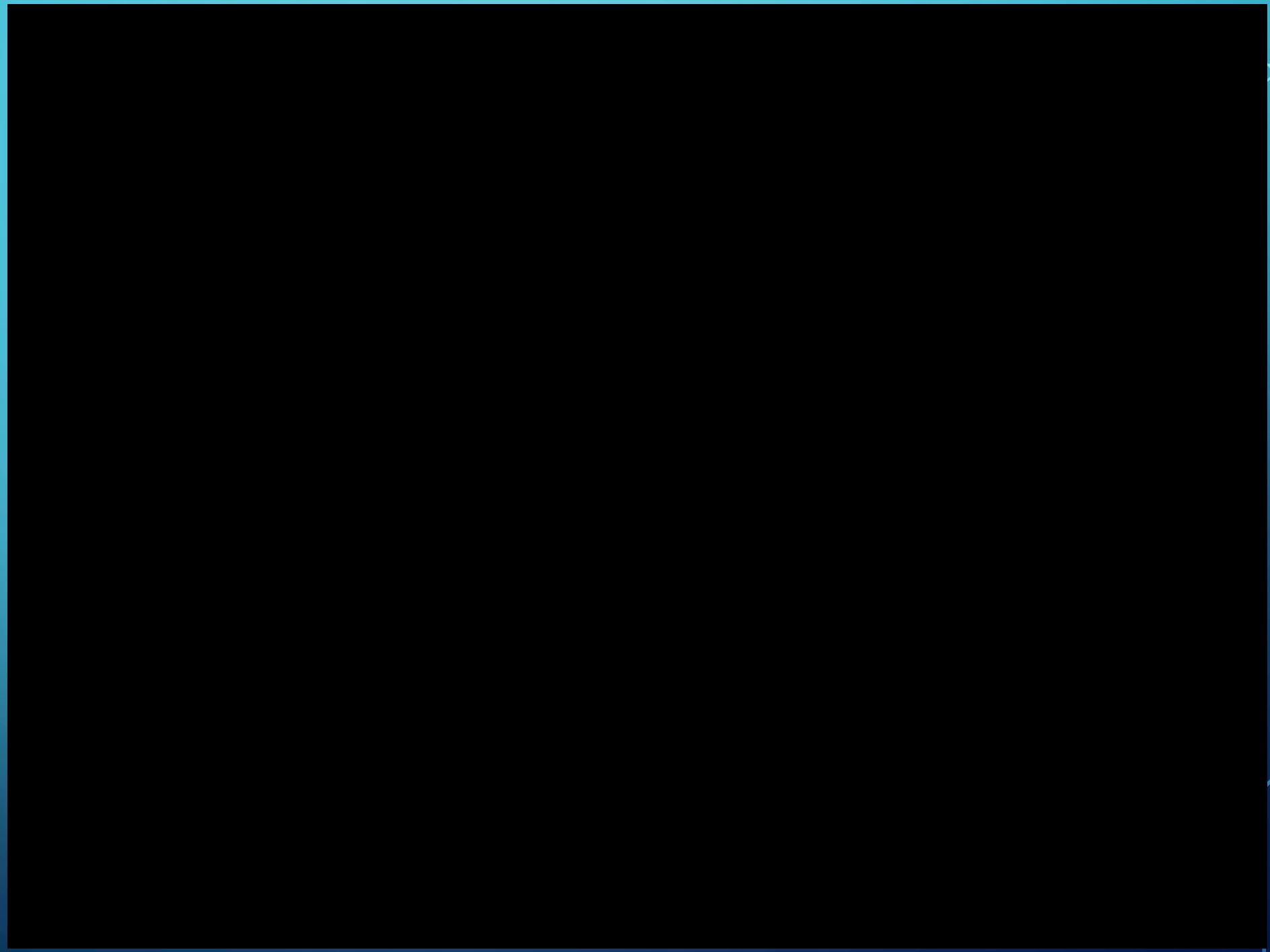
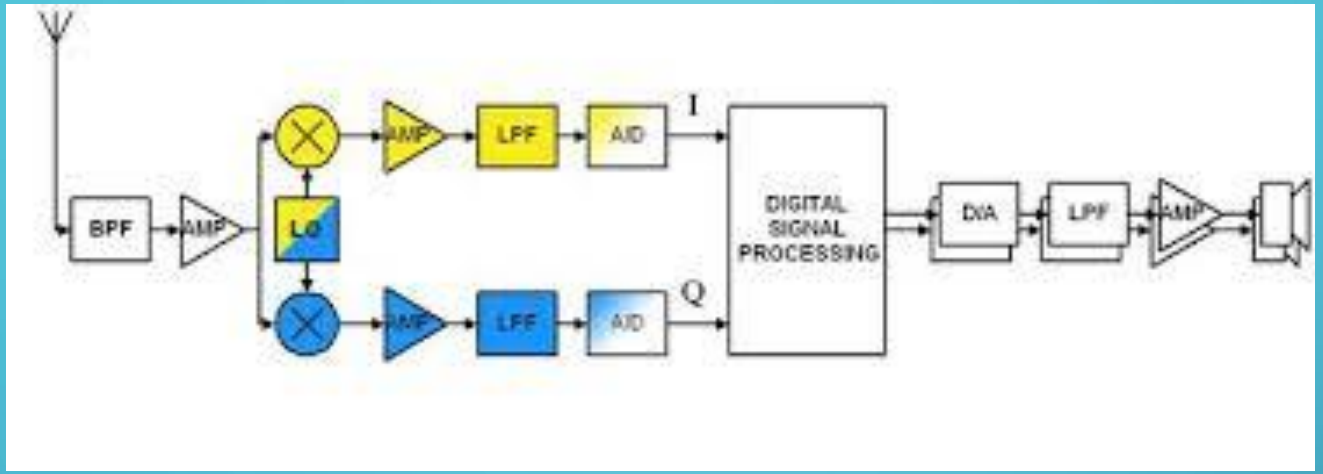


I/Q MODE



Traditional SDR Radio

- Take RF (possible mix to a lower frequency) and feed into two mixers
- Both mixers fed with same LO but frequencies 90 degrees out of phase
- Output from mixers are filtered and fed to a DSP for demodulation
- Sig Gen can generate frequencies 90 degrees out of phase

A FEW CLOSING THOUGHTS…

A NORMAL CAT

DAVE'S CAT

THOUGHTS

- Output is 7 dBm (about 1.5 Vpp). **HOT**
  - Frequency could bleed across Si5351 clock output
  - Will radiate. More so with long unshielded wires/traces
- Square Wave
  - Generates odd harmonics
  - Low order harmonics could radiate or bleed out
- Calibration
  - Signal Amplitude varies with frequency an not linear
  - Say, calibrate at 10 MHz. 100 Mhz will be off