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### Radiocrafts IOT-Module Expansion Board for FX30 and mangOH Gateway

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#### Product Description

The RCxxxx-IEB is a series of expansion boards for the Sierra Wireless FX30 Programmable IoT Gateway (hereafter named FX30) and the open source HW mangOH.

A complete IoT solution is easily created by using the Radiocrafts IOT expansion board and the gateway in combination with sensor nodes based on Radiocrafts RF modules in a local wireless network.

The boards contain an RF module giving wireless connectivity, and the interface circuitry to the host processor in the gateway. The card has an SMA connector for connecting the external antenna.

The insertion board series include several different products supporting different frequencies and radio protocols. The embedded protocol inside the RF module handles all RF communication and only data payload and easy-to-use commands are sent over the UART or SPI serial bus to/from the gateway processor.



#### Supported Protocols and Network Standards

- Wireless M-Bus
- IEEE 802.15.4g
- RC232/TinyMesh
- ZigBee

#### Applications

3G/4G LTE gateway solutions for:

- Internet of Things applications
- Wireless Sensor Networks
- AMR / Smart Metering
- Home automation, building automation and industrial automation
- Fleet and inventory management

### Features

- On-board radio module with embedded protocol
- Easy-to-use UART/SPI interface connects to powerful Sierra Wireless-internal WP module
- RF interface with SMA connector connects to any standard antenna
- Same PCB supports modules from a large portfolio of RF modules
- Miniature LED indicators (connects to RF module-processor)
- CE certified module for EU frequencies
- FCC pre-qualified for dedicated RF modules

### Functional block diagram

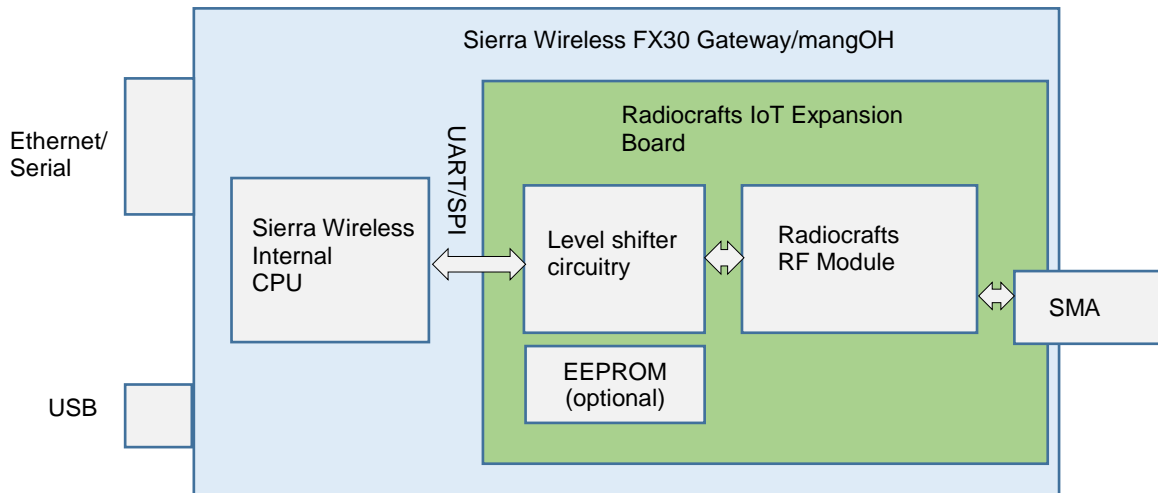


Figure 1: Functional block diagram for FX30 gateway and IoT expansion board

### Gateway programming<sup>1</sup>

The FX30 and mangOH integrates the Legato® Open Source Linux Platform that simplifies application-level development with a secure application framework, maintained Linux distribution, and feature-rich development environment. Legato® enables efficient C-level programming, making FX30 the core component for distributed IoT systems. Legato features an application sandbox that provides a secure environment to run and control multiple applications. With security and connectivity built in, Legato's robust APIs enable users to connect to any cloud or network, and allow developers to focus on building the value-add IoT applications. Legato offers an Eclipse-based integrated development environment (IDE), providing an extensible and familiar toolset with built-in API awareness. With multi-language support, Legato allows developers to code in their preferred language, and provides a robust suite of diagnostic tools, to enable- local and remote debugging, troubleshooting, monitoring and profiling.



Figure 2. FX30 gateway from Sierra Wireless

<sup>1</sup> Information from Sierra Wireless FX30 Datasheet

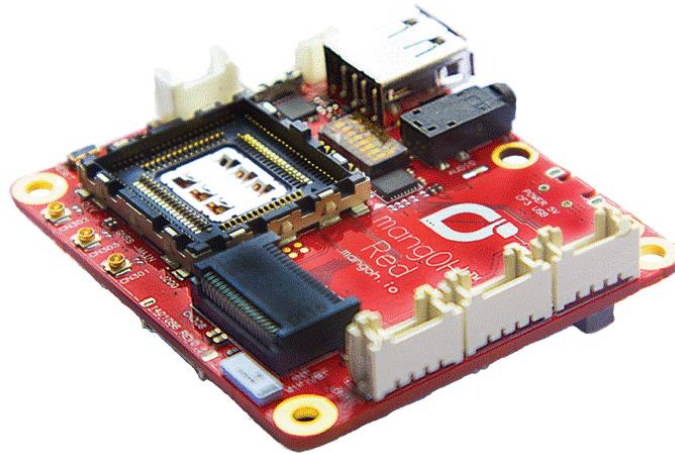


Figure 3. mangOH Red gateway

### Antenna connection

A quarter wave antenna can be directly connected to the SMA antenna connector. If the modem is placed in environments where RF performance is reduced, an external antenna can be connected via an extension coaxial cable to the SMA connector. It is strongly recommended that the Sierra Wireless 3G/4G antenna and the antenna on the expansion card are not pointing in the same direction, in order to reduce possible interference and range reductions. Thus, use angled 3G/4G antenna if straight antenna is used with the expansion card, and vice versa.

### Product variants

For detailed information on each variant of the insertion boards, please see the User Manual and Data Sheet for the respective Radiocrafts modules used on the different variants. Datasheets can be downloaded from the Radiocrafts site [www.radiocrafts.com](http://www.radiocrafts.com)

### IOT expansion board

The expansion board is designed to be the link between the local radio network (ISM band radio), and the cell phone network modem.

The IoT Expansion Card form factor represents an open hardware standard for sensors, network adapters, and other IoT technologies that can be "plugged" into host applications to provide new features and interfaces. As a family, IoT Expansion Cards share a standardized footprint and pinout, with several interfaces to support various IoT technologies

The IOT module has a standardized PCB edge connector that fit in the QSFP+ IoT Connector at the host. The pinout is standardized but described here for each module.

### RCxxxx-IEB Circuit Diagram

The board will have different components mounted depending on the type of Radiocrafts module used. Table 1 shows which signal from FX30 is used at each expansion board. Figure 2-5 shows the schematic for each type of expansion boards.

Pin no	Pin name					Description and internal MCU connection
		RC1180-MBUS3	RC1880CEF	RC1701HP-MBUS4	RC2400HP-ZNM	
1	VCC_5V			Y		5V supply
2-3	NC					Not Connected (USB)
4	GND	Y	Y	Y	Y	System ground
5-10	NC					Not Connected (SDIO)
11	VCC_1V8	Y	Y	Y	Y	1.8V supply
12	TXD	Y	Y	Y	Y	Connects to the module TXD (RXD on host)
13	RXD	Y	Y	Y	Y	Connects to the module's RXD-pin
14	CTS	Y	Y	Y	Y	Connects to the module's CTS-pin
15	RTS	Y	Y	Y	Y	Connects to the module's RTS-pin
16	SPI_CLK		Y		Y	Both RC1880CEF and RC2400HP-ZNM default use
17	SPI_MISO		Y		Y	UART as communication port at baud rate 115200.
18	SPI_MOSI		Y		Y	But the expansion board include the driver for SPI
19	SPI_SS		Y		Y	as an option.
20	NC					Config (enable module configuration mode)
21	GND	Y	Y	Y	Y	System ground
22	I2C	Y	Y	Y	Y	
23	I2C	Y	Y	Y	Y	
24	NC					Not Connected (GPIO1)
25	GPIO2	Y	Y	Y	Y	Connect to BSL_ENABLE (RC1880) and CONFIG pin for all other
26	GPIO3		Y		Y	MRDY signal for SPI Enabled modules
27	NC					Not Connected (GPIO4)
28-29	VCC_3V3	Y	Y	Y	Y	3.3V Supply
30	GND	Y	Y	Y	Y	System ground
31	n_Card_detect	Y	Y	Y	Y	
32	n_Reset	Y	Y	Y	Y	
33-37	NC					Not Connected (I2S/PPS)
38	GND	Y	Y	Y	Y	System ground

Table 1. Pin mapping

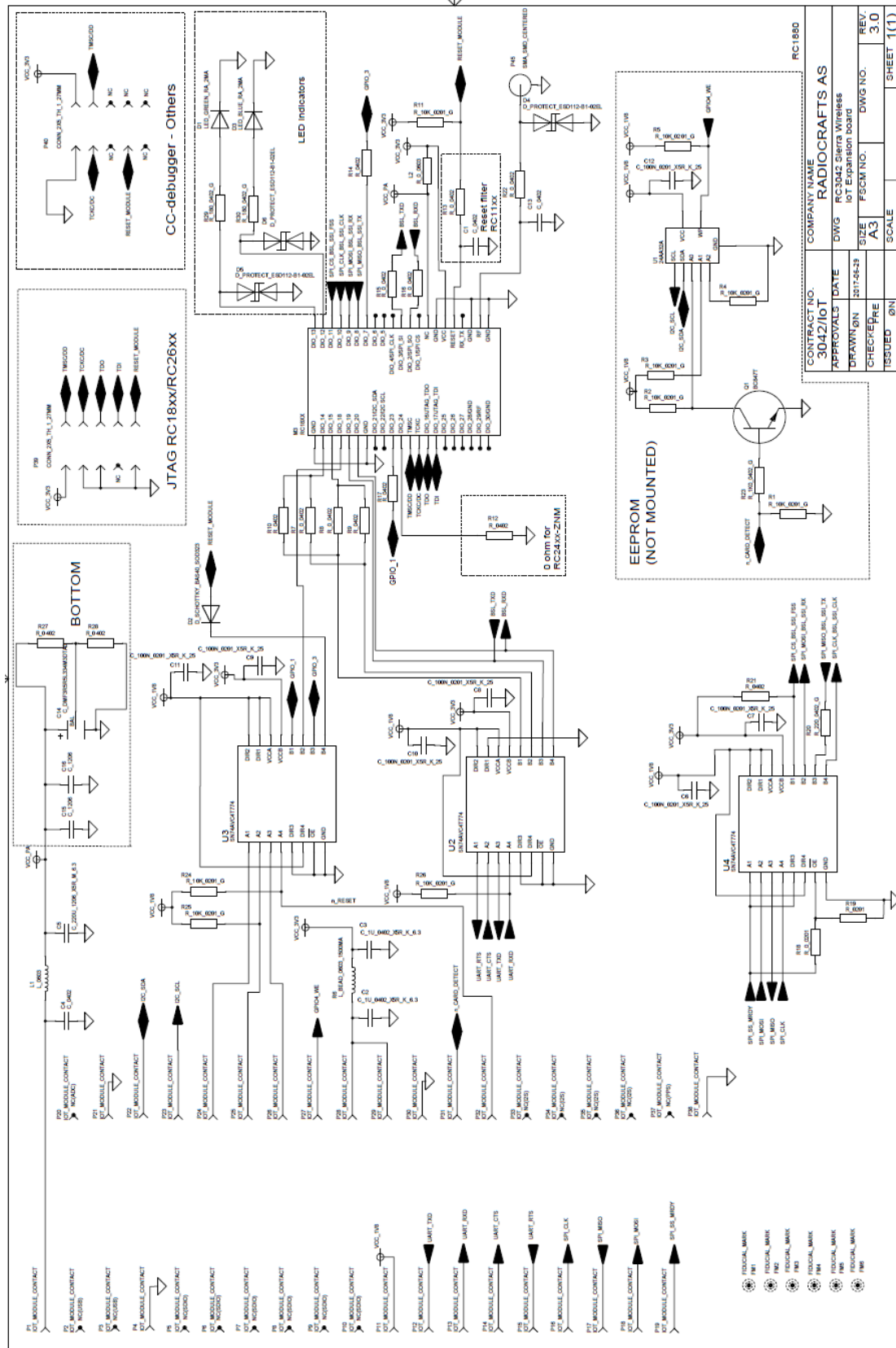
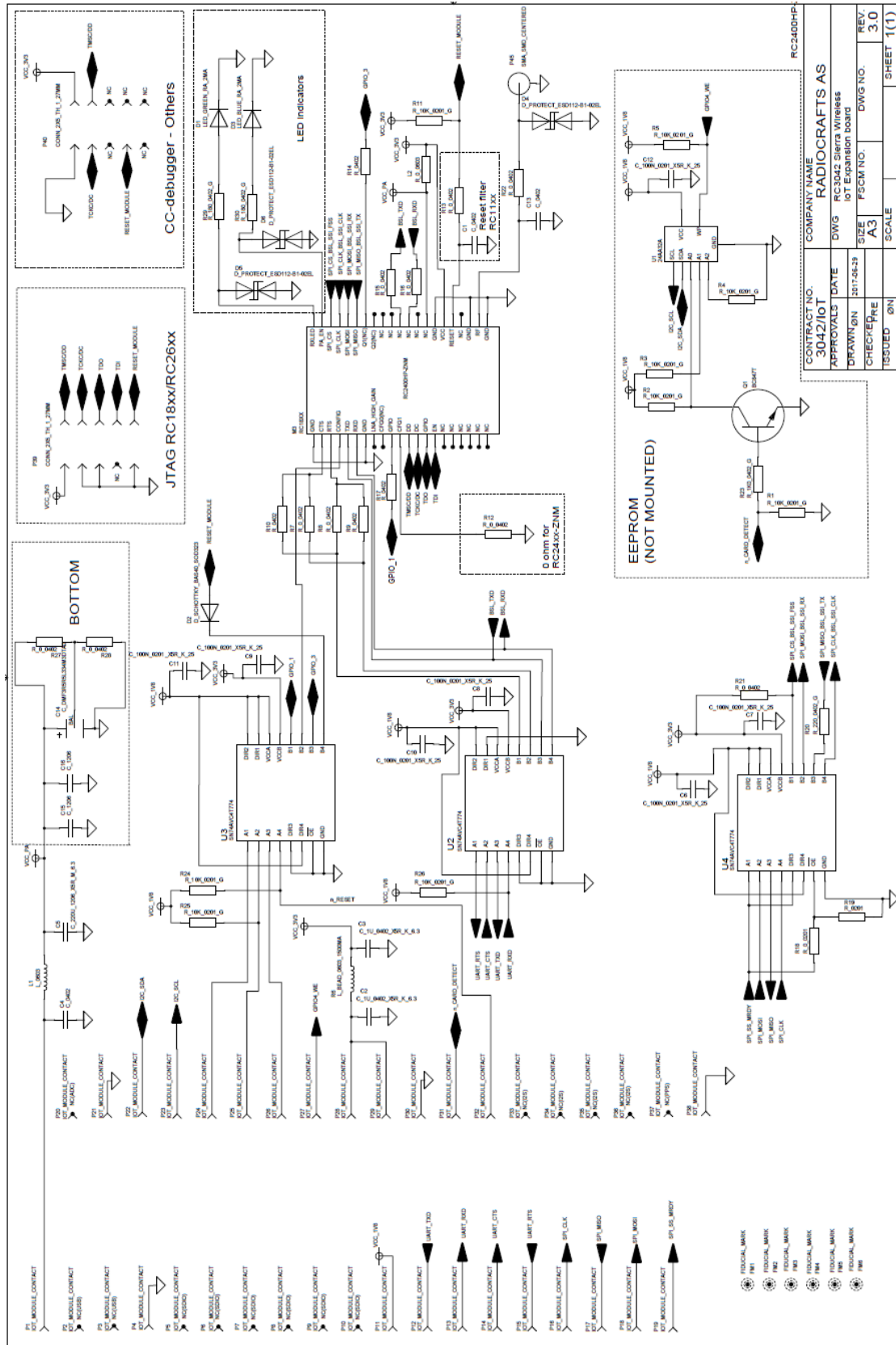


Figure 4. RC1880CEP-IEB schematic



CONTRACT NO.	RC2400HP
COMPANY NAME	RADIOCRAFTS AS
DWG	RC3042 Selects Wireless IoT Expansion board
APPROVALS / DATE	
DRAWN ON	2017-06-29
CHECKED BY	A3
ISSUED	09/1
SCALE	
DWG NO.	
FSCM NO.	
REV.	3.0
SHEET 1(1)	

Figure 5 RC2400HP-ZNM-IEB schematic



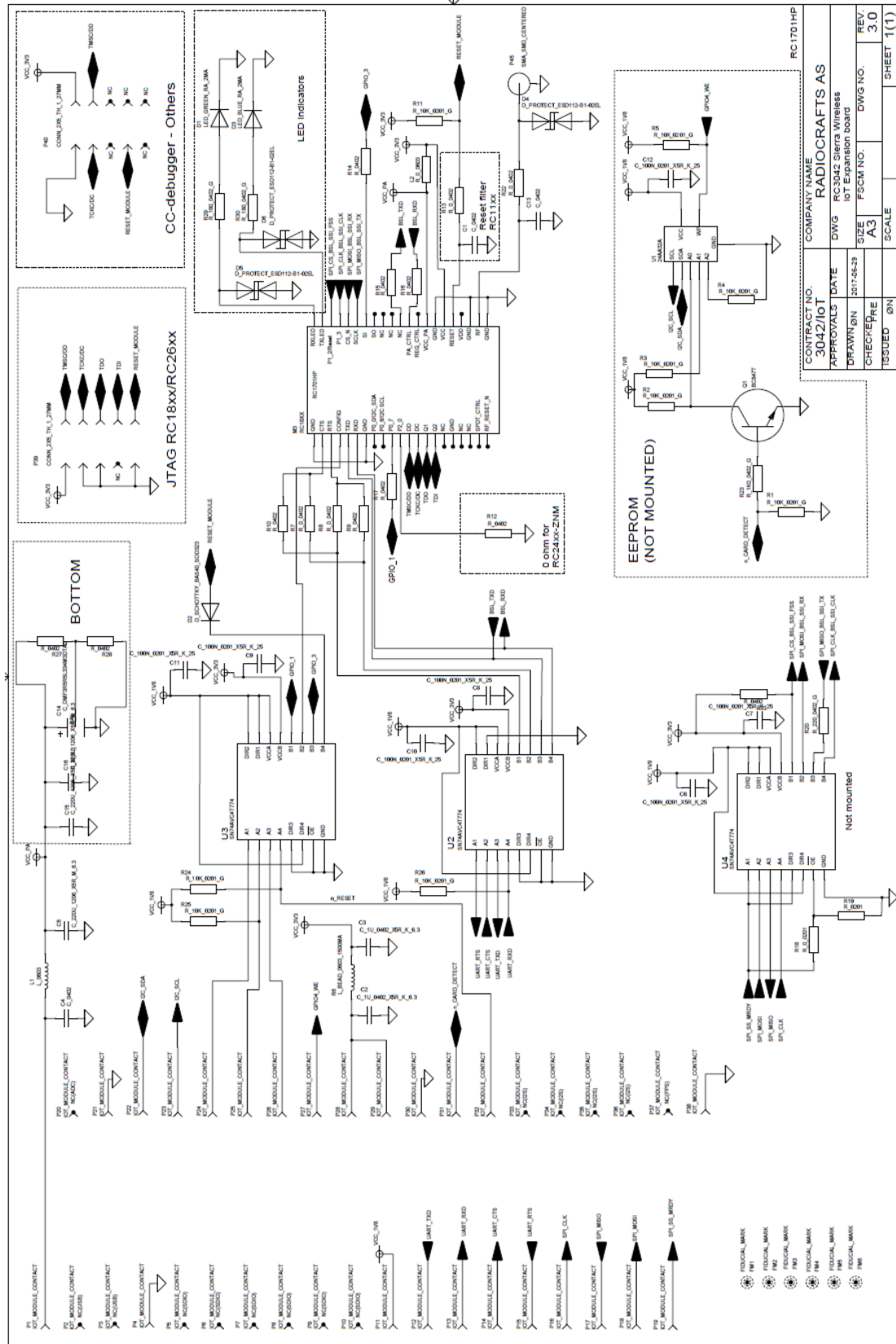
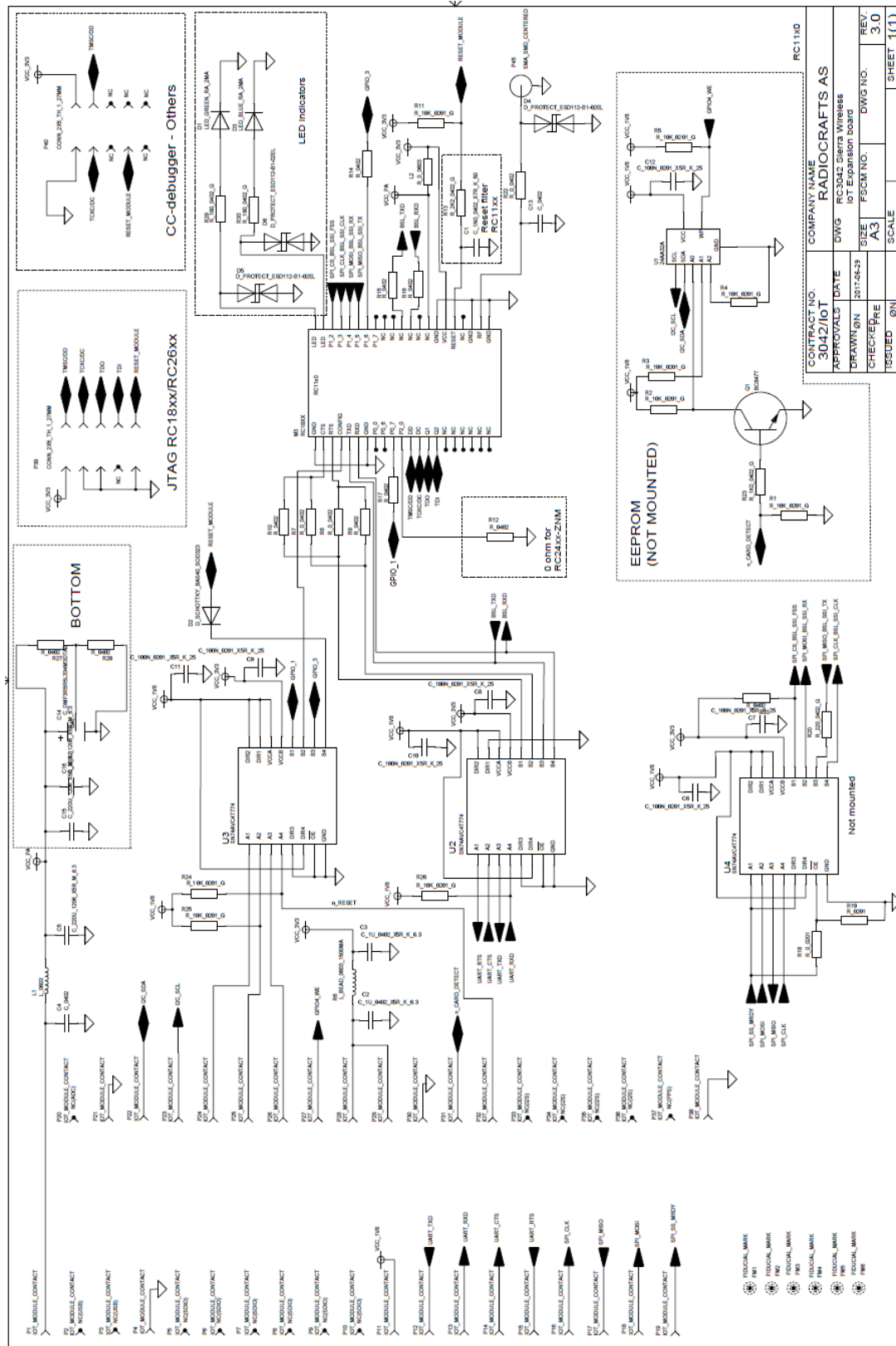


Figure 4: RC1701HP-MBUS4-IEB schematic

CONTRACT NO. 3042/101		COMPANY NAME RADIOCRAFTS AS	
APPROVALS DATE		DWG RC3042 Sierra Wireless IoT Expansion board	
DRAWN ON 2017-06-23		SIZE A3	
CHECKED/FRE		FSCM NO.	
ISSUED ON		DWG NO.	
		REV. 3.0	
		SHEET 1(1)	





CONTRACT NO.	3042/101
APPROVALS DATE	
DRAWN BY	AS
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ISSUED	08N
SCALE	
COMPANY NAME	RADIOCRAFTS AS
DWG	RC3042 Sierra Wireless IoT Expansion board
SIZE	A3
FSCM NO.	
DWG NO.	
REV.	3.0
SHEET	1(1)

Figure 5: RC1180-MBUS3-IEB schematics

### RCxxxx-IEB PCB and Assembly layout

The PCB is a 4-layer board where Layer 2 is used as ground plane. The laminate used is compliant to IPC4101D/126 giving excellent reliability in challenging environment. The PCB is 1.0 mm thick. PCB is edge bevelled/chamfered where it connects to host for easy and repeated mating with connector at host.

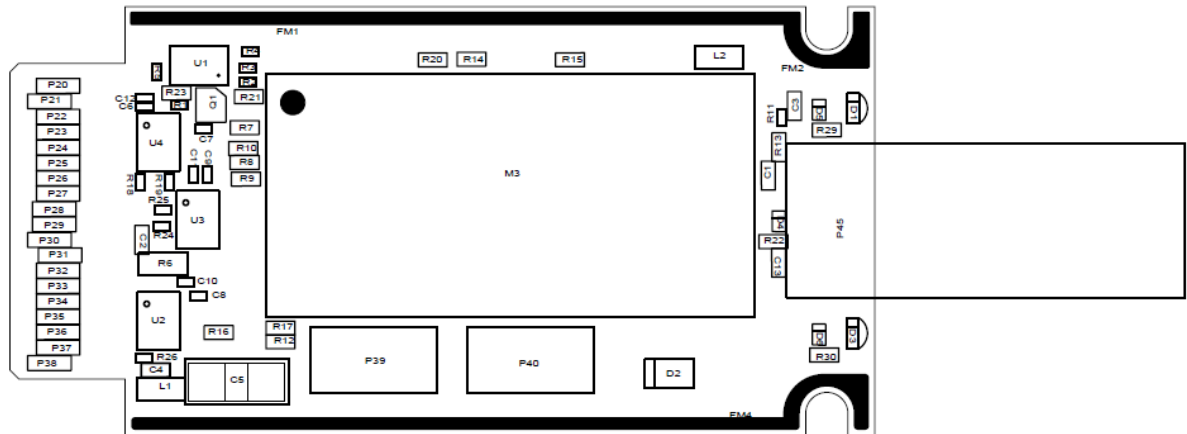


Figure 6: RCxxxx-IEB PCB component placement, top side

### Mechanical Drawing

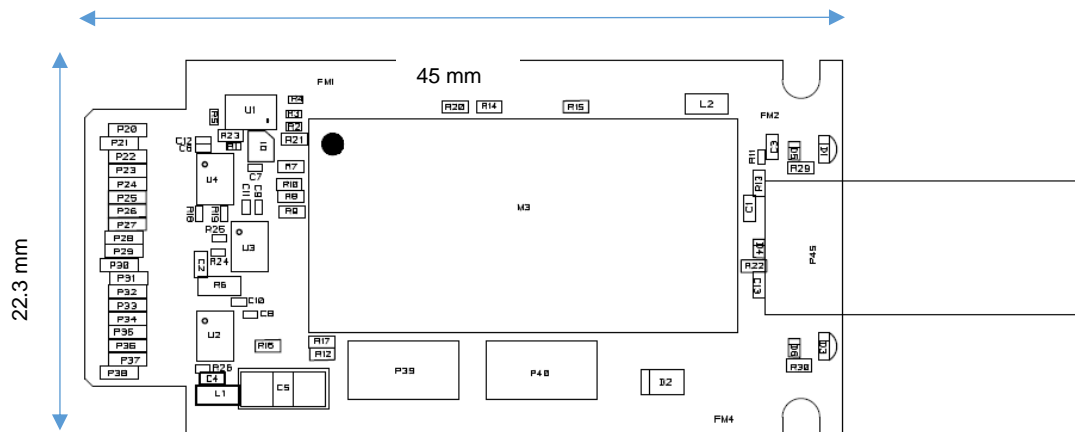


Figure 7: Mechanical drawing

### Mechanical Dimensions

The board size is 35.7 x 57.0 x 4.1 mm (total height for PCB and module).

### Article Numbers

Ordering Number	Module Description	Availability
RC1180-MBUS3-IEB	Embedded Wireless M-Bus protocol (EN13757-4:2005, 868 MHz radio)	Standard parts
RC2400HP-ZNM-IEB	ZNM module for 2.45 GHz mesh	
RC1701HP-MBUS4-IEB	Embedded Wireless M-Bus protocol (EN13757-4:2005, 169 MHz radio) for gas, water, heat and electricity meter readings	
RC1880CEF-IEB	IEEE 802.15.4g connectivity Module is delivered as HW platforms, but as part of our internal tests the module is loaded with COP freeware. <sup>2</sup>	
RC1180-RC232-IEB	868 and 915 MHz high speed modules, RC232 protocol	Non standard parts. Contact Radiocrafts sales for lead time and MOQ
RC1190-RC232-IEB		
RC1180-TM-IEB	Tinymesh gateway	
RC1170-TM-IEB		
RC1701HP-RC232-IEB	169 MHz module with RC232 firmware	

Other variants are available upon request.  
Please contact [sales@radiocrafts.com](mailto:sales@radiocrafts.com)

<sup>2</sup> The COP FW is a firmware image which implements the MAC IEEE 802.15.4-2006 standard in a dedicated system on a chip (SoC), providing a simple serial interface to an external host processor for control and processing of the Co-Processor operations.  
[http://dev.ti.com/tirex/content/simplelink\\_cc13x0\\_sdk\\_1\\_40\\_00\\_10/docs/ti154stack/ti-15.4-stack-cop-interface-guide.pdf](http://dev.ti.com/tirex/content/simplelink_cc13x0_sdk_1_40_00_10/docs/ti154stack/ti-15.4-stack-cop-interface-guide.pdf). The image is also available for download on [www.radiocrafts.com](http://www.radiocrafts.com).

### Document Revision History

Document Revision	Changes
1.00	First release
1.01	Part number update on RC1880 variant
1.02	Name change from –FX30 to IEB in order to also focus on mangOH

### Disclaimer

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As far as possible, major changes of product specifications and functionality, will be stated in product specific Errata Notes published at the Radiocrafts website. Customers are encouraged to check regularly for the most recent updates on products and support tools.

### Trademarks

RC232™ is a trademark of Radiocrafts AS. The RC232™ Embedded RF Protocol is used in a range of products from Radiocrafts. The protocol handles host communication, data buffering, error check, addressing and broadcasting. It supports point-to-point, point-to-multipoint and peer-to-peer network topologies.

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