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DesignNews

Constructing a Raspberry Pi RP2040 Low-Power Sensor Node

Day 4:

Data Radio Rodeo

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Fred Eady

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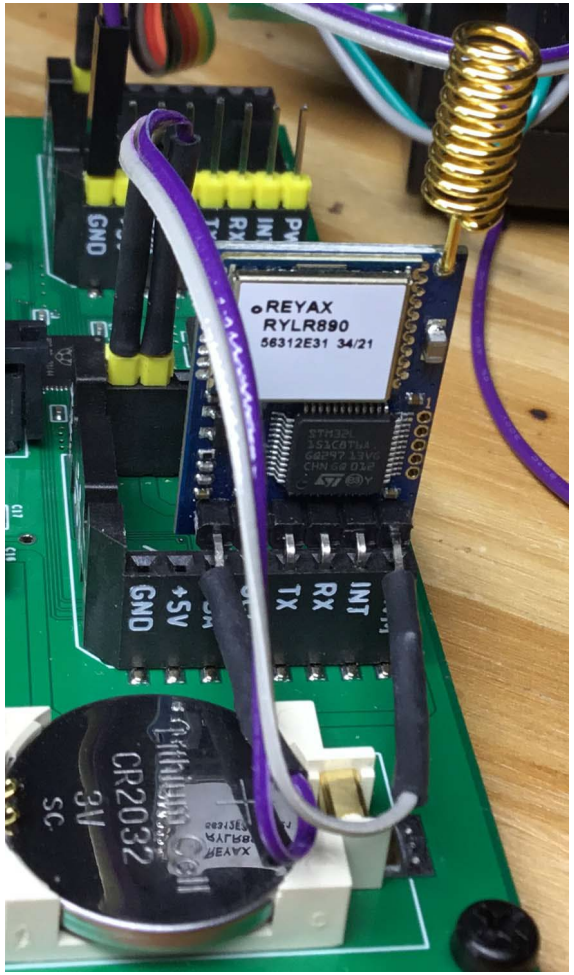
AGENDA

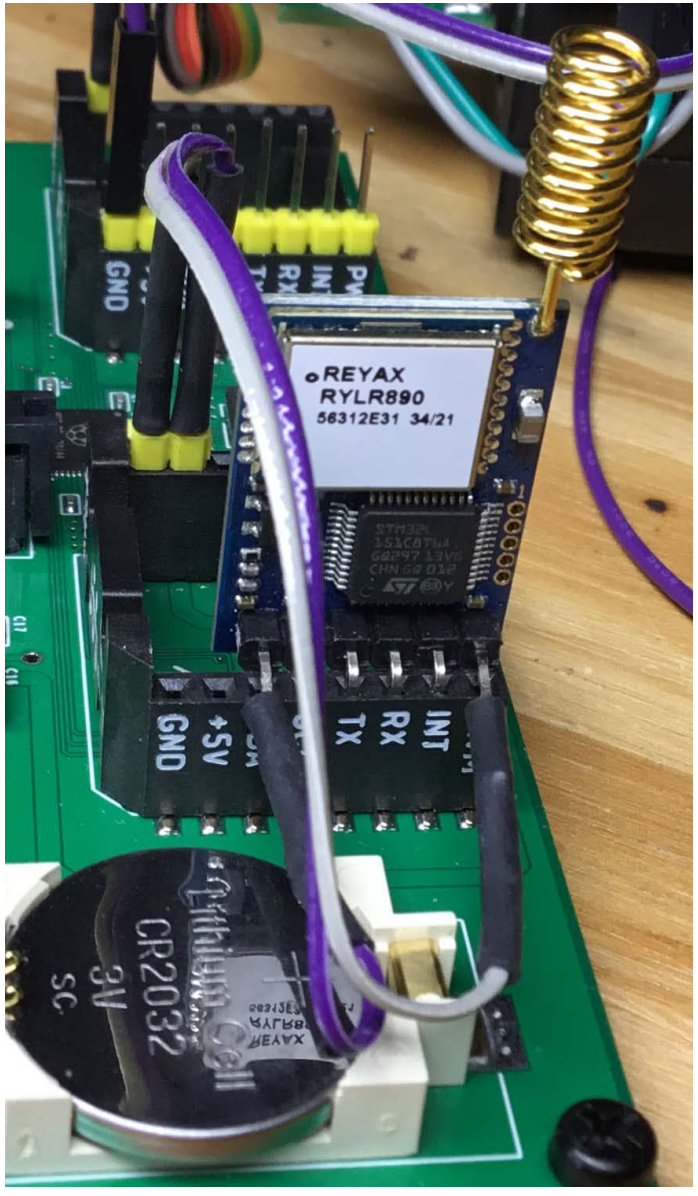
- LORA
- XBee



REYAX RYLR896 – CMakeLists.txt

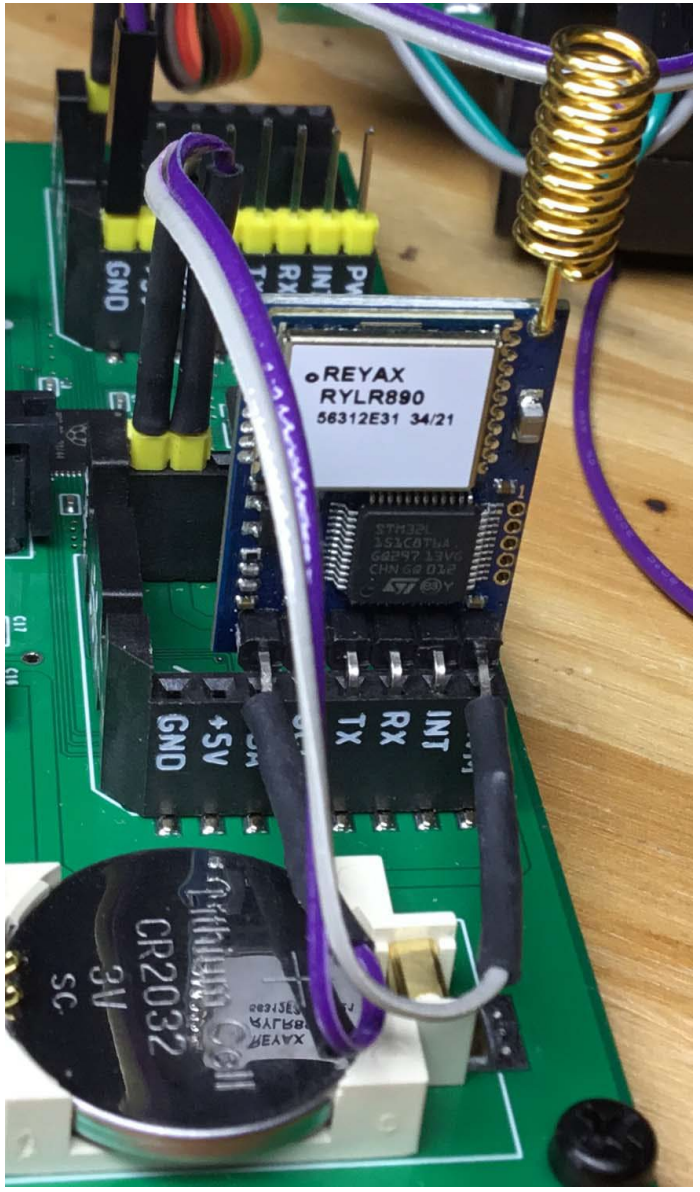
CMakeLists.txt

```
# Set minimum required version of CMake
cmake_minimum_required(VERSION 3.12)

# Include build functions from Pico SDK
include($ENV{PICO_SDK_PATH}/external/pico_sdk_import.cmake)

# Set name of project (as PROJECT_NAME) and C/C++ standards
project(reyax C CXX ASM)
set(CMAKE_C_STANDARD 11)
set(CMAKE_CXX_STANDARD 17)

# Creates a pico-sdk subdirectory in our project for the libraries
pico_sdk_init()

# Tell CMake where to find the executable source file
add_executable(${PROJECT_NAME}
    uart_advanced.c
)

# Create map/bin/hex/uf2 files
pico_add_extra_outputs(${PROJECT_NAME})

# Link to pico_stdlib (gpio, time, etc. functions)
target_link_libraries(${PROJECT_NAME}
    pico_stdlib
    hardware_gpio
    hardware_uart
    hardware_irq
)

# Enable usb output, enable uart output
pico_enable_stdio_usb(${PROJECT_NAME} 0)
pico_enable_stdio_uart(${PROJECT_NAME} 1)
```



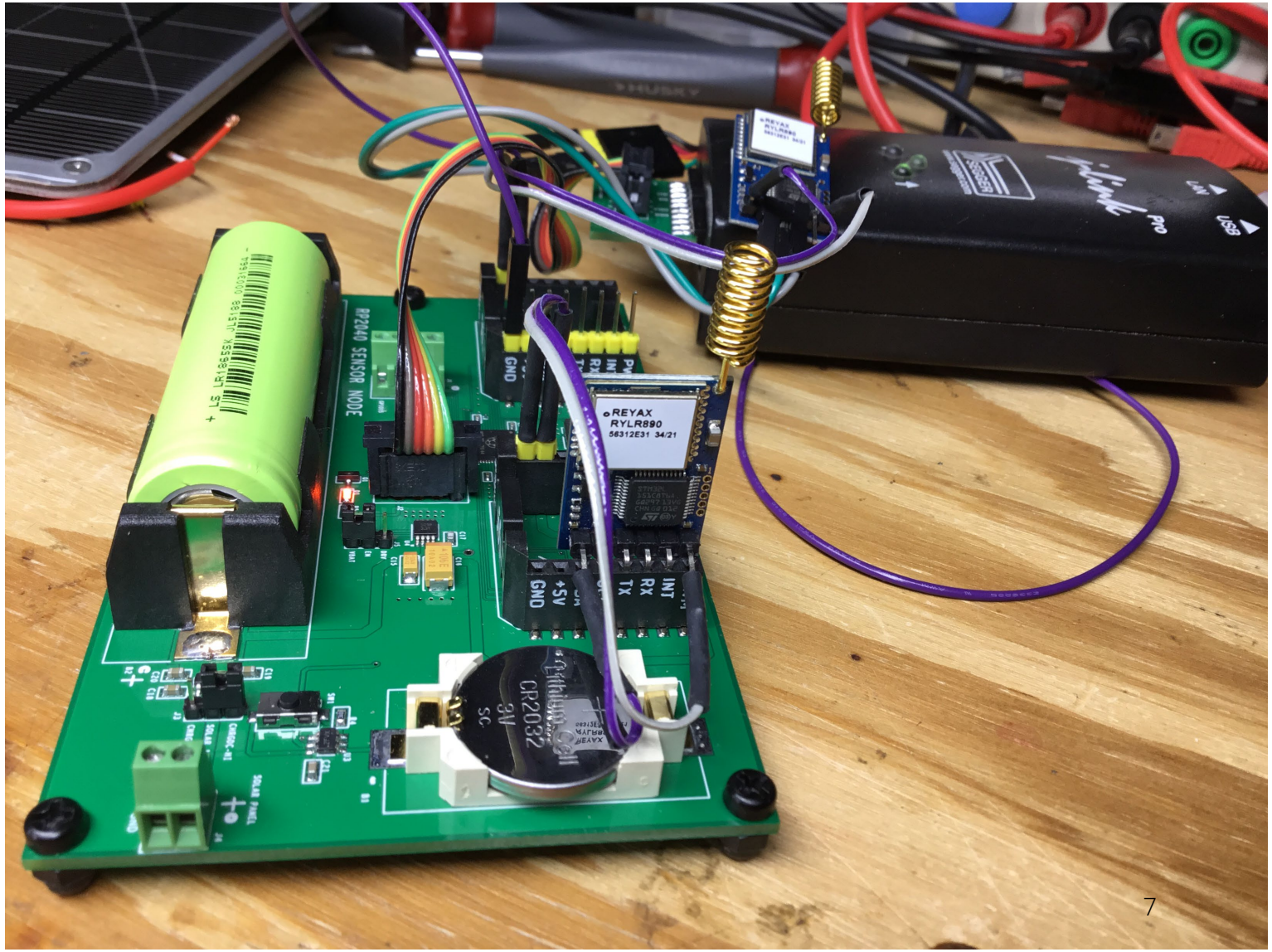
REYAX RYLR896 – Interrupt Handler, Variables and GPIO Pin Assignments

```
5   // Application States
6   enum
7   {
8       wait4ready,
9       sendAT,
10      sendMsg
11  };
12  // Serial Input/Output Monitor Pins
13  // REYAX Receiver Pins
14  #define UART0_TX_PIN    0
15  #define UART0_RX_PIN    1
16  // REYAX Transmitter Pins
17  #define UART1_TX_PIN    20
18  #define UART1_RX_PIN    21
19  // REYAX Reset Pin
20  #define NRST1_PIN       25
21  // Sensor Node LED Pin
22  #define LED_PIN         17
23  // DONE Pin
24  #define DONE_PIN        16
25
26  uint8_t rxBuf_1[16];    // uart1 RX buffer
27  uint8_t indx_1;         // RX buffer index
28  uint8_t state;          // state machine variable
29
30  // RX interrupt handler
31  void uart1_rx_handler()
32  {
33      while (uart_is_readable(uart1))
34      {
35          rxBuf_1[indx_1++] = uart_getc(uart1);
36      }
37  }
```



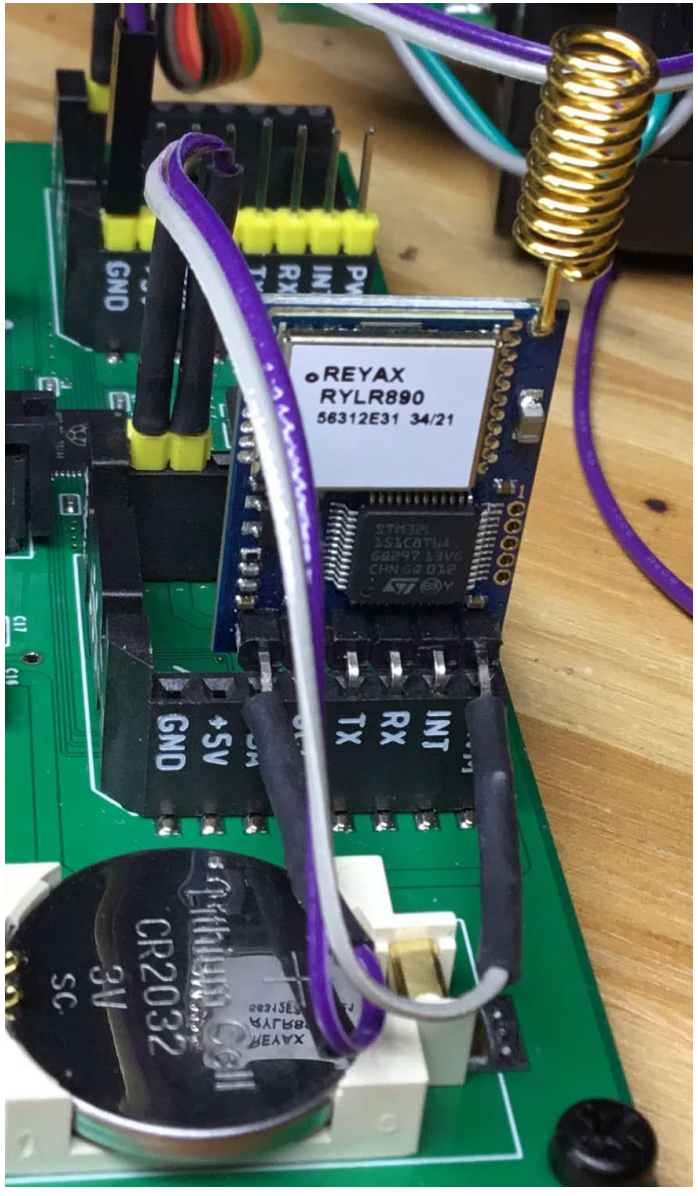
REYAX RYLR896 – GPIO Initialization

```
39  int main()
40  {
41      uint8_t i;
42
43      // GPIO Init
44      gpio_init(NRST1_PIN);
45      gpio_set_dir(NRST1_PIN, GPIO_OUT);
46      gpio_put(NRST1_PIN, false);
47
48      gpio_init(LED_PIN);
49      gpio_set_dir(LED_PIN, GPIO_OUT);
50      gpio_put(LED_PIN, false);
51
52      gpio_init(DONE_PIN);
53      gpio_set_dir(DONE_PIN, GPIO_OUT);
54      gpio_put(DONE_PIN, false);
```



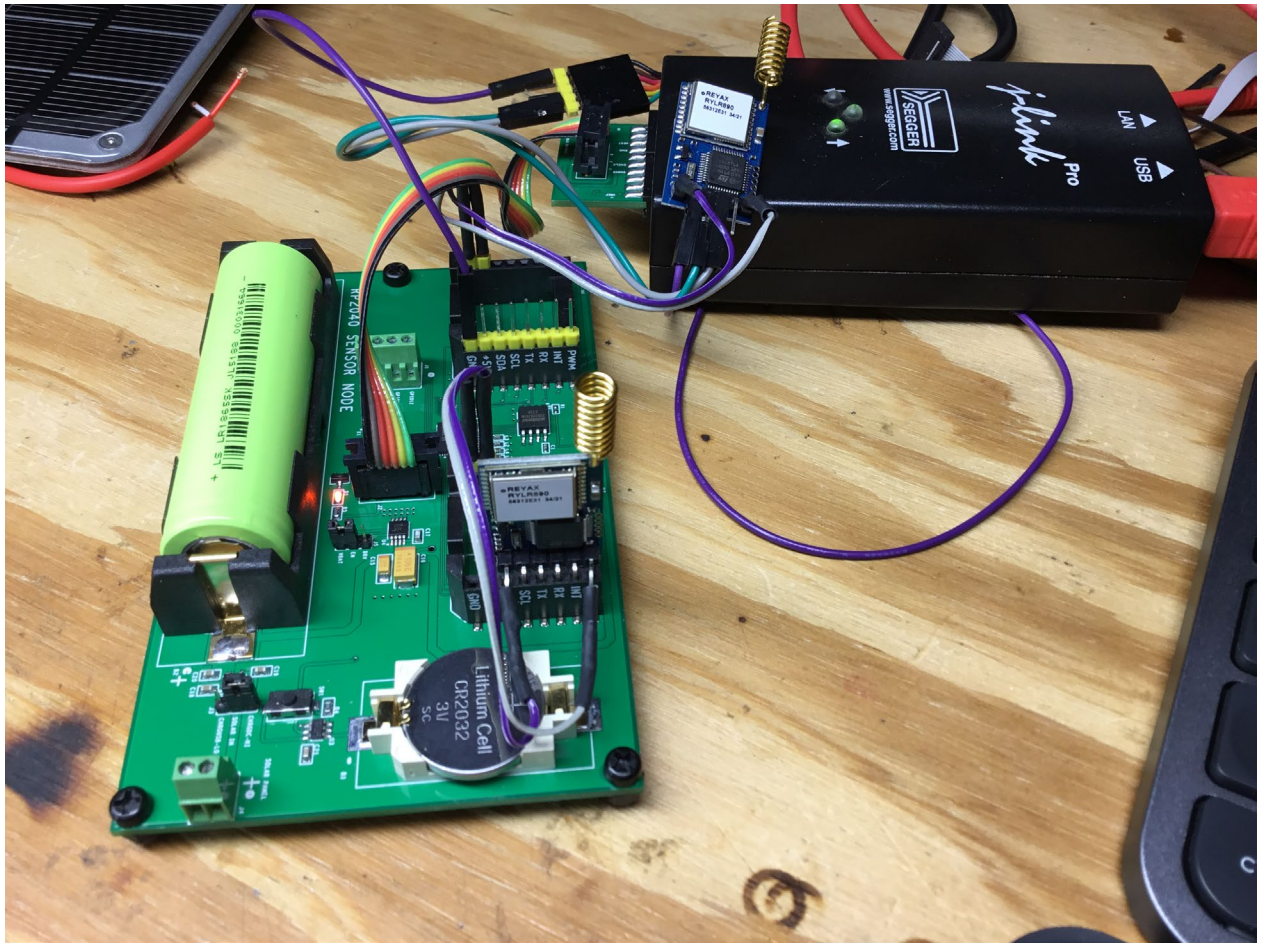
REYAX RYLR896 – UART Initialization

```
56      // UART Init
57      stdio_uart_init_full(uart0, 115200, UART0_TX_PIN, UART0_RX_PIN);
58      stdio_uart_init_full(uart1, 115200, UART1_TX_PIN, UART1_RX_PIN);
59
60      // Turn off FIFO
61      uart_set_fifo_enabled(uart1, false);
62
63      // Set up and enable the interrupt handler
64      irq_set_exclusive_handler(UART1_IRQ, uart1_rx_handler);
65      irq_set_enabled(UART1_IRQ, true);
66
67      // Enable the UART RX interrupt
68      uart_set_irq_enables(uart1, true, false);
```



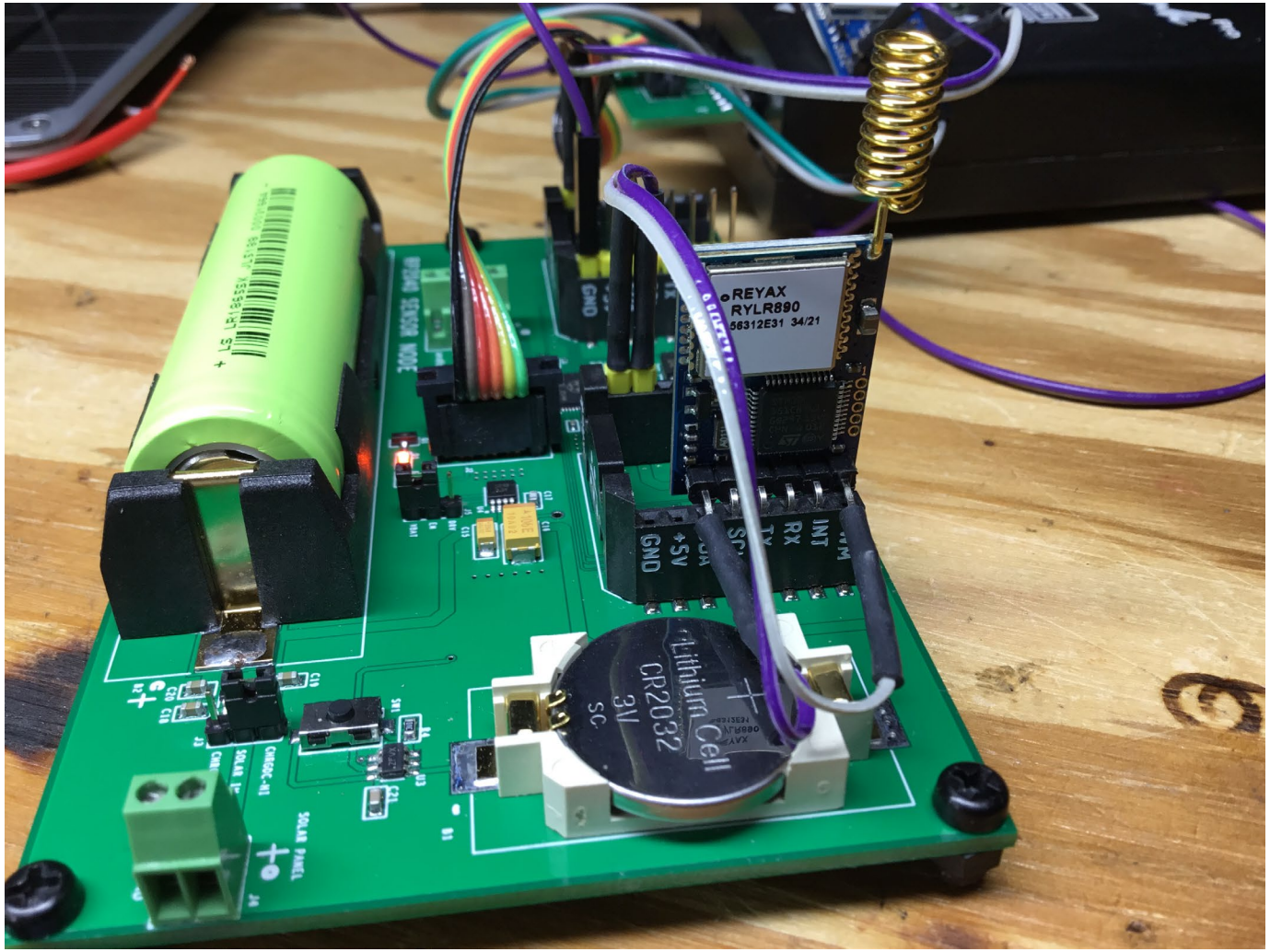
REYAX RYLR896 – Lift Reset Pin and Begin

```
70      // Init state machine variable and init RX buffer index
71      state = wait4ready;
72      indx_1 = 0;
73      // Pull REYAX out of reset
74      sleep_ms(100);
75       gpio_put(NRST1_PIN, true);
```



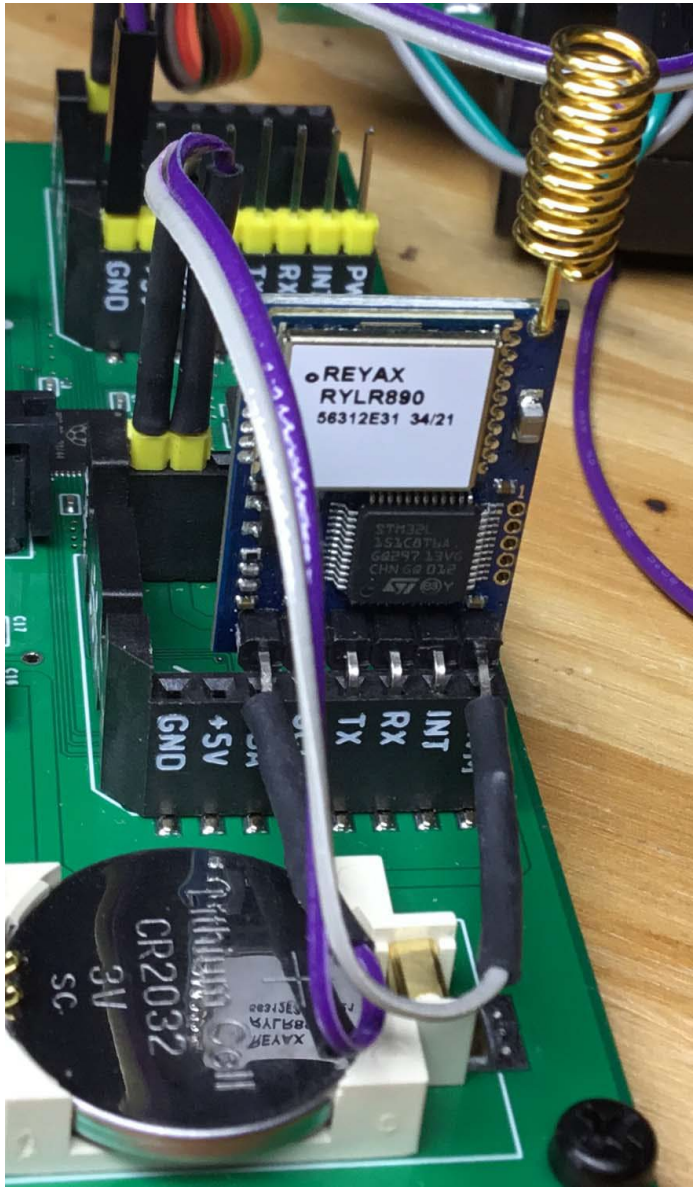
REYAX RYLR896 – wait4ready

```
77      while (1)
78      {
79          switch(state)
80          {
81              // Look for +READY from the REYAX and discard it
82              case wait4ready:
83                  if(indx_1 > 0)
84                  {
85                      sleep_ms(100);
86                      // DEBUG MONITOR
87                      for(i=0;i<indx_1;i++)
88                      {
89                          uart_putc(uart0, rxBuf_1[i]);
90                      }
91                      // DEBUG MONITOR END
92                      indx_1 = 0;
93                      state = sendAT;
94                  }
95              break;
```



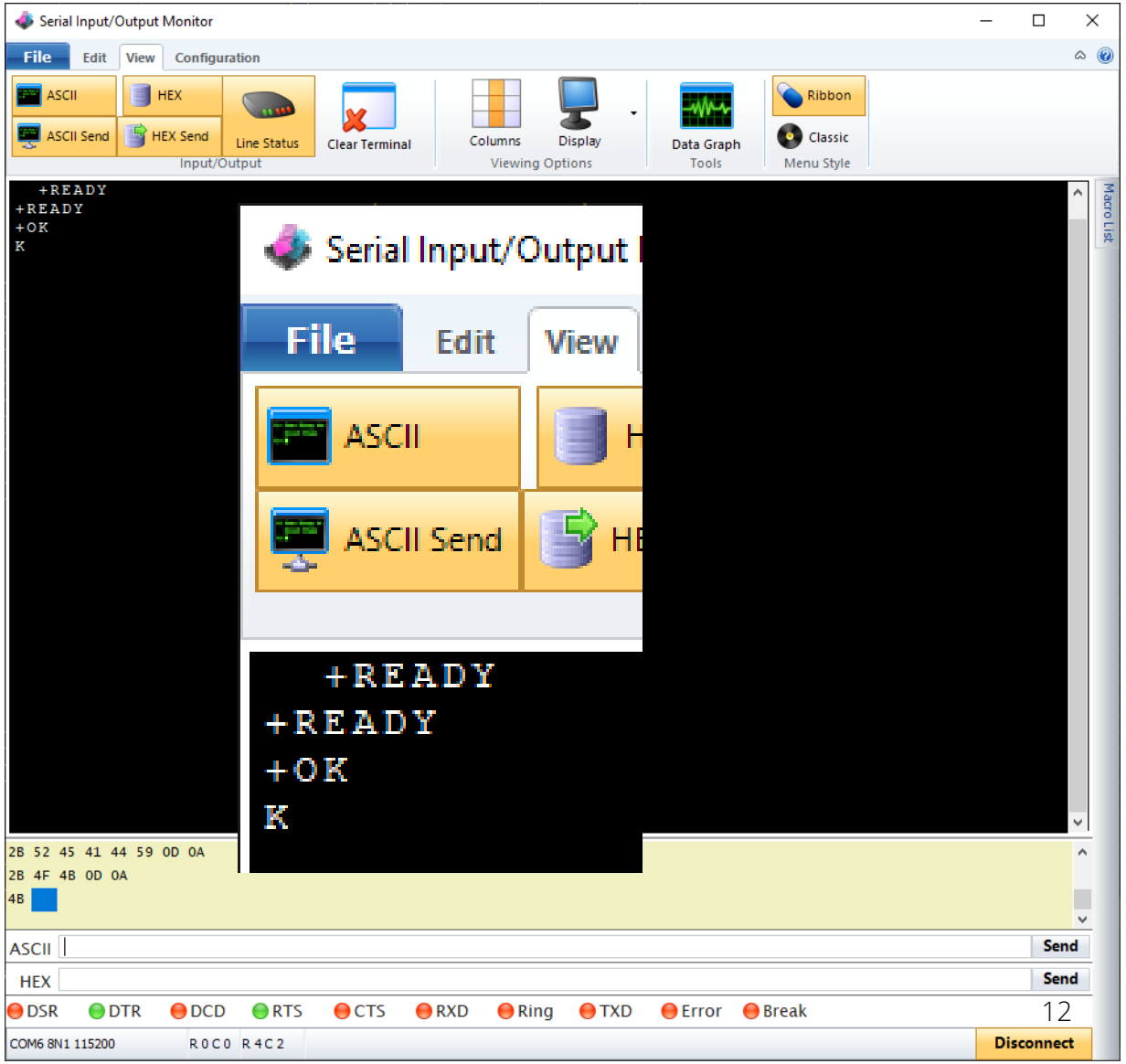
REYAX RYLR896 - sendAT

```
96          // Send AT command
97          case sendAT:
98              uart_puts(uart1, "AT\r\n");
99              while(indx_1 == 0);
100             sleep_ms(100);
101             // DEBUG MONITOR START
102             for(i=0;i<indx_1;i++)
103             {
104                 uart_putc(uart0, rxBuf_1[i]);
105             }
106             // DEBUG MONITOR END
107             if(rxBuf_1[indx_1-3] == 'K')
108             {
109                 // DEBUG MONITOR START
110                 uart_putc(uart0, rxBuf_1[indx_1 - 3]);
111                 // DEBUT MONITOR END
112                 indx_1 = 0;
113                 state = sendMsg;
114             }
115         break;
```



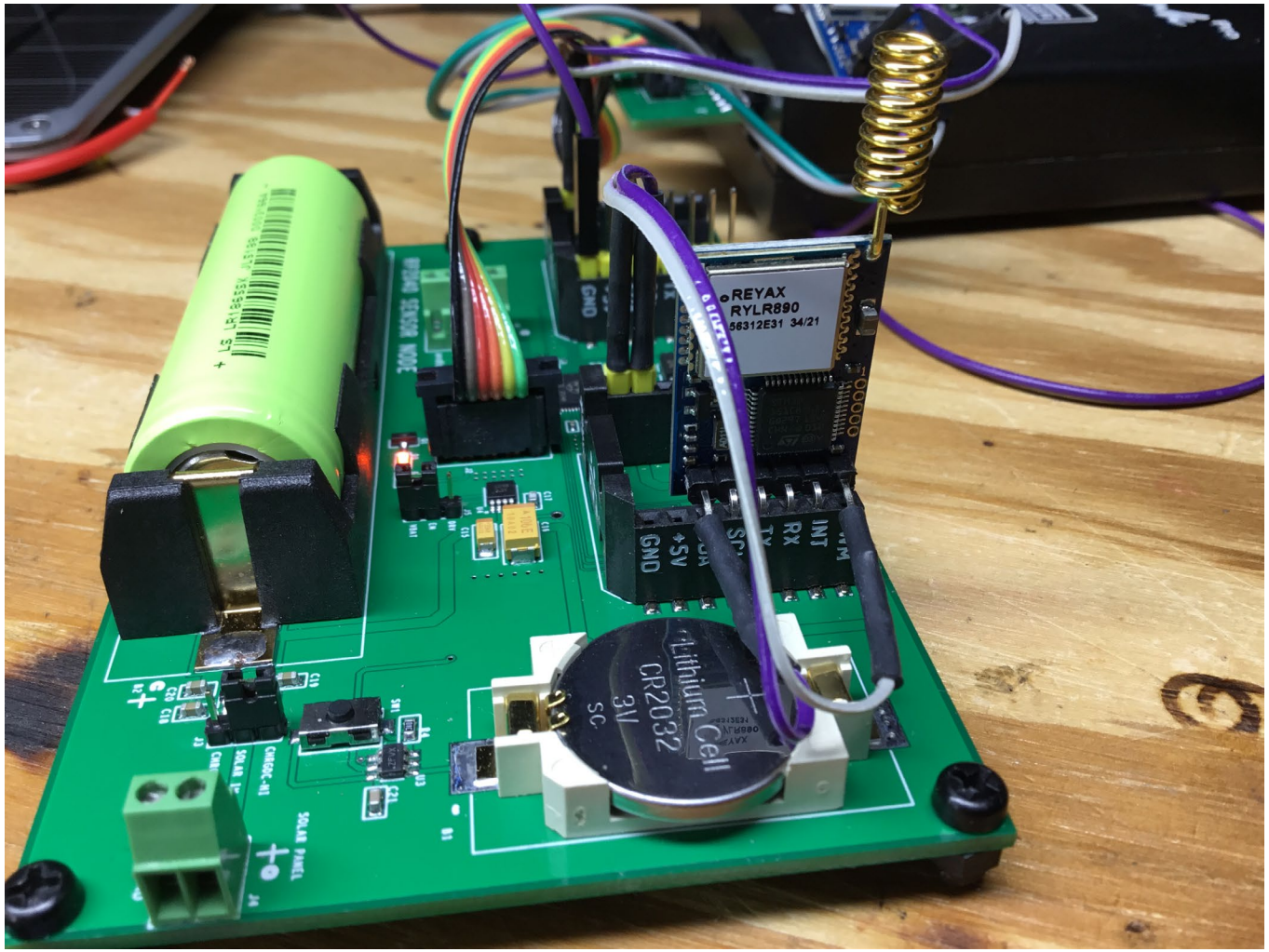
REYAX RYLR896 - sendAT

```
96          // Send AT command
97          case sendAT:
98              uart_puts(uart1, "AT\r\n");
99              while(indx_1 == 0);
100             sleep_ms(100);
101             // DEBUG MONITOR START
102             for(i=0;i<indx_1;i++)
103             {
104                 uart_putc(uart0, rxBuf_1[i]);
105             }
106             // DEBUG MONITOR END
107             if(rxBuf_1[indx_1-3] == 'K')
108             {
109                 // DEBUG MONITOR START
110                 uart_putc(uart0, rxBuf_1[indx_1 - 3]);
111                 // DEBUT MONITOR END
112                 indx_1 = 0;
113                 state = sendMsg;
114             }
115         break;
```

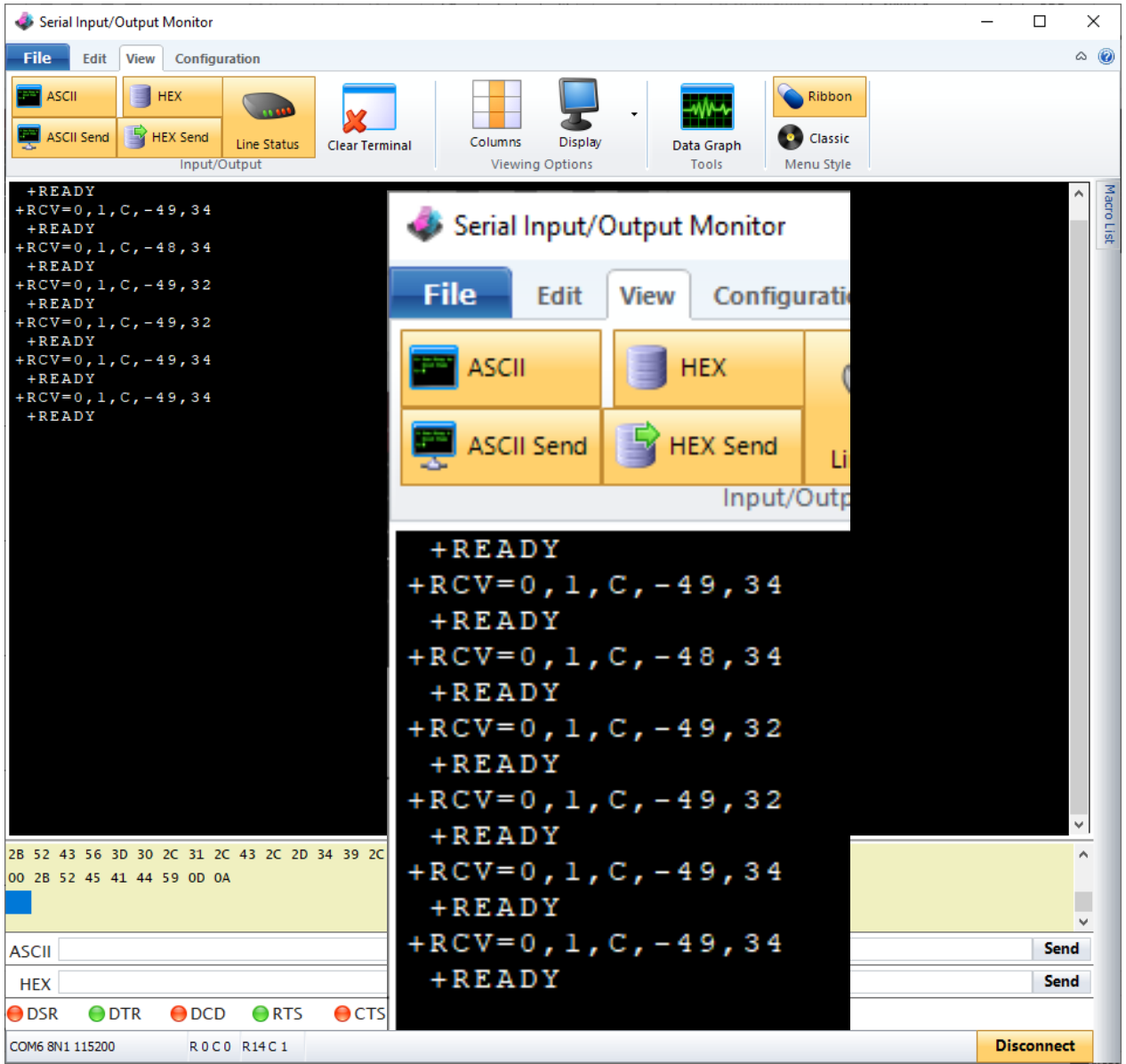


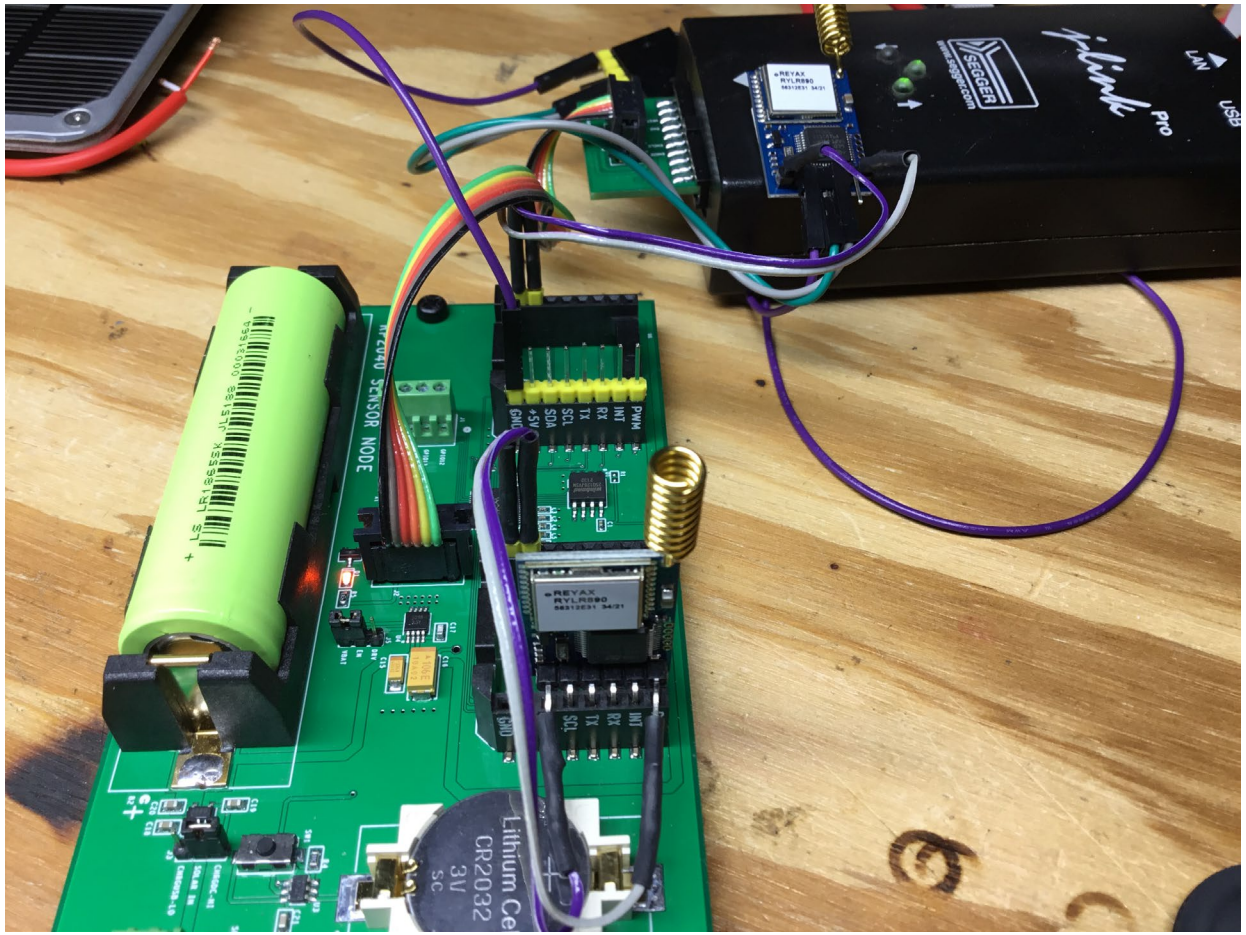
REYAX RYLR896 - sendMsg

```
117                 case sendMsg:
118
119                     uart_puts(uart1, "AT+SEND=0,1,C\r\n");
120                     // DEBUG MONITOR START
121                     gpio_put(LED_PIN, true);
122                     // DEBUG MONITOR END
123                     sleep_ms(900);
124                     gpio_put(DONE_PIN, true);
125                     while(1);
126                 break;
127             }
128         }
129     }
130
```



Low-Power REYAX RYLR896 Communications





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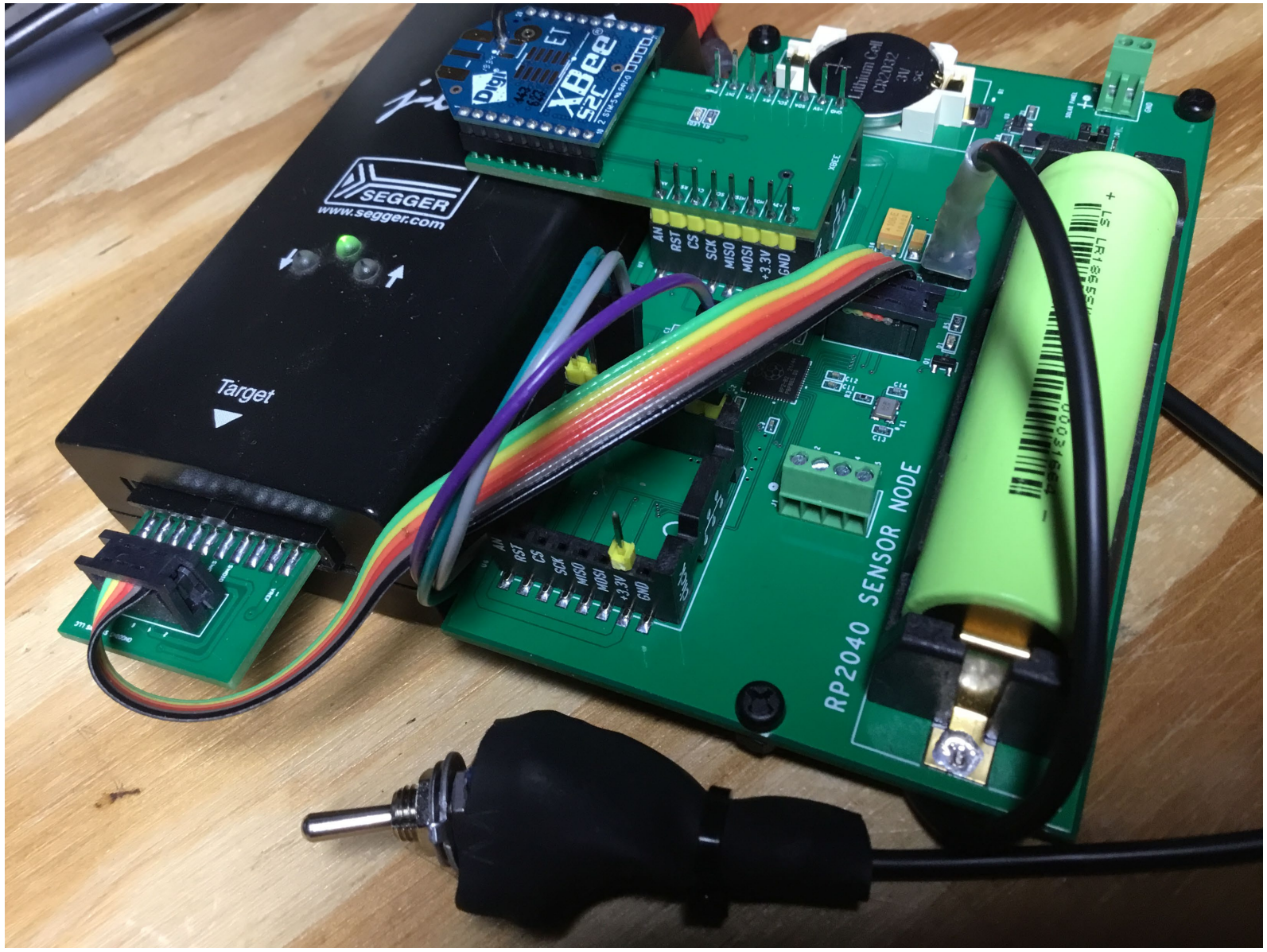
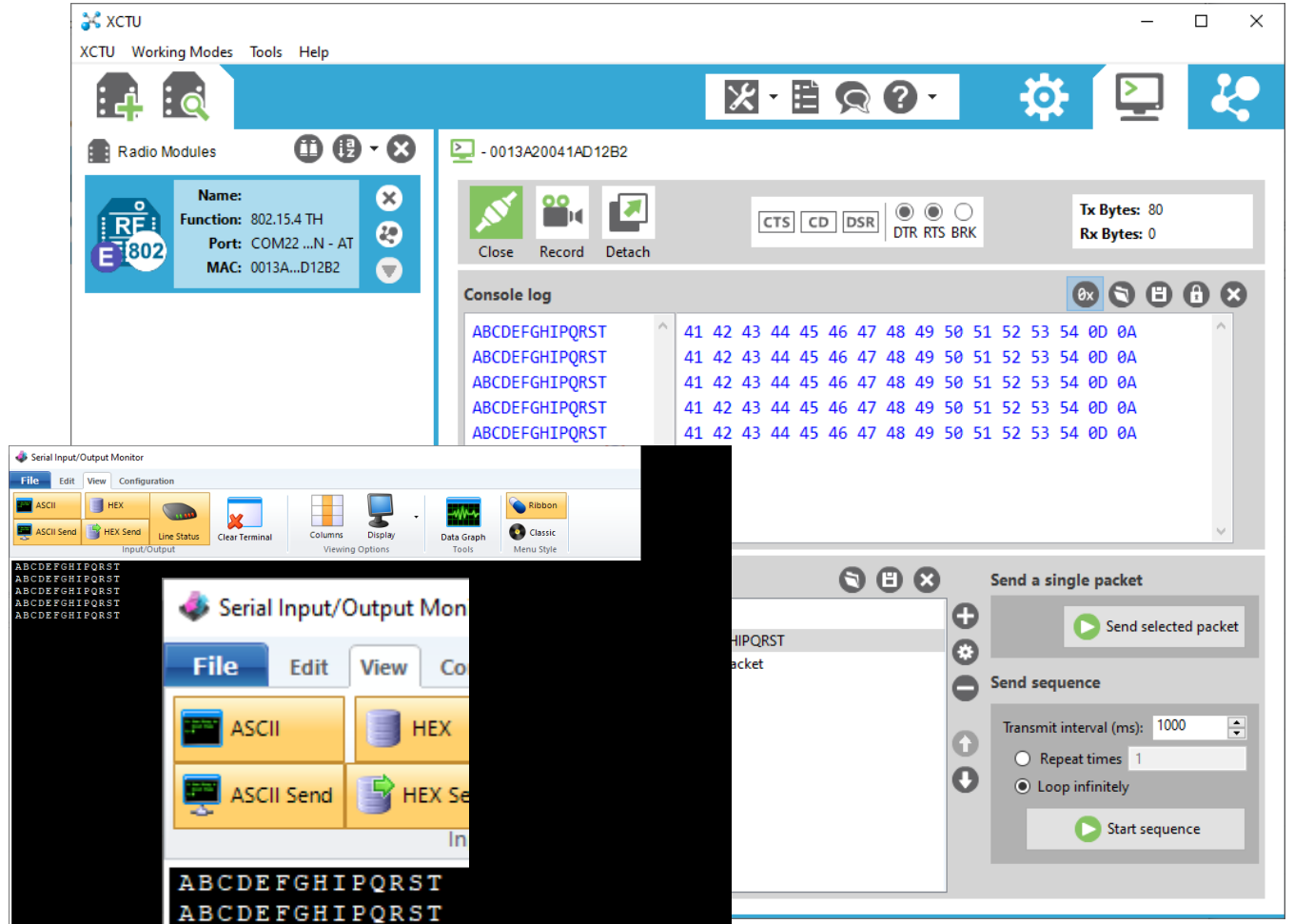
Run/Low-Power Test Setup



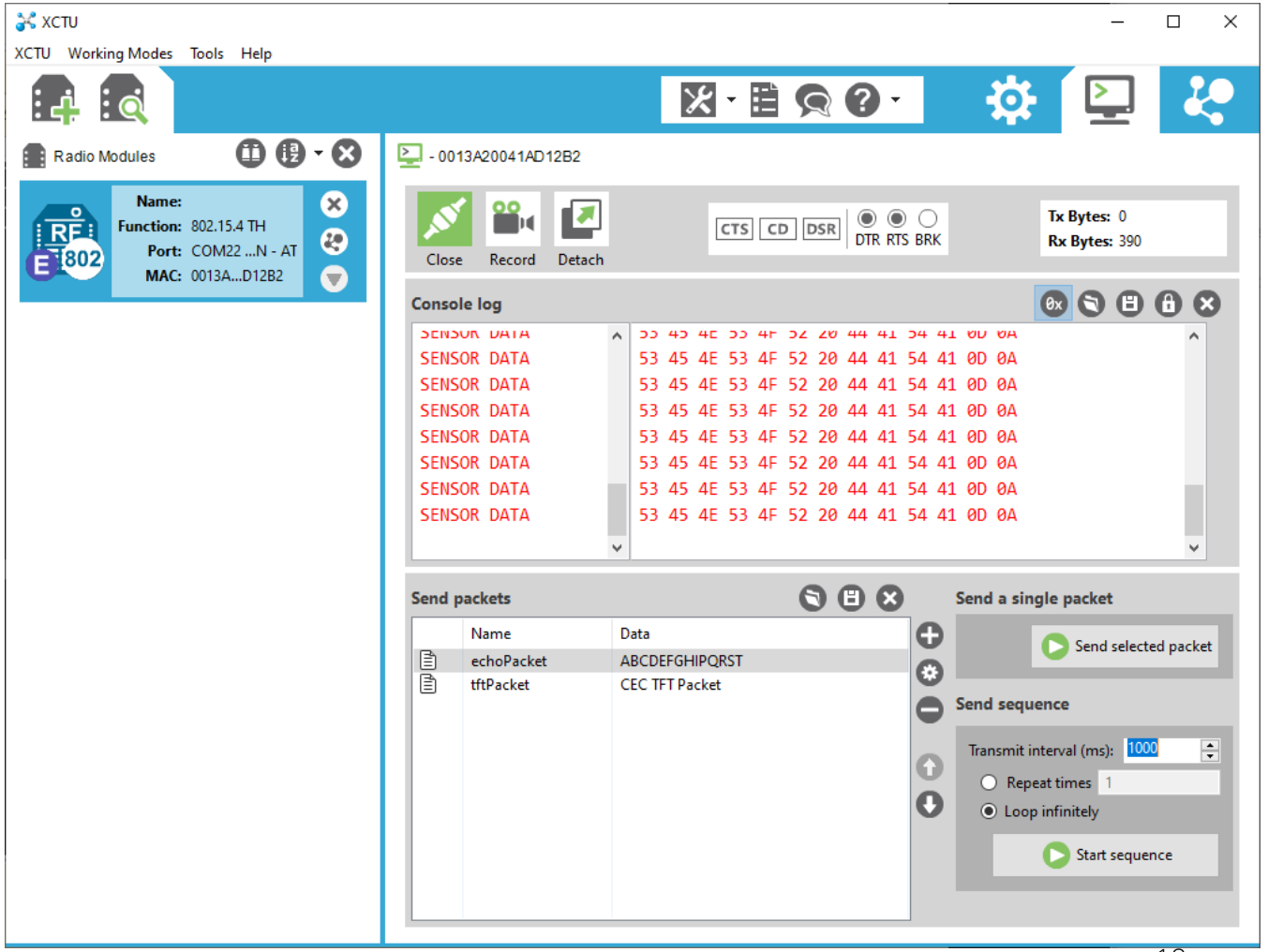
UART1 Receive Interrupt Test

```
69      // Init state machine variable and init RX buffer index
70      state = wait4ready;
71      indx_1 = 0;
72      // Pull XBee out of reset
73      sleep_ms(1000);
74       gpio_put(NRST1_PIN, true);
75      while (1)
76      {
77          switch(state)
78          {
79              // Look for traffic from the XBee
80              case wait4ready:
81                  if(indx_1 > 0)
82                  {
83                      sleep_ms(100);
84                      // DEBUG MONITOR
85                      for(i=0;i<indx_1;i++)
86                      {
87                          uart_putc(uart0, rxBuf_1[i]);
88                      }
89                      // DEBUG MONITOR END
90                      indx_1 = 0;
91                      //sleep_ms(1000);
92                      //uart_puts(uart1, "SENSOR DATA\r\n");
93                      //sleep_ms(1000);
94                      //gpio_put(DONE_PIN, true);
95                      //while(1);
96                  }
97              break;
```



Low-Power XBee Communications

```
69      // Init state machine variable and init RX buffer index
70      state = wait4ready;
71      indx_1 = 0;
72      // Pull XBee out of reset
73      sleep_ms(1000);
74       gpio_put(NRST1_PIN, true);
75      while (1)
76      {
77          switch(state)
78          {
79              // Look for traffic from the XBee
80              case wait4ready:
81                  //if(indx_1 > 0)
82                  //{
83                  //    sleep_ms(100);
84                      // DEBUG MONITOR
85                  //    for(i=0;i<indx_1;i++)
86                  //    {
87                  //        uart_putc(uart0, rxBuf_1[i]);
88                  //    }
89                      // DEBUG MONITOR END
90                  //    indx_1 = 0;
91                      sleep_ms(1000);
92                      uart_puts(uart1, "SENSOR DATA\r\n");
93                      sleep_ms(1000);
94                      gpio_put(DONE_PIN, true);
95                      while(1);
96                  }
97              break;
```

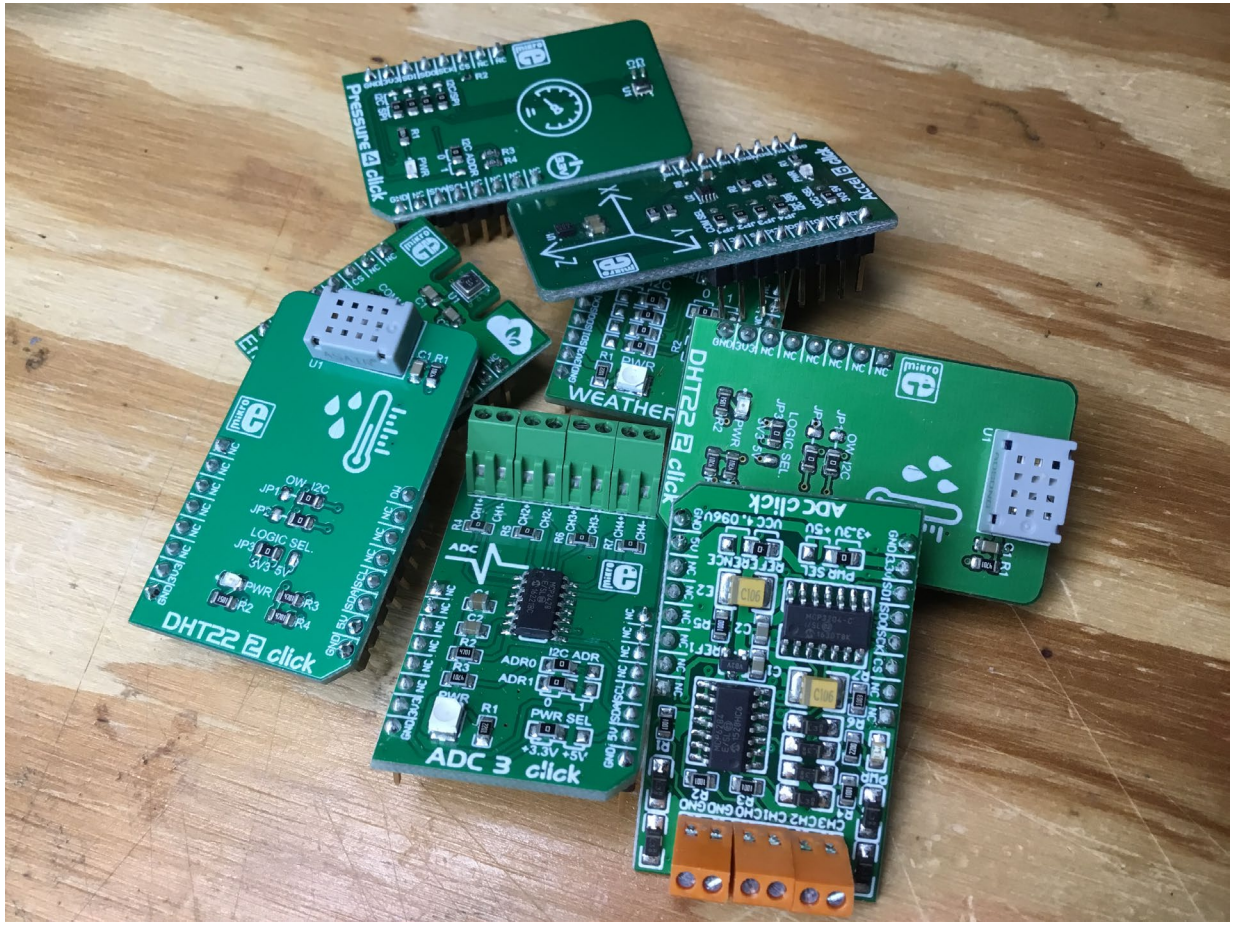


Thank you for attending!!!

Please consider the resources below:

- raspberrypi.org
- RP2040 Data Sheet
- www.digi.com
- www.reyax.com

MORE TO COME..



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