

PaLFI Range Extender

RI-ACC-ADR2
(ez430-TMS37157 Base Station)
plus
RI-RFM-007B-30
(LF Transmitter Module, High Power)

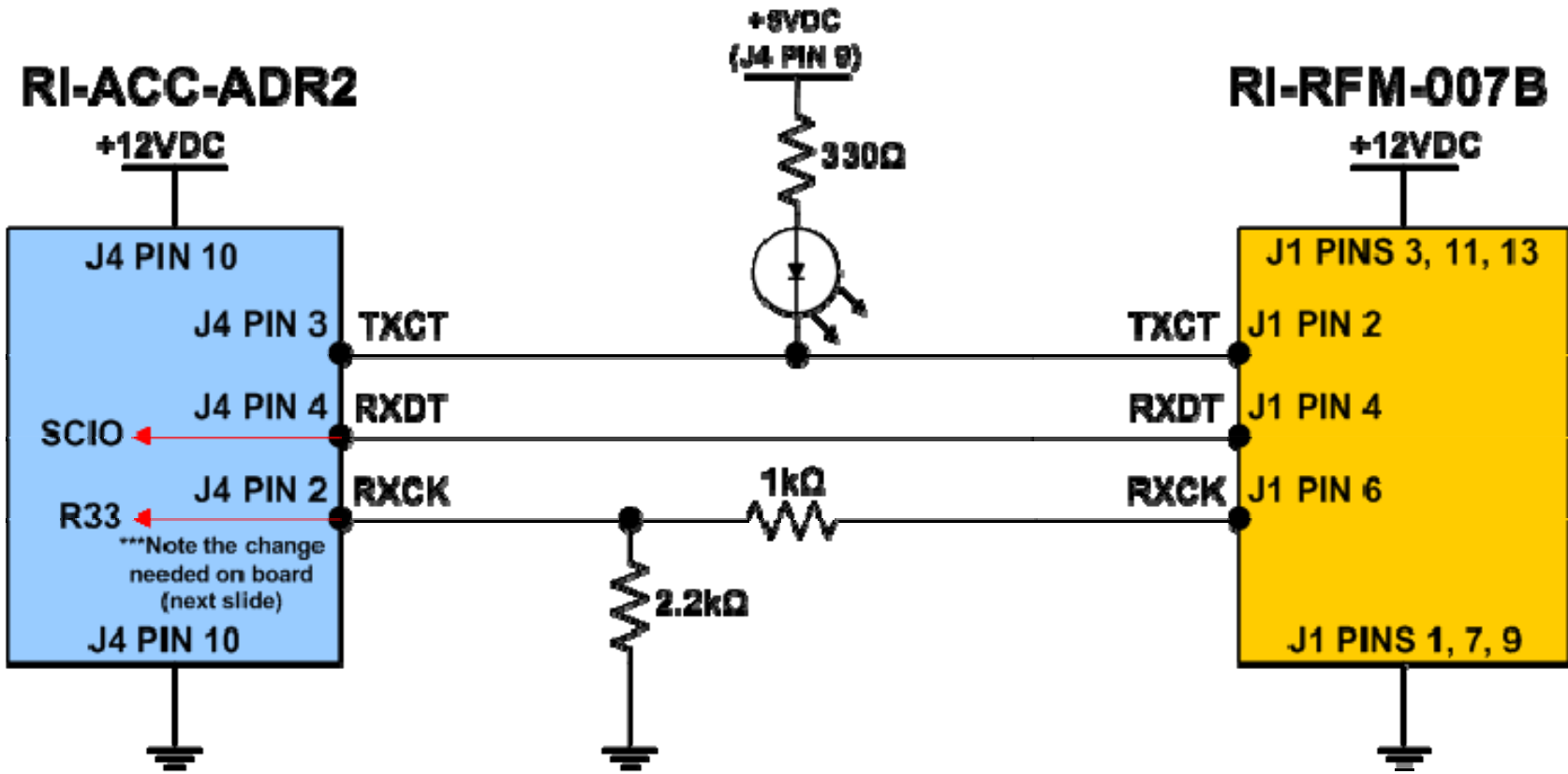
Development Prototype

RI-ACC-ADR2 + RI-RFM-007B

Parts Needed

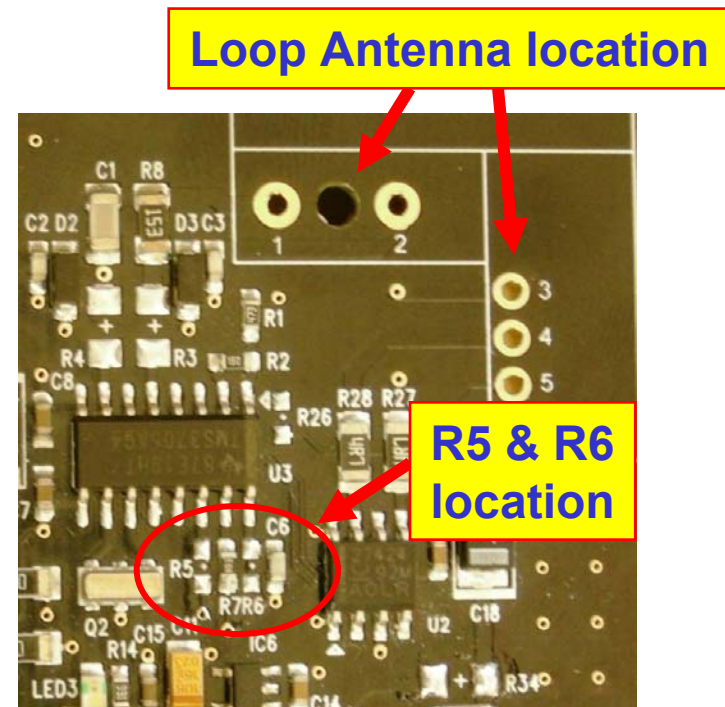
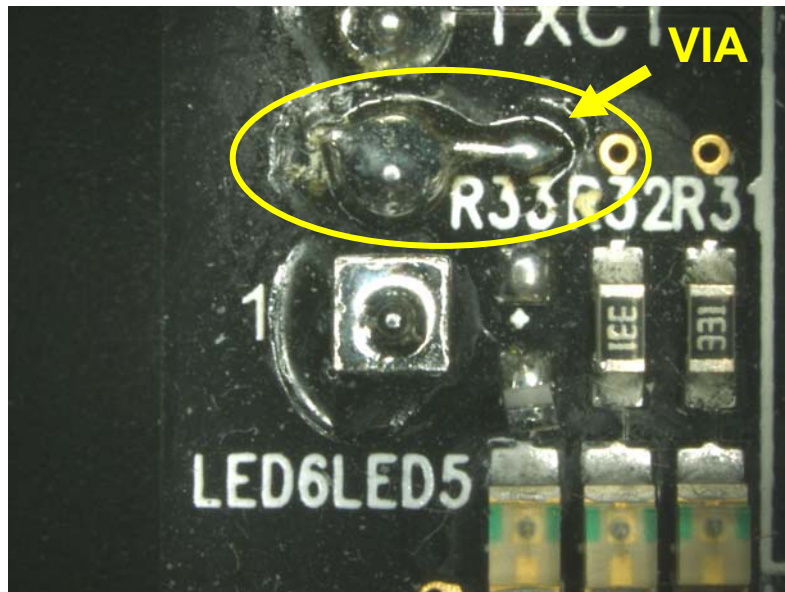
- RI-ACC-ADR2 Board (found in ez430-TMS37157 kit)
- RI-RFM-007B Module (available through distribution)
 - <http://www.ti.com/litv/pdf/scbu022>
- RI-ANT-x0xx Antenna (available through distribution)
 - <http://www.ti.com/lit/pdf/scbu025>
- Recommended Components
 - 330 Ω resistor (for current limiting TXCT activity LED)
 - 1k Ω resistor
 - 2.2k Ω resistor
 - One LED (your choice of color and size, for TXCT activity indication)
 - Board Headers for mounting RFM (0.100CTR Double Row Style)
 - Four 4x40 Standoffs (for mounting RFM to circuit board)
- Small Circuit Board
 - 15" x 10" or greater size (similar to picture at end of presentation)

RI-ACC-ADR2/RI-RFM-007B Connection Circuit



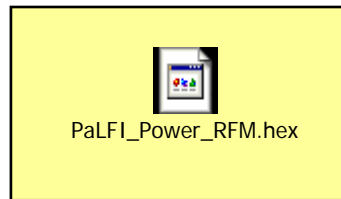
Modify RI-ACC-ADR2 Board

- Implement changes on RI-ACC-ADR2 board
 - Remove R33 and connect J4 pin 2 with via
 - Remove Resistors R5 & R6
 - Remove Loop Antenna



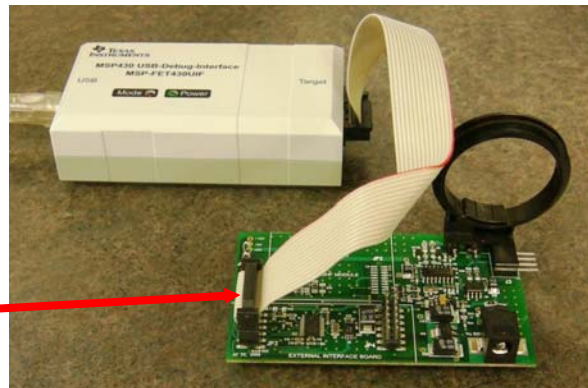
Load Modified Firmware

- Use modified Firmware that can handle the RXCK / RXDT signals

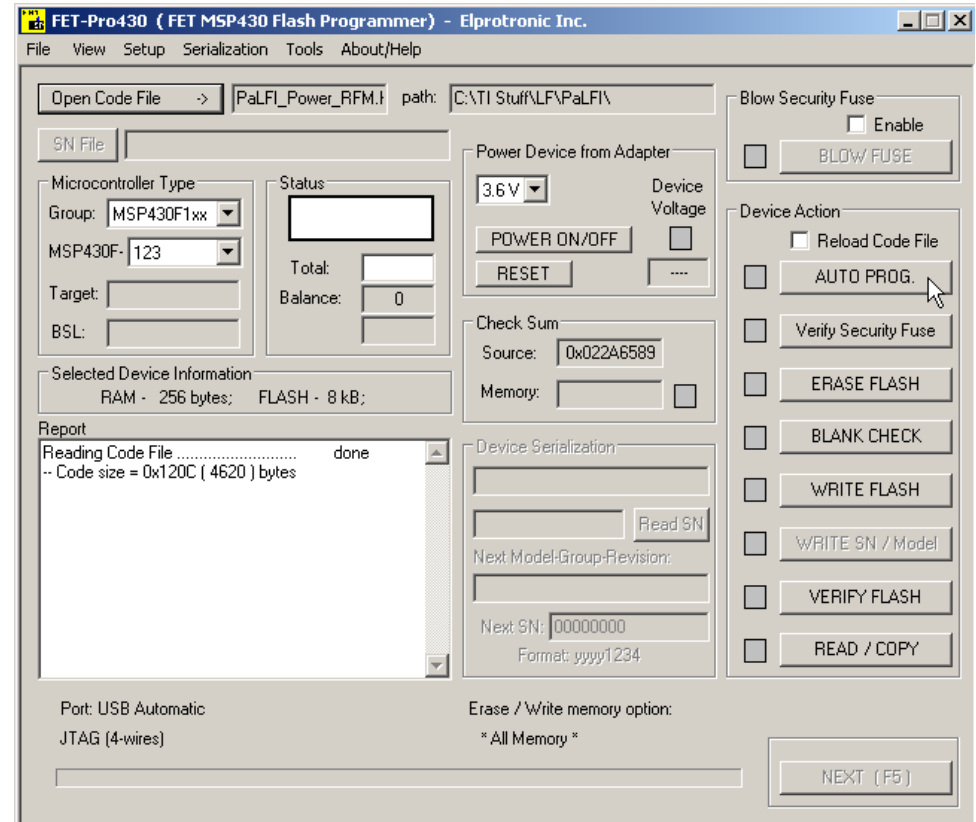


PaLFI_Power_RFM.hex

Firmware file for RI-ACC-ADR2 Reader
use copy paste to save this file
Load with JTAG Connector on RI-ACC-ADR2 Board



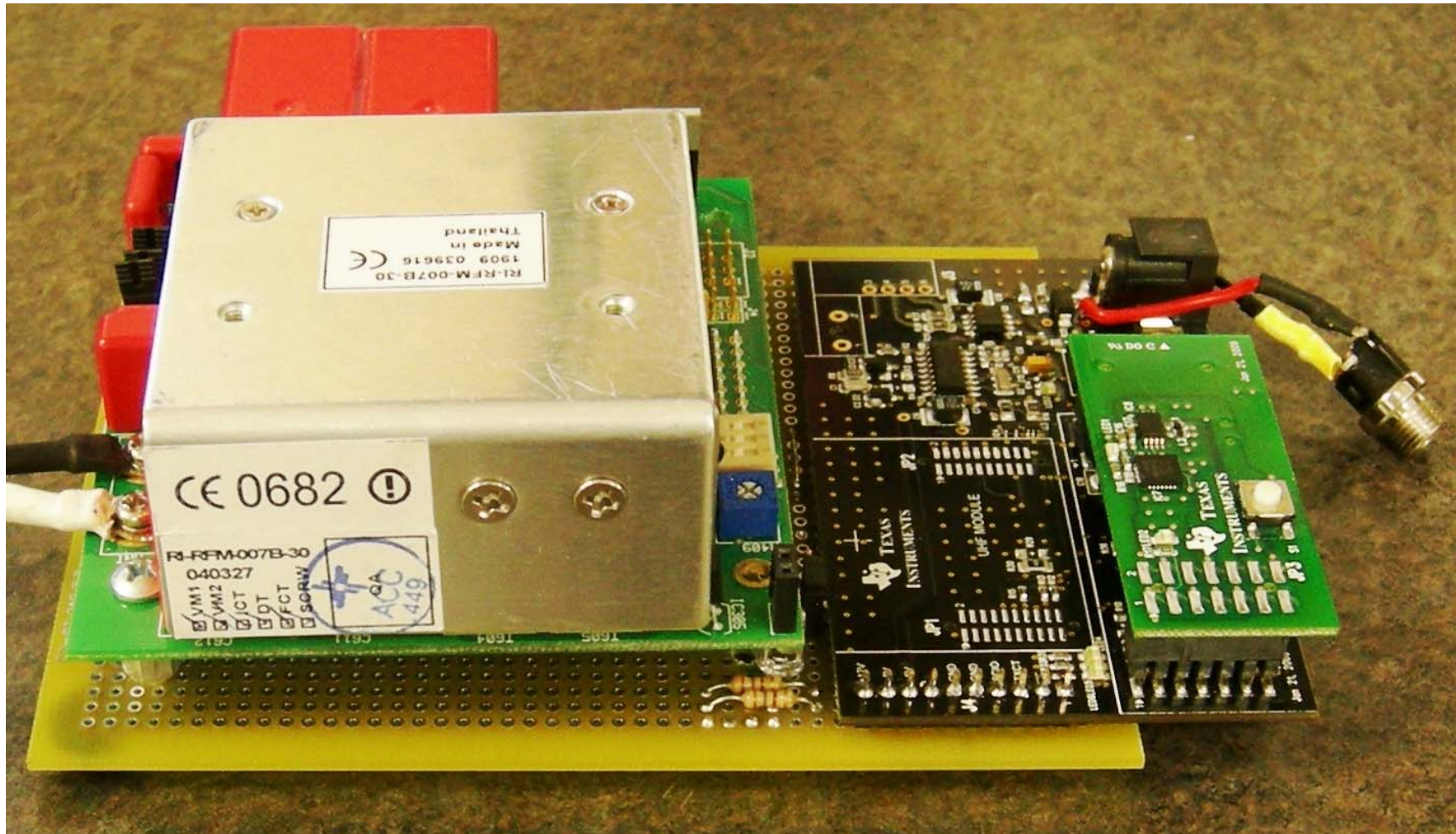
Remove USB board
to access JP3
JTAG Connector



With +12VDC applied to the RI-ACC-ADR2
board, JTAG the file into the MSP430F123

Helfried Vollbrecht 3. Feb. 2010
Josh Wyatt 08/04/2010

RI-ACC-ADR2/RI-RFM-007B Combo Completed Prototype Assembly

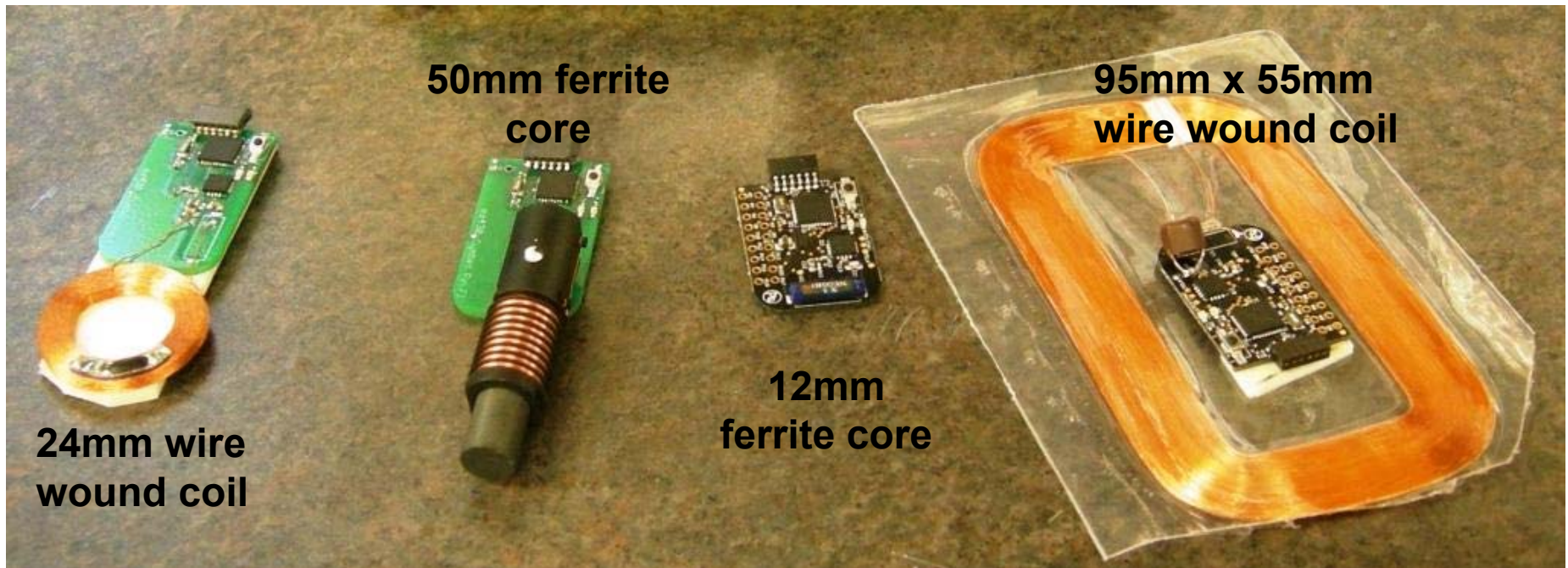


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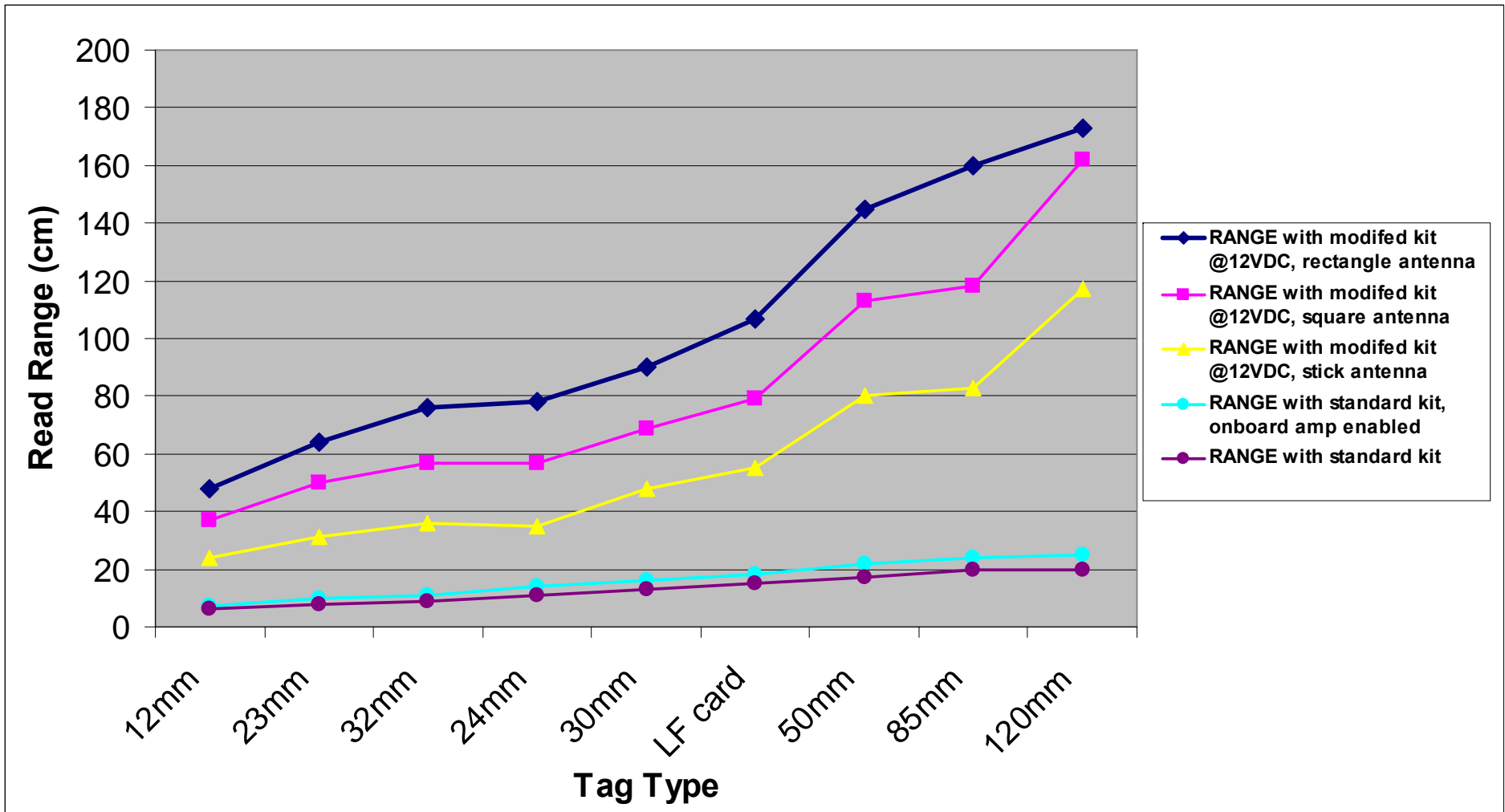
TMS37157 Based Transponders Tested



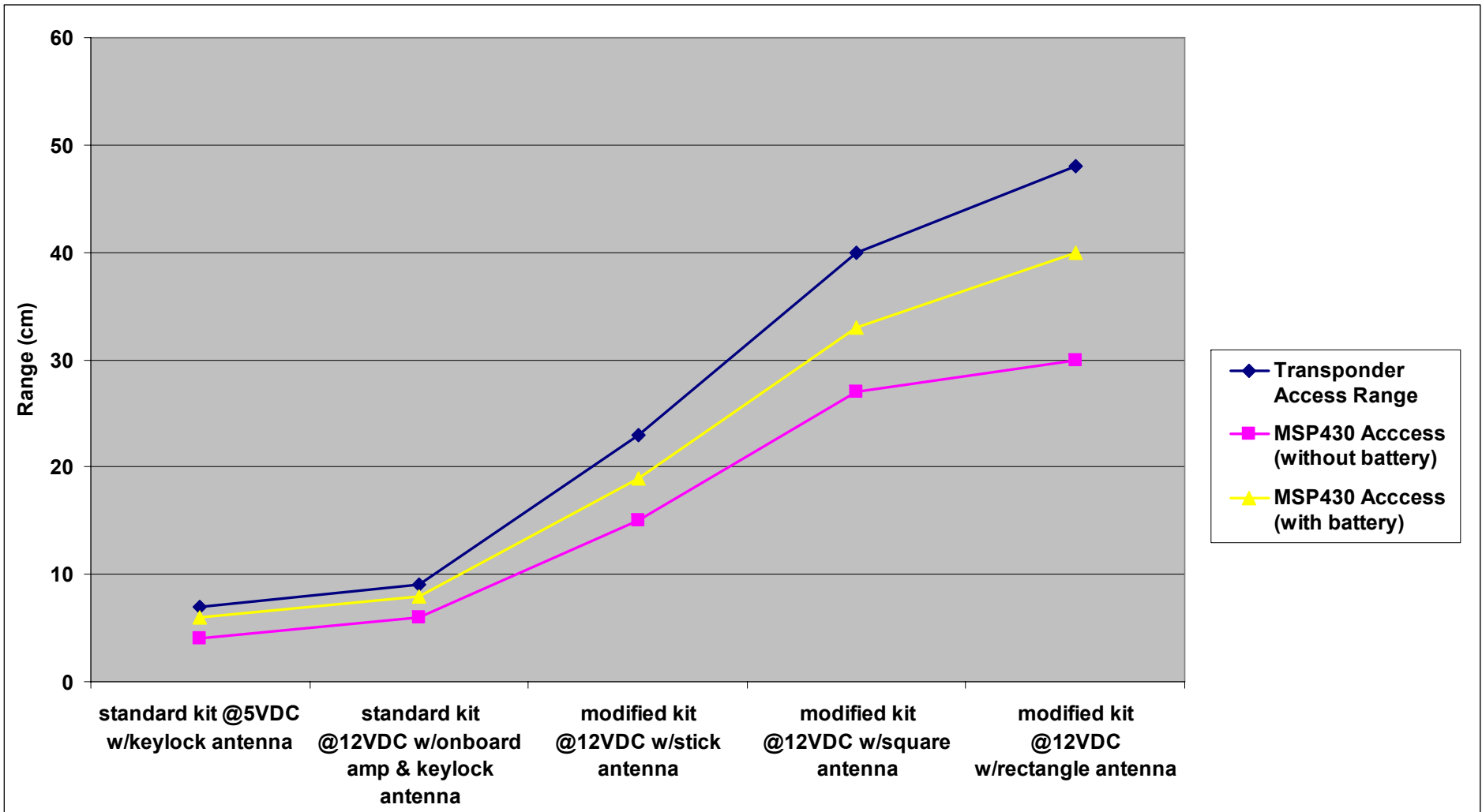
TMS37124 Based Transponders Tested



ez430-TMS37157 kit (standard and modified) TI RO/RW Transponder Read Ranges



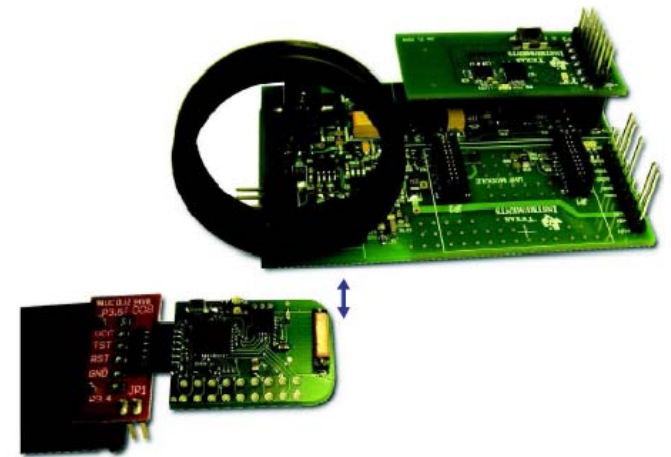
ez430-TMS37157 kit Target Board Basic Commands Read Ranges



- **BACKUP**

Range Measurements (@ 5VDC) Standard ez430-TMS37157 PaFLI Kit

- **Standard TMS37157 Target Board with 12mm antenna**
 - Passive Transponder Read = **7cm**
 - MSP430 Access/Flash LED (without battery) = **4cm**
 - MSP430 Access/Flash LED (with battery) = **6cm**
- **24mm circle antenna target board**
 - Passive Transponder Read = **10cm**
 - MSP430 Access/Flash LED (without battery) = **7.5cm**
 - MSP430 Access/Flash LED (with battery) = **9cm**
- **50mm antenna target board**
 - Passive Transponder Read = **15cm**
 - MSP430 Access/Flash LED (without battery) = **10cm**
 - MSP430 Access/Flash LED (with battery) = **13cm**
- **95mm x 55mm antenna target board**
 - Passive Transponder Read = **19cm**
 - MSP430 Access/Flash LED (without battery) = **15cm**
 - MSP430 Access/Flash LED (with battery) = **16cm**
- **Standard LF Transponders**
 - 12mm = **6cm**
 - 23mm = **8cm**
 - 32mm = **9cm**
 - 24mm circular = **11cm**
 - 30mm Circular = **13cm**
 - LF Card = **15cm**
 - 50mm = **17cm**
 - 85mm Circular = **20cm**
 - 120mm = **20cm**



Range Measurements (@ 12VDC) Standard ez430-TMS37157 PaFLI Kit with onboard amplifier enabled

- **Standard TMS37157 Target Board with 12mm antenna**
 - Passive Transponder Read = **9cm**
 - MSP430 Access/Flash LED (without battery) = **6cm**
 - MSP430 Access/Flash LED (with battery) = **8cm**
- **24mm circle antenna target board**
 - Passive Transponder Read = **12cm**
 - MSP430 Access/Flash LED (without battery) = **9.5cm**
 - MSP430 Access/Flash LED (with battery) = **11cm**
- **50mm antenna target board**
 - Passive Transponder Read = **18cm**
 - MSP430 Access/Flash LED (without battery) = **13cm**
 - MSP430 Access/Flash LED (with battery) = **16cm**
- **95mm x 55mm antenna target board**
 - Passive Transponder Read = **23cm**
 - MSP430 Access/Flash LED (without battery) = **17cm**
 - MSP430 Access/Flash LED (with battery) = **18cm**
- **Standard LF Transponders**
 - 12mm = **7.5cm**
 - 23mm = **10cm**
 - 32mm = **11cm**
 - 24mm circular = **14cm**
 - 30mm Circular = **16cm**
 - LF Card = **18cm**
 - 50mm = **22cm**
 - 85mm Circular = **24cm**
 - 120mm = **25cm**

**Range Measurements (@ 12VDC)
RI-ACC-ADR2 + RI-RFM-007B version
with RI-ANT-S01C (140mm stick)
(in relative noise free environment)**

- **Standard TMS37157 Target Board with 12mm antenna**
 - Passive Transponder Read = **23cm**
 - MSP430 Access/Flash LED (without battery) = **15cm**
 - MSP430 Access/Flash LED (with battery) = **19cm**
- **24mm circle antenna target board**
 - Passive Transponder Read = **35cm**
 - MSP430 Access/Flash LED (without battery) = **27cm**
 - MSP430 Access/Flash LED (with battery) = **30cm**
- **50mm antenna target board**
 - Passive Transponder Read = **60cm**
 - MSP430 Access/Flash LED (without battery) = **40cm**
 - MSP430 Access/Flash LED (with battery) = **48cm**
- **95mm x 55mm antenna target board**
 - Passive Transponder Read = **69cm**
 - MSP430 Access/Flash LED (without battery) = **49cm**
 - MSP430 Access/Flash LED (with battery) = **60cm**
- **Standard LF Transponders**
 - 12mm = **24cm**
 - 23mm = **31cm**
 - 32mm = **36cm**
 - 24mm circular = **35cm**
 - 30mm Circular = **48cm**
 - LF Card = **55cm**
 - 50mm = **80cm**
 - 85mm Circular = **83cm**
 - 120mm = **117cm**

**Range Measurements (@ 12VDC)
RI-ACC-ADR2 + RI-RFM-007B version
with RI-ANT-G02E (200mm x 200mm square)
(in noisy environment)**

- Standard TMS37157 Target Board with 12mm antenna
 - Passive Transponder Read = **32cm**
 - MSP430 Access/Flash LED (without battery) = **22cm**
 - MSP430 Access/Flash LED (with battery) = **29cm**
- 24mm circle antenna target board
 - Passive Transponder Read = **45cm**
 - MSP430 Access/Flash LED (without battery) = **33cm**
 - MSP430 Access/Flash LED (with battery) = **41cm**
- 50mm antenna target board
 - Passive Transponder Read = **71cm**
 - MSP430 Access/Flash LED (without battery) = **50cm**
 - MSP430 Access/Flash LED (with battery) = **63cm**
- 95mm x 55mm antenna target board
 - Passive Transponder Read = **81cm**
 - MSP430 Access/Flash LED (without battery) = **59cm**
 - MSP430 Access/Flash LED (with battery) = **70cm**

**Range Measurements (@ 12VDC)
RI-ACC-ADR2 + RI-RFM-007B version
with RI-ANT-G02E (200mm x 200mm square)
(in relative noise free environment)**

- **Standard TMS37157 Target Board with 12mm antenna**
 - Passive Transponder Read = **40cm**
 - MSP430 Access/Flash LED (without battery) = **27cm**
 - MSP430 Access/Flash LED (with battery) = **33cm**
- **24mm circle antenna target board**
 - Passive Transponder Read = **56cm**
 - MSP430 Access/Flash LED (without battery) = **42cm**
 - MSP430 Access/Flash LED (with battery) = **48cm**
- **50mm antenna target board**
 - Passive Transponder Read = **89cm**
 - MSP430 Access/Flash LED (without battery) = **56cm**
 - MSP430 Access/Flash LED (with battery) = **77cm**
- **95mm x 55mm antenna target board**
 - Passive Transponder Read = **97cm**
 - MSP430 Access/Flash LED (without battery) = **74cm**
 - MSP430 Access/Flash LED (with battery) = **86cm**
- **Standard LF Transponders**
 - 12mm = **37cm**
 - 23mm = **50cm**
 - 32mm = **57cm**
 - 24mm circular = **57cm**
 - 30mm Circular = **69cm**
 - LF Card = **79cm**
 - 50mm = **113cm**
 - 85mm Circular = **118cm**
 - 120mm = **162cm**

**Range Measurements (@ 12VDC)
RI-ACC-ADR2 + RI-RFM-007B version
with RI-ANT-G01E (718mm x 270mm rectangle)
(in noisy environment)**

- Standard TMS37157 Target Board with 12mm antenna
 - Passive Transponder Read = **38cm**
 - MSP430 Access/Flash LED (without battery) = **30cm**
 - MSP430 Access/Flash LED (with battery) = **35cm**
- 24mm circle antenna target board
 - Passive Transponder Read = **56cm**
 - MSP430 Access/Flash LED (without battery) = **52cm**
 - MSP430 Access/Flash LED (with battery) = **55cm**
- 50mm antenna target board
 - Passive Transponder Read = **82cm**
 - MSP430 Access/Flash LED (without battery) = **76cm**
 - MSP430 Access/Flash LED (with battery) = **81cm**
- 95mm x 55mm antenna target board
 - Passive Transponder Read = **102cm**
 - MSP430 Access/Flash LED (without battery) = **96cm**
 - MSP430 Access/Flash LED (with battery) = **102cm**

**Range Measurements (@ 12VDC)
RI-ACC-ADR2 + RI-RFM-007B version
with RI-ANT-G01E(718mm x 270mm rectangle)
(in relative noise free environment)**

- Standard TMS37157 Target Board with 12mm antenna
 - Passive Transponder Read = **48cm**
 - MSP430 Access/Flash LED (without battery) = **30cm**
 - MSP430 Access/Flash LED (with battery) = **40cm**
- 24mm circle antenna target board
 - Passive Transponder Read = **72cm**
 - MSP430 Access/Flash LED (without battery) = **52cm**
 - MSP430 Access/Flash LED (with battery) = **63cm**
- 50mm antenna target board
 - Passive Transponder Read = **118cm**
 - MSP430 Access/Flash LED (without battery) = **76cm**
 - MSP430 Access/Flash LED (with battery) = **105cm**
- 95mm x 55mm antenna target board
 - Passive Transponder Read = **130cm**
 - MSP430 Access/Flash LED (without battery) = **104cm**
 - MSP430 Access/Flash LED (with battery) = **115cm**
- Standard LF Transponders
 - 12mm = **48cm**
 - 23mm = **64cm**
 - 32mm = **76cm**
 - 24mm circular = **78cm**
 - LF Card = **107cm**
 - 50mm = **145cm**
 - 85mm Circular = **160cm**
 - 120mm = **173cm**

Conclusions/Other things to do...

- With RI-RFM-007B at $\sim\frac{1}{2}$ power for this test, significant range improvements were realized over the standard ez430-TMS37157 evaluation kit (with and without onboard amplifier circuit being used)
- The RI-RFM-007B can also be separated from +12VDC and then connected to up to +24VDC supply. (+7VDC to +24VDC is input voltage range) This should lead to higher output FS and longer ranges still.
- Different Reader Antennas could be tested as well. (RI-ANT-G04E (large rectangle) or custom size)
- Different tag coil sizes/arrangements can also be tested.