CAPE-II Educational and Communication Subsystems

C. A.P. E.

Cajun Advanced Picosatellite Experiment

- Educational Objectives

- Communication System Objectives

- System Component Overview

C. A. P. E.

Cajun Advanced Picosatellite Experiment

- Objective: To provide the opportunity for grade school and high school students to interact with an active orbiting satellite.

  – Help students around the world become excited about science, technology and engineering

- How can we do this?
  - Parrot Repeater
  - Simplify a data query for diagnostic data

- Record an incoming voice
- After a delay, retransmit voice recording
  - Doppler shift lesson
  - Cool factor

- Using a DTMF keypad on a low cost ham radio, a student can access the diagnostic data with a simple code.
  - Currents, temperatures, voltages, etc.

- Example
  - Dialing a pin code (1,2,3,4) would open the diagnostic link to the satellite
  - Dialing 0,0,0,1 would ask for the solar cell temperature on X+ side of the satellite
  - Dialing 1,0,0,1 would provide the current supplied from the X+ side of the satellite

- Satellite Performance
  - What type of "weather" does a satellite experience (temperature ranges)
  - How much power is produced from solar cells? (current and voltage measurements V=IR)
- What is Doppler Shift?
- Satellite tracking

- Objective: To provide a high speed, low power, reliable, and flexible communication link.

- Software Defined Radio (SDR)
- Hardware Radio
  - Drop Dead Reset

- SDR
  - 0.5 Watt power budget
  - Blackfin MCU
  - Multiple modulation schemes on fixed frequency
    - AM, SSB, FM, Narrowband and Wideband FM, FSK, GFSK, BPSK, and QPSK

http://sdr.ulcape.org

- High Speed Modem (38.8 Baud)
- Low Speed Modem (1200 Baud)
- Digital Tone Multiple Frequency (DTMF) Decoder
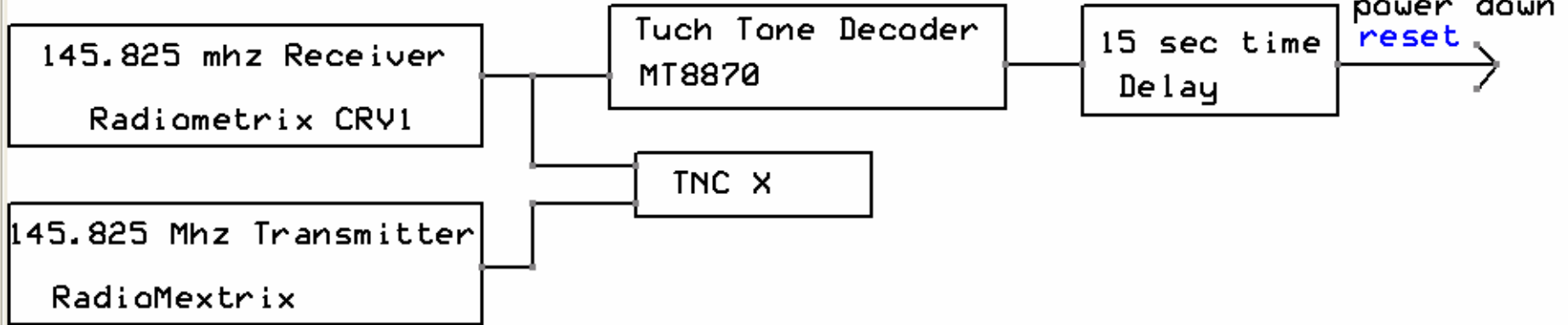- Simplex Voice Repeater
- Text-To-Speech Processor

Questions???

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Back up radio Cheap Insurance < $200

- Simple no processor
- 15 second of tone is last resort reset command
- 1200 baud TNC
- Very inexpensive
- Beacon Transmitter
- Frequency 145 MHZ
- 100 mw output
- Receiver draws 21 mw
- Small foot print

power down
reset

145.825 mhz Receiver Radiometrix CRV1	→	Tuch Tone Decoder MT8870	→	15 sec time Delay
		TNC X		
145.825 Mhz Transmitter RadioMextrix				

Receiver Specifications

Frequency 145 MHZ
Double heterodyne
Voltage 3VDC
Power consumed 21 MW
Sensitivity –120 dbm @ 12 db sninad
Image/spur –60 db or better
Blockage –85 db or better
Adjacent channel –65 db
Size 33 X 23 X 8 mm

Transmitter Specifications

Frequency 145 Mhz

Voltage 3 VDC

Power Out 100 mw

Power consumed 280 MW

Crystal controlled

Size 43 X14 X 5 mm
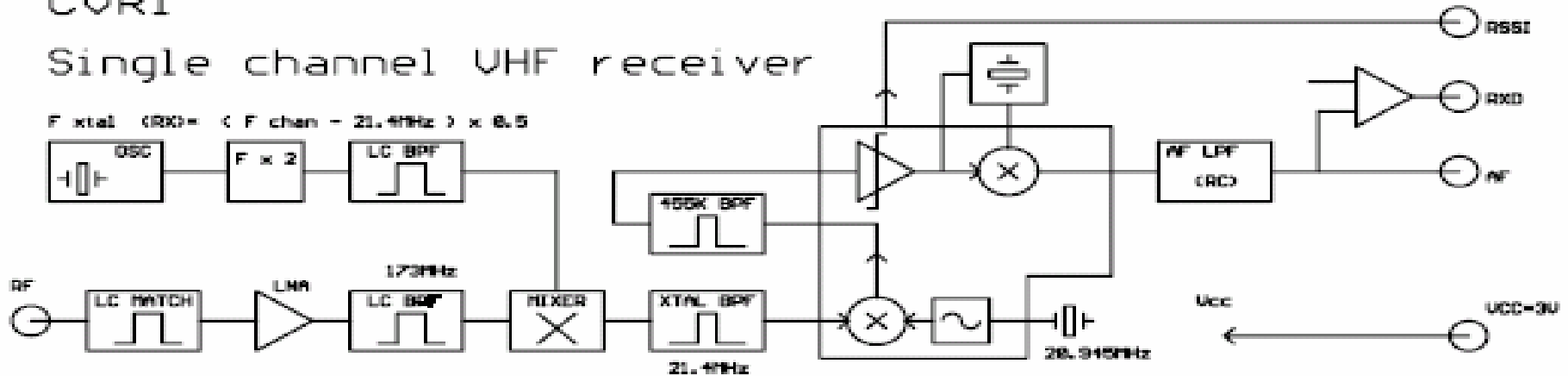
Figure 2: CVR1 block diagram

38.89 KBs

435 MHZ Radio	←	CML908		PIC 18f6722
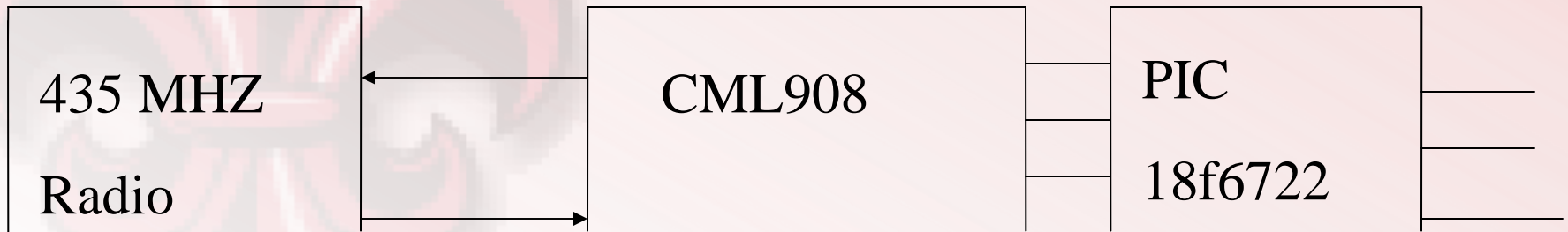
1.2 KBS

Features

➢38 KBS out rout   435 MHZ

➢Framing done   IF band with 70 khz

➢Scrambling done   2 Watt output

➢Forwarded error   GMSK
corrected