

# ***UHF Communication System for Modular Satellite***



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21th September, 2010

# *Agenda*

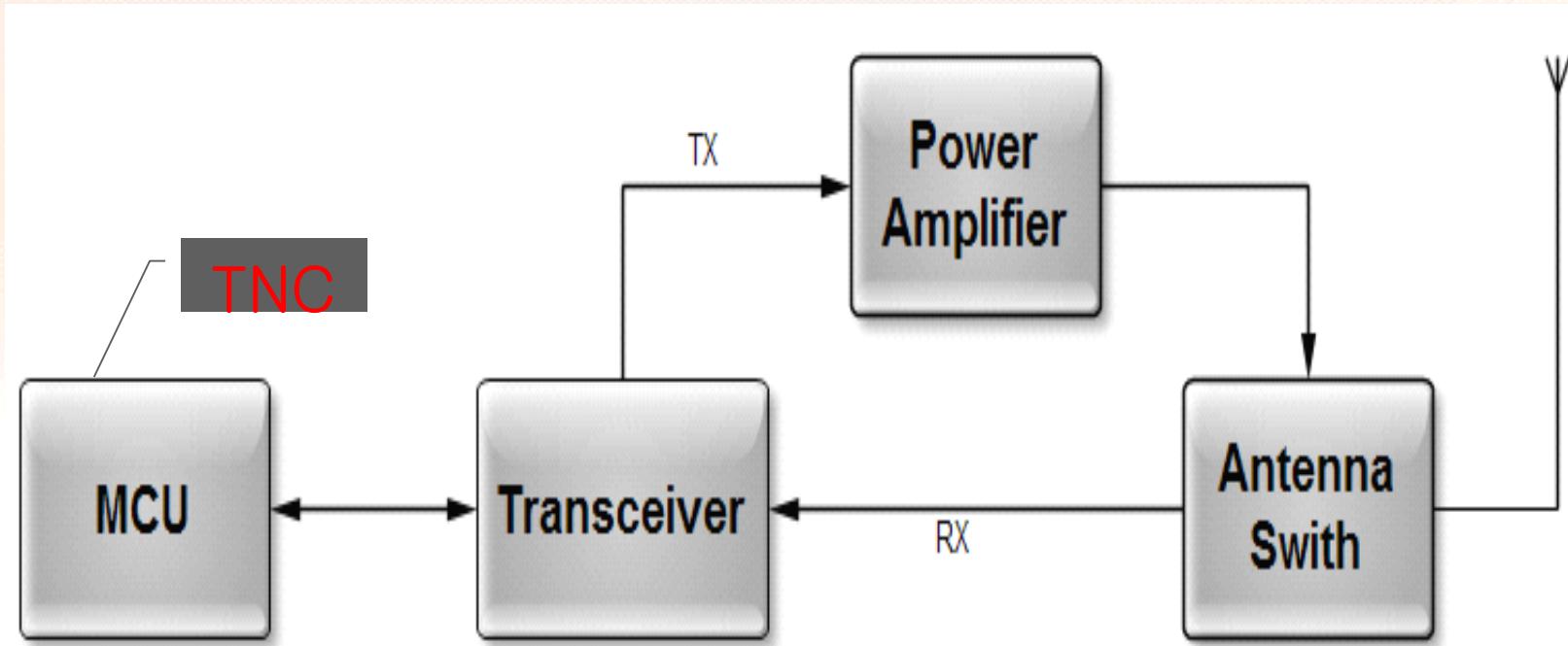
- Introduction
- Hardware Development
- Software Development
- Realization and Test
- Conclusion

# *Introduction*

- AraMiS project
  - Modular Architecture for Satellite
  - Evolution of PiCPoT
- RF communication system
  - S band (2.4GHz)
  - ***UHF band (437MHz)***
- Design Specifications (UHF)  
small size, low weight, low power, half-duplex,  
9600 baud, compatible with amateur radio

# *Introduction*

- UHF System Structure



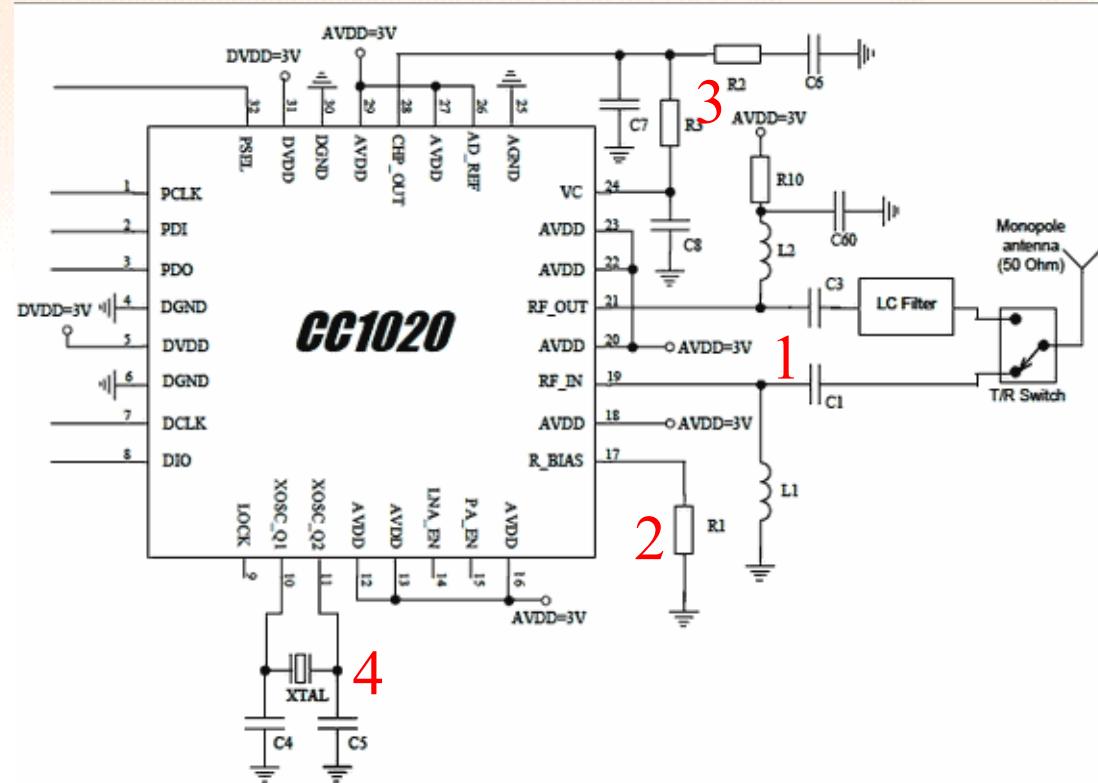
Through microcontroller programming, realize the functionality of a TNC!

# Hardware Development

## ■ Devices Selection →

MCU	MSP430F149
Transceiver	CC1020
PA	RF2175

## ■ Main Circuit

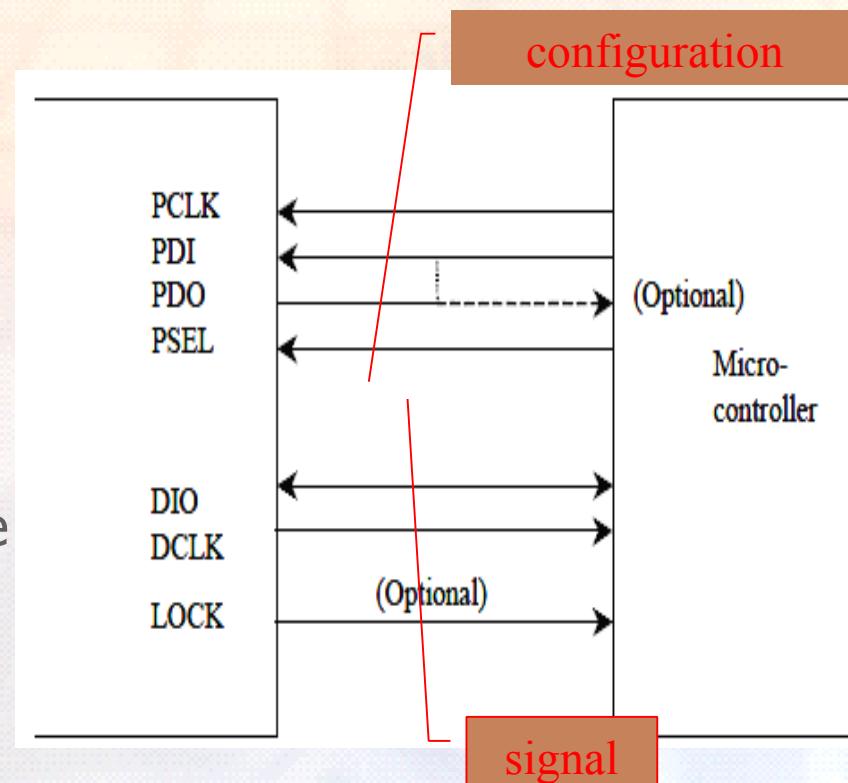


External components

- ① Input/output matching
- ② Bias resistor
- ③ PLL loop filter
- ④ Crystal
- ⑤ Decoupling and filtering capacitors

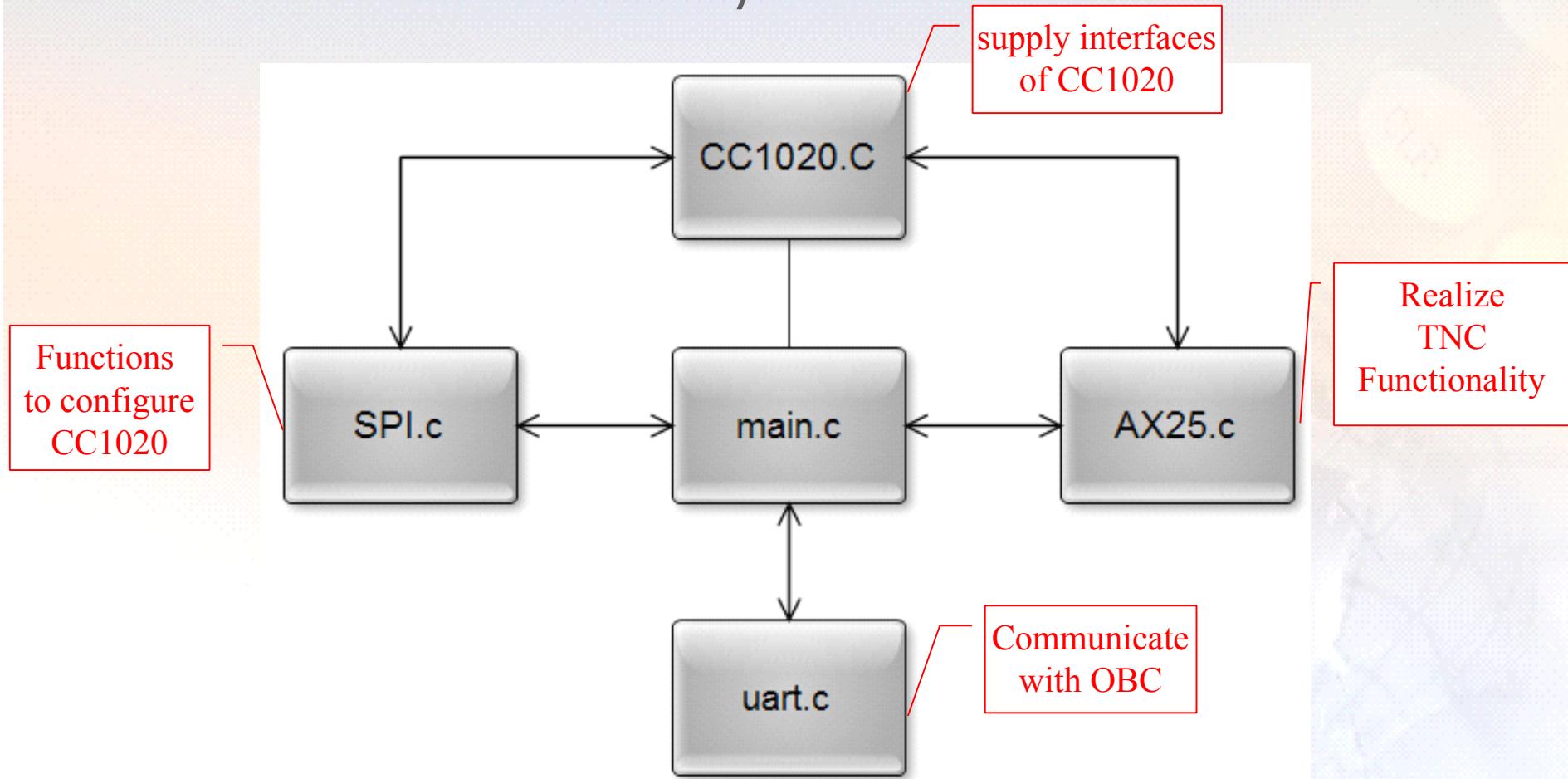
# *Hardware Development*

- Interface
  - MCU and OBC (On-Board-Computer)
    - USART0 of MCU works in UART mode as a serial bus
  - MCU and CC1020
    - 1.Configuration
      - 3-wire SPI bus
    - 2.Signal
      - MCU is the Slave
      - Tx: USART1 in SPI mode
      - Rx: basic I/O function



# *Software Development*

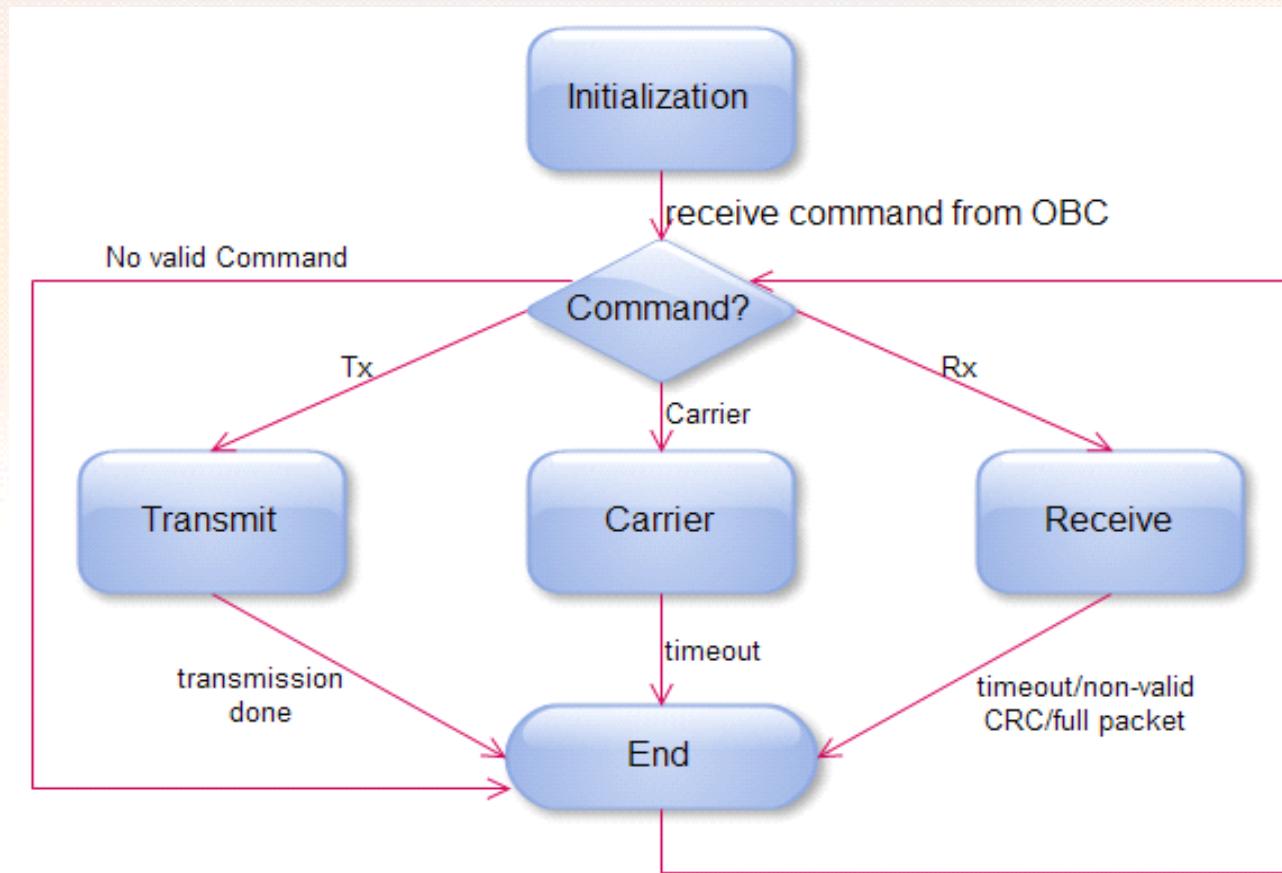
- Software Functionality Modules



! AX25.c realized the TNC functionality

# *Software Development*

## MCU main processing loop (main.c)



# *Software Development*

## TNC Functionality (AX25.C)

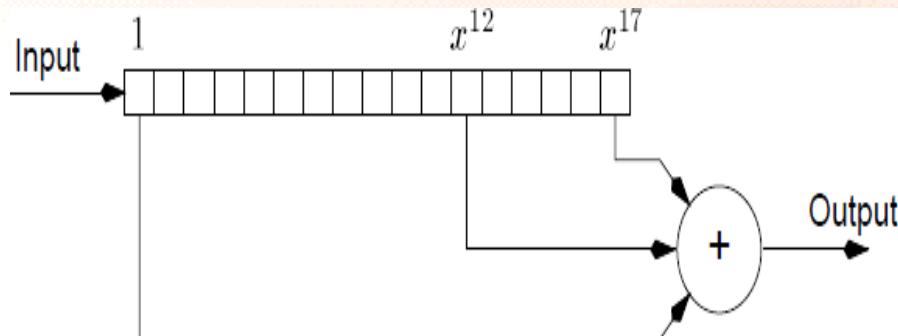
- AX.25 protocol
  - designed for amateur radio

Flag	Address	Control	PID	Info	FCS	Flag
01111110	112/224 Bits	8/16 Bits	8 Bits	N*8 Bits	16 Bits	01111110

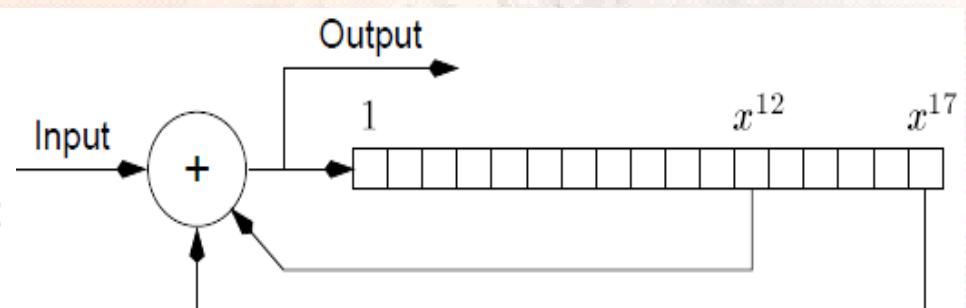
- HDLC (High-Level Datalink Control)
  - NRZI encoding
  - Bit stuffing
  - Frame Delimiting

# *Software Development*

- Polynomial scrambling/descrambling  
(G3RUH standard)
  - standard 9600 baud modem,  $1+x^{12}+x^{17}$
  - built with logic shift registers and exclusive-OR gate



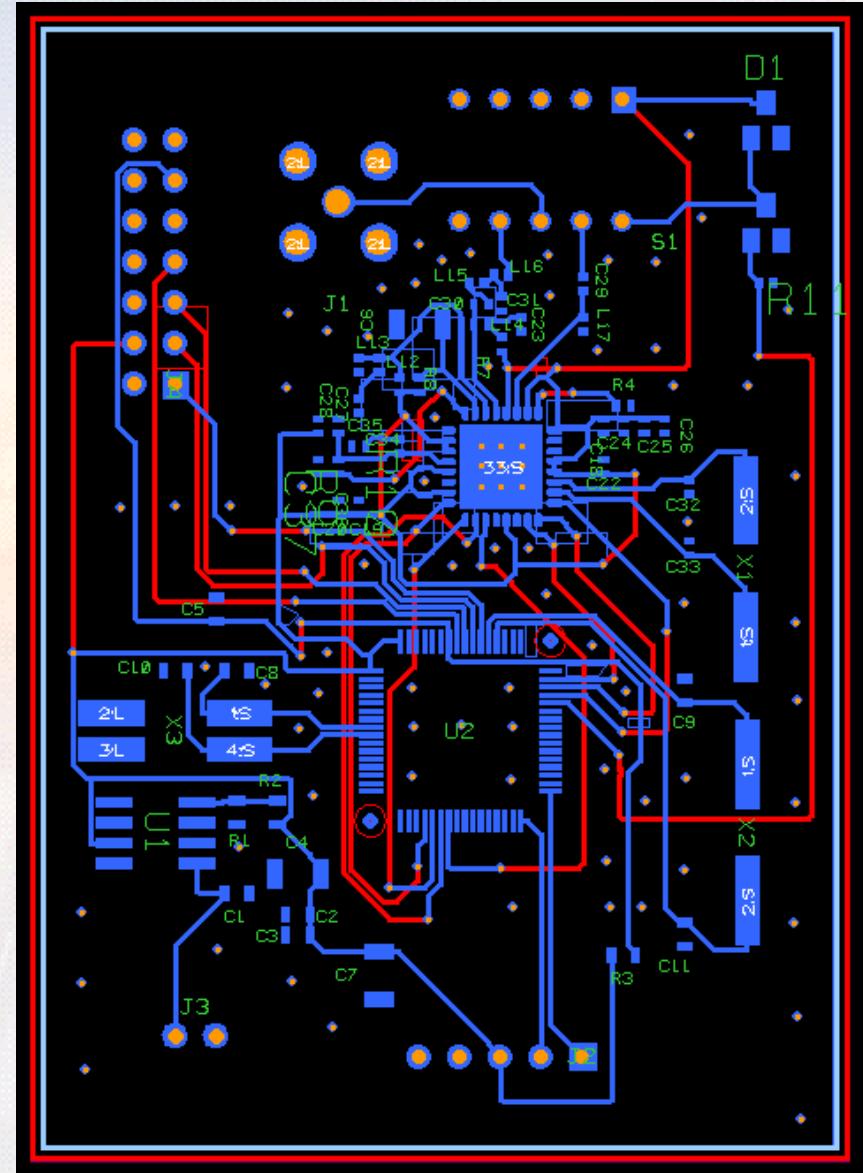
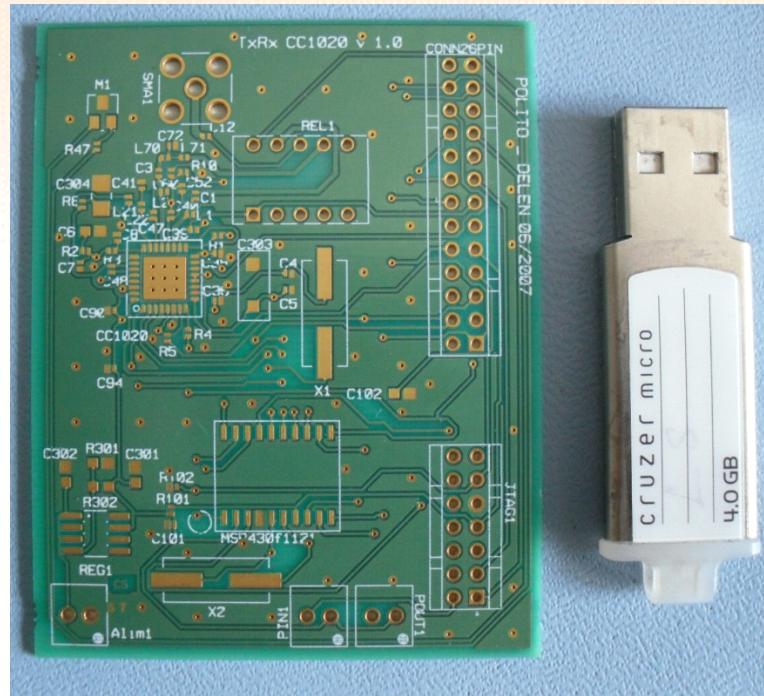
scrambler



descrambler

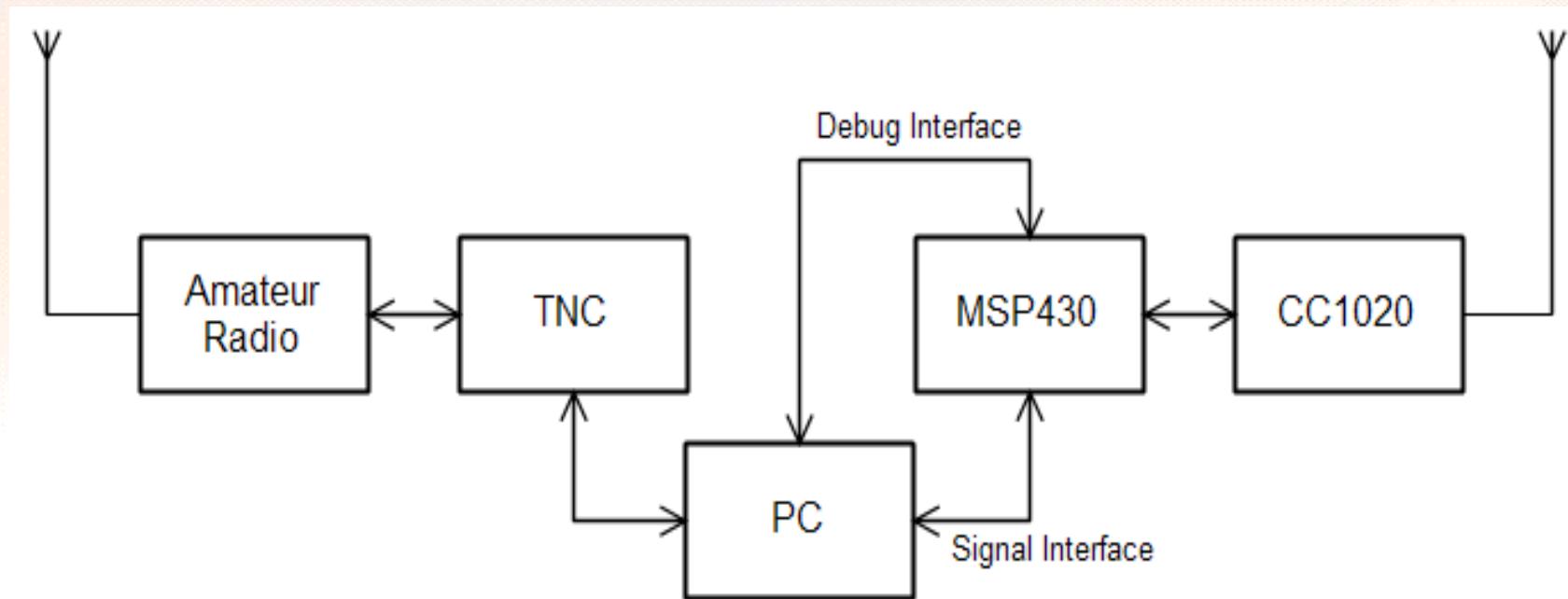
# *Realization & Test*

- Software Tool
  - Mentor Graphics
- PCB realization



# *Realization & Test*

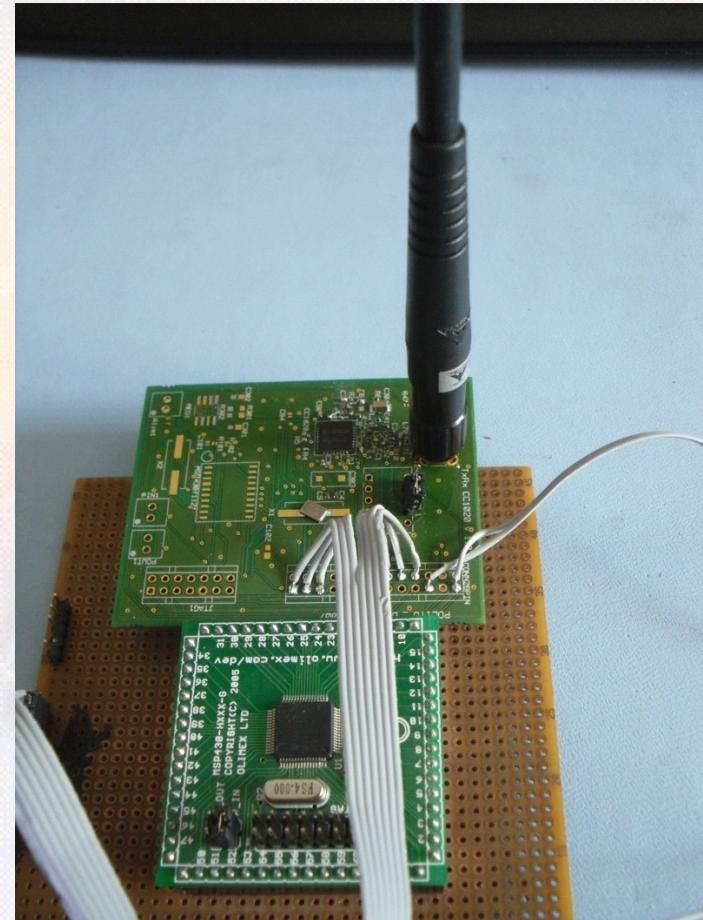
- Experiment



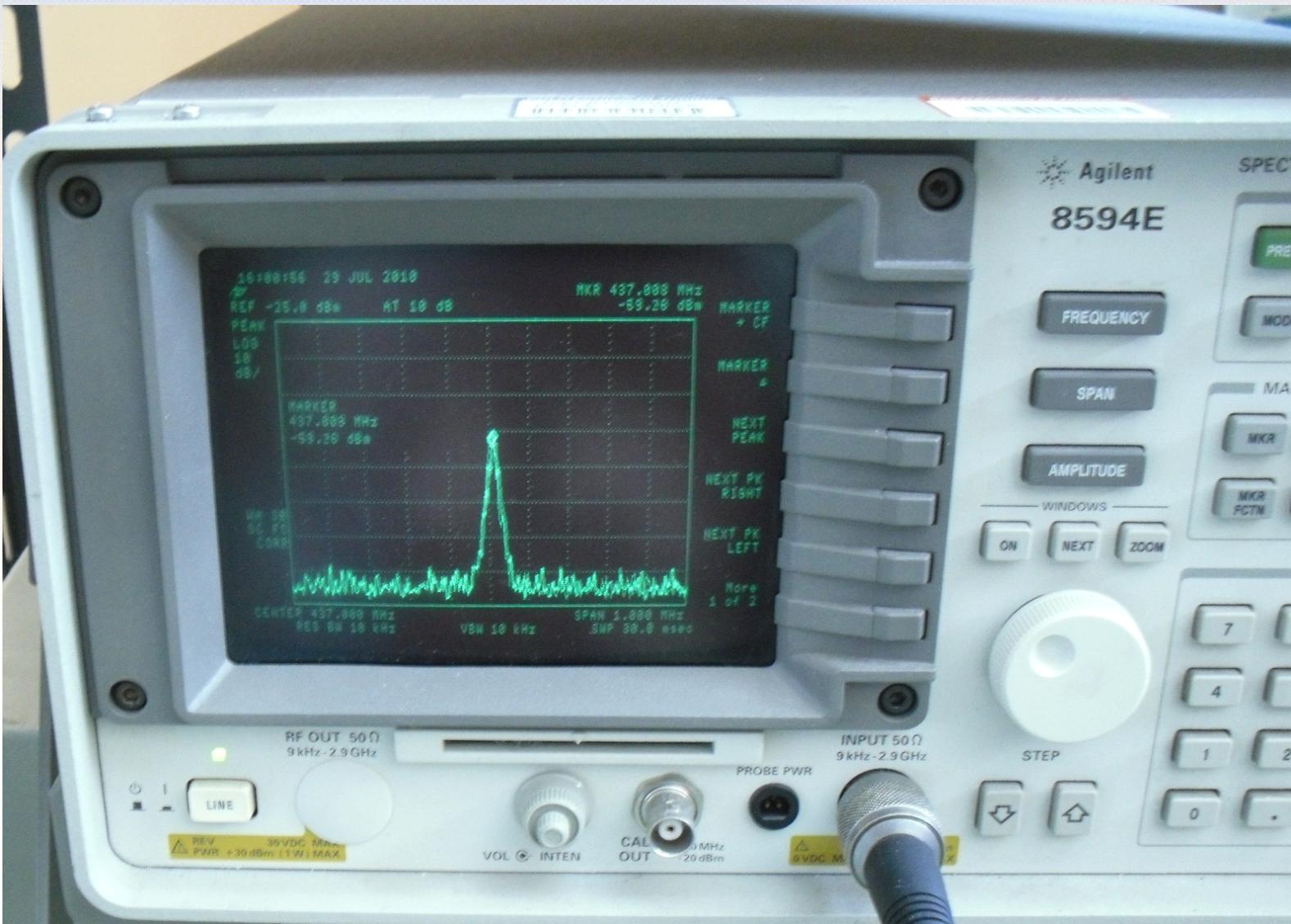
construction

# *Realization & Test*

- Test Environment
  - Hardware

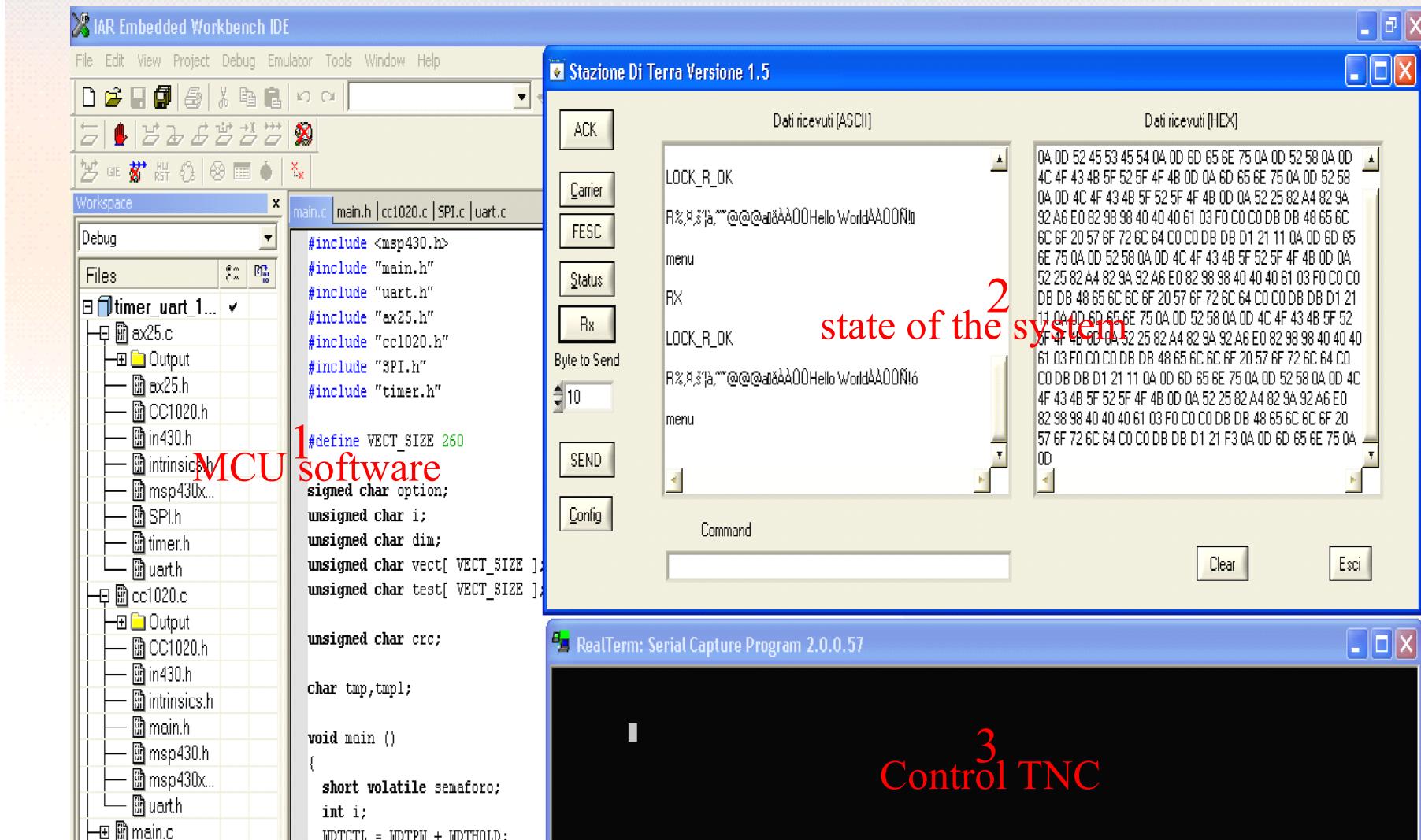


# *Realization & Test*



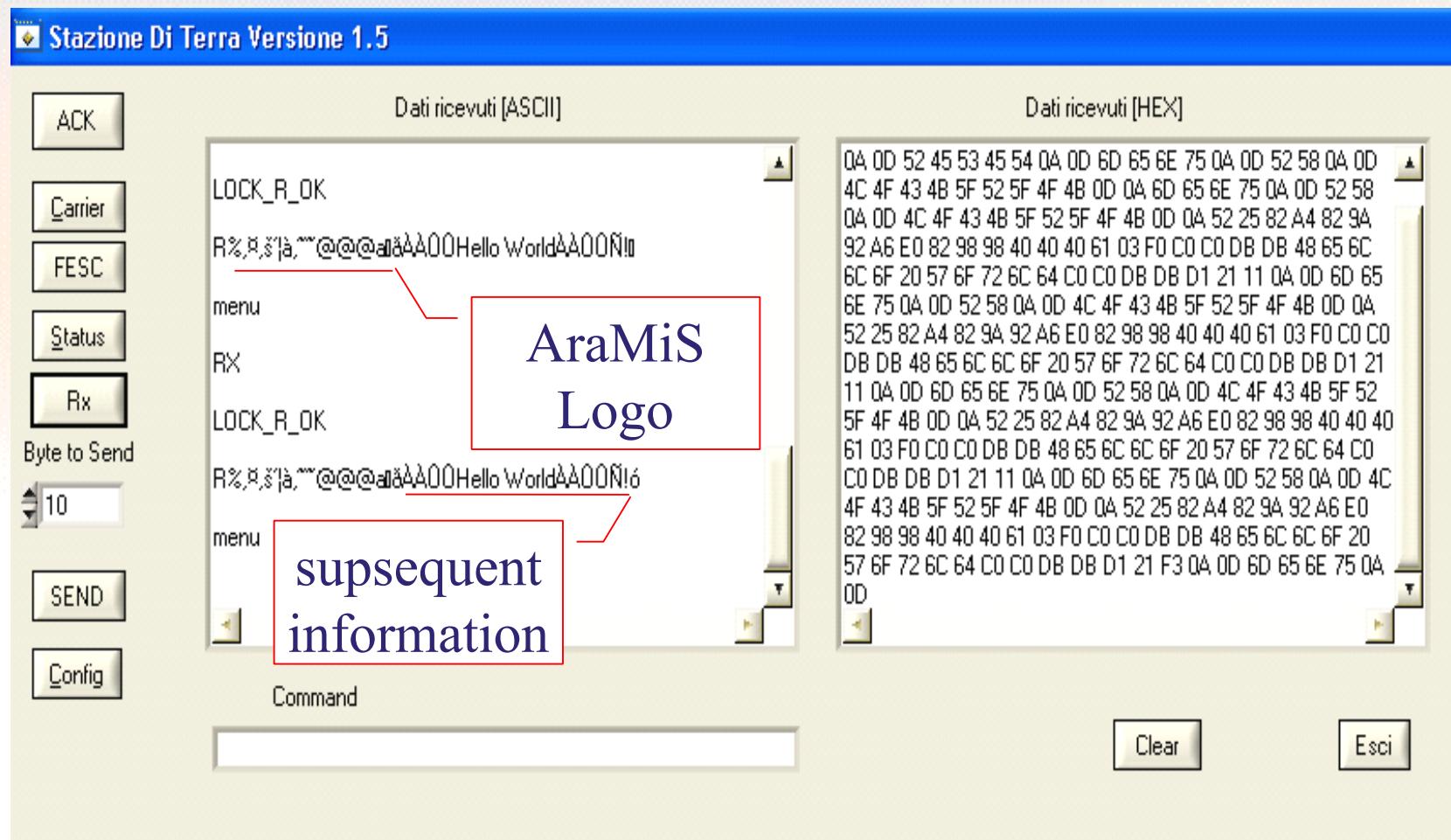
# Realization & Test

## ■ Software

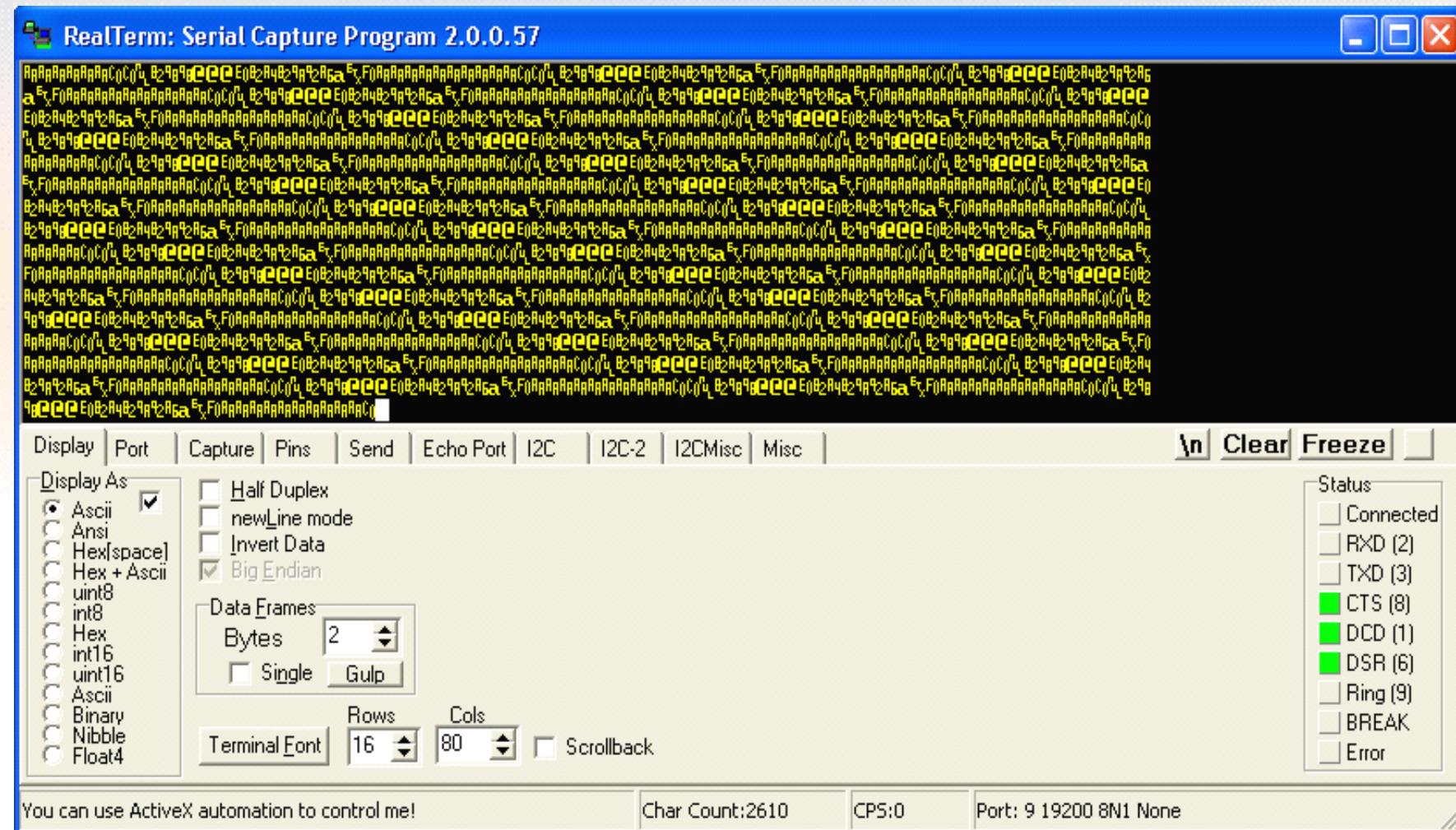


# Realization & Test

## ■ Result



# Realization & Test



# *Conclusion*

- Realization

*This project has developed a small size, low weight, low power and amateur radio compatible UHF communication system with 9600 baud data rate.*

- Future Work

- Long range test
- Reliability test in radiation environment



Thank you for your attention!