eZ430-Chronos Workshop
connecting people

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MSP430
Overview of the eZ430-Chronos and CC430 is presented and followed by a short demo showcasing the features of the standard Chronos package. The next lab aims at getting Chronos to communicate in peer to peer mode. Attendees will then work with SmartRF Studio to configure the CC430 RF settings and reapply new RF configurations to their Chronos. The workshop wraps up with an optional lab demonstrating power (RSSI) meter application with the Chronos.
1. Introduction: Chronos & CC430
2. Lab 1: Enable RF in Chronos
3. Lab 2: Configure RF with SmartRF Studio
4. Lab 3: RSSI Meter with Chronos
5. CC430 Eco-system
Introduction

Chronos & CC430

- CC430 Overview
- eZ430-Chronos
- Chronos Playtime
CC430 | RF + Ultra-Low Power MCU

MSP430™ Microcontroller
- Industry’s lowest power MCU
- 16-bit RISC architecture
- 20 MHz processor
- High-performance analog
- Sensor interface

CC1101 <1GHz RF Transceiver
- High sensitivity
- Low current consumption
- Excellent blocking performance
- Flexible data rate & modulation format

Intelligent Peripherals
- 100 nA comparator
- 8ch 12-bit ADC offering 200-ksp
- 96 segment LCD controller
- 128-bit AES security encryption/decryption coprocessor

64/48QFN Pin Package
- 9.1/7.1 mm² area

Monolithic
- Single die package
Chronos | Advanced Integration

- CC430F6137 MCU
- 3-Axis Accelerometer
- Pressure & Altitude Sensor
- Temperature Sensor
- Voltage & Battery Sensor
- CR2032 Battery
- <1GHz RF
  - 433, 868 & 915 MHz
- 2-Wire JTAG Access
- 96 segment LCD
- Buzzer
- eZ430 Programmer
- RF Access Point
- Chronos Disassembly Tool
Chronos | **Playtime [Non-RF]**

**Cycle through**
- Top Menu
- Bottom Menu

**Activate**
- Top Function
- Backlight
- Bottom Function

**Top Menu:**
- Time → Alarm → Temperature → Altimeter → mi/h → Accelerometer →

**Bottom Menu:**
- Date → Stop Watch → Battery → RF [ Acc – PPT – Sync – BSL ] →

*unused in workshop*
Chronos Workshop

Agenda

1. Introduction: Chronos & CC430
2. Lab 1: Enable RF in Chronos
3. Lab 2: Configure RF with SmartRF Studio
4. Lab 3: RSSI Meter with Chronos
5. CC430 Eco-system
Enable RF in your Chronos
• Set your assigned RF channel
• Edit code with CCS
• Compile & Download to Chronos
• Link & find your partner
Chronos2Chronos | Goal

- Bottom Menu → C2C
- Press “v” → Turn on RF
- Press “#” → increment your partner’s Chronos counter
- Your Chronos counter changes → your partner is pressing their Chronos button
- Work as a team!
- Locate second team w/ same channel
Tips:
1. Press the screwdriver down firmly when unscrewing to prevent stripping
2. Pry against the edge of the eZ-connector to lift the PCB out
3. **Do not** take the battery out of the battery holder

*After the workshop, if interested in replacing the battery:
Chronos Disassembly & Reassembly Video: [http://www.youtube.com/watch?v=WDL3awjhLpw](http://www.youtube.com/watch?v=WDL3awjhLpw)*
CCS | Import ChronosWorkshop Project

• Open CCS
  – Select workspace, browse to C:\ChronosWorkshop\Workspace\n  – Close welcome screen

• Import Project
  – Project > Import Existing CCS/CCE Eclipse Project
  – Browse to C:\ChronosWorkshop\Workspace\
  – Select ChronosWorkshop project
  – Select Finish to import

• Default build configuration
  – 915MHz – Unrestricted CCS Platinum (USA)
Code | Modify RF channel

OPEN:  
ROOT\simpliciti\Components\mrfi\smartrf\CC430\smartrf_CC430.h

Line 26:  
#define SMARTRF_SETTING_CHANNR YOUR_CHANNEL

CHANGE:  
YOUR_CHANNEL to the assigned channel on your paper
1. Connect the bare Chronos to the eZ430 USB Emulator
2. Plug the PCBs into the USB port of your PC
3. In CCS, select debug to
   1. Compile
   2. Download … be patient...
4. Stop debugging
5. Unplug your Chronos
Chronos2Chronos | Operate

1. Bottom Menu: “C2C”
2. Link w/ Partner
   Press “v”
3. Connected
4. Inc Partner’s Counter
   Press “#”

Partner not found in ~ 10 seconds?
Auto return to C2C screen
Configure RF settings with SmartRF Studio

• Complete CC430 RF configuration in SW
• Modify register settings
• Generate c code
• See results
RF Settings | How to Modify?

Change RF settings manually
- CHANNEL: simple, manageable
- Frequency, modulation, filtering: user’s guide

Change RF settings automatically
- Fully configure your system
- Instantly verify your settings with connected devices
- Template & code generation
SmartRF | Configure Register View

- Open SmartRF
  - CC430 in Offline Mode
- Configure Register View
  - Select View → Expert Mode
  - Enable checkboxes
    - Register View
    - RF Parameters
SmartRF | Modify RF settings

- Align with the partner you just found on a new frequency
- Note: This must be within your assigned frequency range
- Change to desired RF base frequency
- Notice the changes in the register view
Code | Modify RF settings

- Open file `smartrf_cc430.h` again
- Find 3 `#define` lines for the FREQ (Lines 20 – 22)
- Copy new Hex values from SmartRF to appropriate lines
- Reset `SMARTRF_SETTING_CHANNR` to 0x00 (Line 26)
CCS | Compile & Download

- Recompile & download project
- … be patient…
- Stop debugging and unplug your Chronos
- Use Chronos2Chronos menu again
- Help your partner
- Make sure you are using the frequency band assigned to you [check paper]
- Can you see similar results?
- Are you still able to connect to your partner?
Lab 3 [BONUS] RSSI Chronos Meter

Use your Chronos to measure TX signal

• We broadcast carrier freq. of 888MHz
• Notice how the RSSI value changes
Operate | Power Meter

- Move closer/away from the CC430EM to see differences in reading
- Reading changes with
  - Distance
  - Interference / obstacles
  - Antenna radiation pattern / characteristic

- Instructor’s CC430 is broadcasting
  - Continuous RF carrier @ 888MHz
- Chronos measures power
  - RSSI readout from RF1A (Radio) module
  - 888 MHz with 400 kHz filter
Open logic\menu.c in CCS
Uncomment & comment 2 code lines
Recompile & Download
Operate | Power Meter

- Top Menu → Cycle to rSSI
- Press “^” → Turn on rSSI
- See measured power level in dBm
- Press “^” again → Stop measurement

RSSI .. Received Signal Strength Indicator
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CC430 | Eco-System

CC430EM
[915/868/433MHz]

Chronos
[915/868/433MHz]

EXP-CC430 Experimenter’s Board
[915/868/433MHz] – SMA Connector

SmartRF® Studio 7

RF Modules:

RF stacks:
SimpliciTI, BlueRobin, W-Mbus, 6LoWPAN, Dash 7, ...

SA430 Spectrum Analyzer/Packet Sniffer
[Sub-GHz]– SMA Connector / Antenna
Use RfBSL menu in your Chronos menu in conjunction Chronos Control Center to program it without opening it.

For example you can get the watch to its initial state - with all the PPT and Heart rate monitor features - by flashing the standard code into it:

C:\Program Files\Texas Instruments\ eZ430-Chronos\Recovery\Chronos Watch\Wireless Updater\eZ430_Chronos_rfbsl_915M Hz_1_0.txt
Chronos <3 Beagle Board

Download Now for Linux (SLAC388)
Both windows and Linux versions are available @ www.ti.com/chronoswiki

Follow the install instructions in the eZ430-Chronos user’s guide

The Chronos RF USB dongle is not automatically recognized by BeagleBoard. Install the appropriate drivers by following these commands in the terminal.

```bash
opkg update
opkg install kernel-module-cdc-acm
modprobe cdc-acm
```
Chronos | Projects

Co-op Challenges [Dallas, Freising]

Community

Chronos

[Images of various projects related to Chronos]
Thank you!

Chronos Links

GoogleGroup: http://groups.google.com/group/ti-chronos-development-/topics
E2E: http://e2e.ti.com → MSP430 Microcontroller Forum
Appendix | Chronos Sport Watch

Also available on the Chronos booklet and user’s guide (online)
Endless possibilities | Chronos serves as a central hub for nearby wireless sensors

- Control ceiling fan
- Raise & lower blinds
- Display GPS data
- Adjust thermostat
- Adjust entertainment system settings
- Pair with heart rate monitor
- Map Chronos buttons for PC Automation, motion-based control and more
- Pair with pedometer