TRN-2012/TRN-2113 Integration Specification

On-Ramp Wireless Incorporated
10920 Via Frontera, Suite 200
San Diego, CA 92127
U.S.A.

TRN-2012 / TRN-2113 Integration Specification

014-0047-00 Rev. C

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Revision History

Revision	Release Date	Change Description
A	December 4, 2012	Initial release
B	March 11, 2013	Updated: ■ Document reference list in the Overview chapter ■ Provisioning Process and Work Flow information Added: ■ New chapter on Operating and Troubleshooting
C	May 13, 2013	Updated product names, block diagrams, and regulatory/certification information.

1 Overview

The purpose of this document is to provide guidelines allowing an integrator to design a host product that uses the TRN-2012 MCM (Meter Communications Module) or the TRN-2113 MCM and ensures that the system meets all of its technical objectives and requirements.

1.1 On-Ramp Wireless Total Reach Network

The On-Ramp Wireless Total Reach Network is comprised of host modules, such as TRN-2012/TRN-2113 modules equipped with microNodes, and Access Points (APs). The network operates in the unlicensed 2.4 GHz ISM band. The TRN-2012 and TRN-2113 circuit boards are designed to easily integrate into electric meters, through standard interfaces, enabling robust wireless communication with one or more APs interfaced with a service provider's local or wide area network.

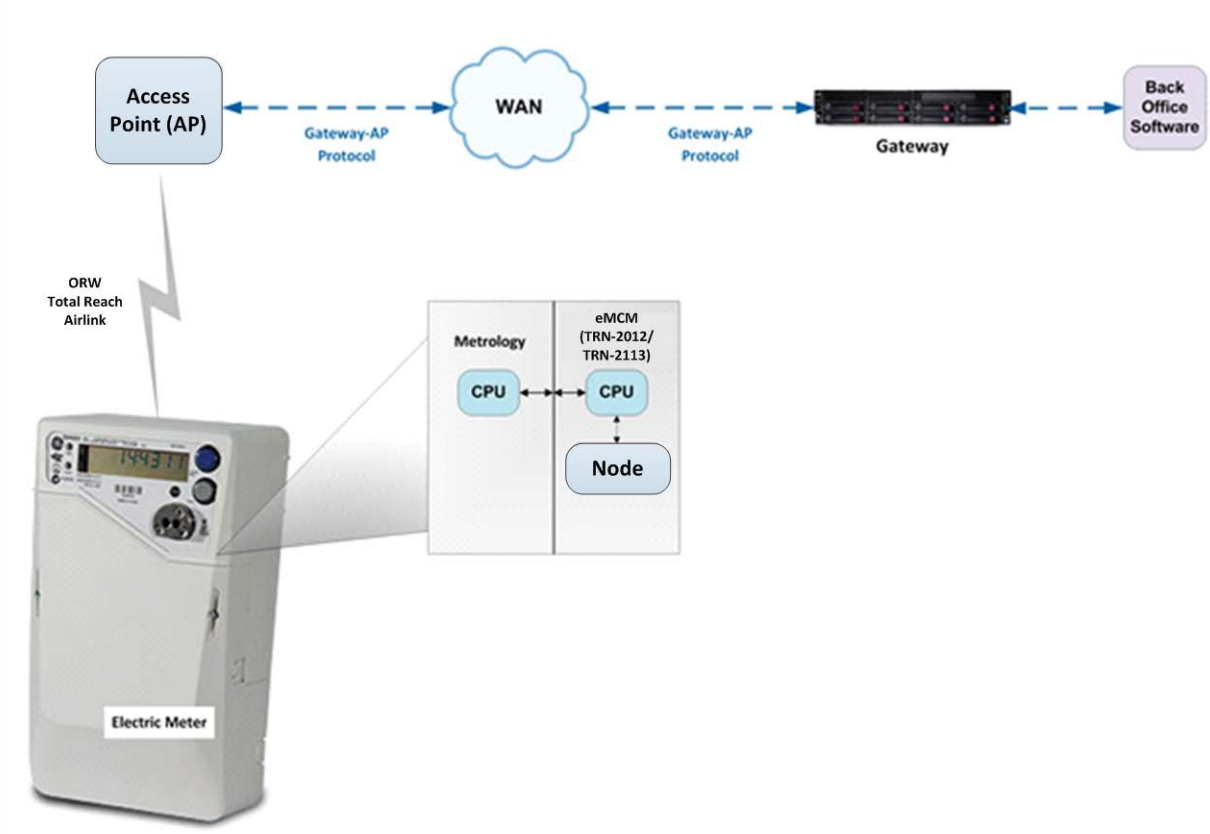


Figure 1. On-Ramp Wireless Total Reach Network

1.2 Model Numbers

- TRN-2012 with internal antennas
- TRN-2113 with external antennas

1.3 Referenced Documents

The following documents are referenced and provide more detail:

- **Test Mode Software Interface**
  Appendix B of this manual provides details relating to the Test Mode Interface.
- **TRN-2012 and TRN-2113 ETSI EMC Test Reports**
  The EMC Test Reports from third party labs authorized to conduct these tests.
- **Provisioning Guide (010-0074-00)**
  Describes setup, configuration, and use of a collection of utilities called Node Provisioning Tools (NPT) used for Node provisioning.
- **Node Host Message Specification (014-0020-00)**
  Provides details relating to Node Host commands and messages.
- **GE Energy, Operating Level Procedure (OLP): On-Ramp Wireless' Meter Communication Module**
  Describes the incoming/outgoing inspection and RMA process.
- **On-Ramp Wireless Document 008-0013-00, Process, Return Material Authorization (RMA)**
  Describes the handling and RMA process between GE and On-Ramp Wireless.

2 DC and RF Characteristics

2.1 Absolute Maximum Ratings

Operation outside of the Absolute Maximum Ratings may damage the module.

Table 1. Absolute Maximum Ratings

Parameter	Min	Max	Unit
Storage Temperature (Ts)	-40	85	ºC
Ambient Temperature (Ta)	-40	85	ºC
Input Voltage (VBATT)	0.0	18.0	V

2.2 Recommended Operating Conditions

Operation outside of the Recommended Operating Conditions may not yield proper operation.

Table 2. Operating Conditions

Parameter	Min	Nominal	Max	Unit
Ambient Temperature (Ta)	-40	25C	85	ºC
Input voltage (VBATT)	8.0	12.0V	16.0	V

2.3 Operating Characteristics for all Models

The following characteristics apply across the -40°C to +85°C temperature range unless otherwise noted.

Table 3. Operating Characteristics

Parameter	On-Ramp Wireless TRN-2012 / TRN-2113 Module
Frequency	2.4 GHz ISM
Bandwidth	1 MHz nominal
Modulation	Dynamic-Direct Sequence Spread Spectrum (D-DSSS)
Multiple Access Scheme	Random Phase Multiple Access (RPMA)
Transmit Power (peak EiRP)	+10 dBm (ETSI markets includes peak internal/external antenna gain)
Receive Sensitivity	-136 dBm (includes peak internal or external antenna gain)
Antenna Options	Integrated antenna diversity **or** external antenna diversity
Data Throughput	60 kbps (at access point in 1 MHz channel bandwidth)
Maximum Allowable Path Loss	150 dB
TX Burst Time	≈ 2.2 Seconds
RX Burst Time	≈ 2.5 Seconds

Parameter	On-Ramp Wireless TRN-2012 / TRN-2113 Module
Current Consumption	0.10A max. @ 12VDC (during TX[1]) 0.13A max. @ 12VDC (during RX[2])
Operating Temperature	-40°C to 85°C
Relative Humidity	5% to 95% non-condensing
Security	AES 128-bit payload encryption, mutual authentication of network elements
Certifications	ETSI EMC certifications are pending for the TRN-2012 and the TRN-2113. Meter ANSI and Unintentional Radiator certifications required once integrated into the meter product.

NOTE 1: During TX mode the supercap charger is disabled to reduce peak currents. However under manual control (not a link) this current could be up to 0.14A.

NOTE 2: During RX mode the supercap charger is enabled. The supercap charge current is limited to about 40mA at 12VDC input.

NOTE 3: Specifications subject to change.

2.4 Power Supplies

The TRN-2012 and the TRN-2113 utilize two main power supplies when functioning:

1. **Initial Switching Power Supply and Supercap Charger (~4.4VDC output)**
   This buck-type switching power supply is used to lower the wide input voltage range and charge the super capacitors. It is in use at all times when primary power is applied.
2. **Main switching power supply (3.3VDC output)**
   This main buck/boost switching power supply is operating at all times. It supplies power to all digital and radio circuits. It is normally sourced by the Initial power supply. However when primary power is interrupted the super caps become the source of power to this regulator.

Additionally the microNode module on the TRN-2012/TRN-2113 printed circuit board has its own switching power supply (buck-boost) that uses, as its source, the main switching power supply (3.3V) of the TRN-2012/TRN-2113.

3 Electrical Interface

This chapter describes the electrical interface for the TRN-2012 (with internal antennas) and the TRN-2113 (with external antennas).

3.1 Signal Connectors

Each side of the TRN-2012 and the TRN-2113 printed circuit boards is shown in Figure 2 and Figure 3.

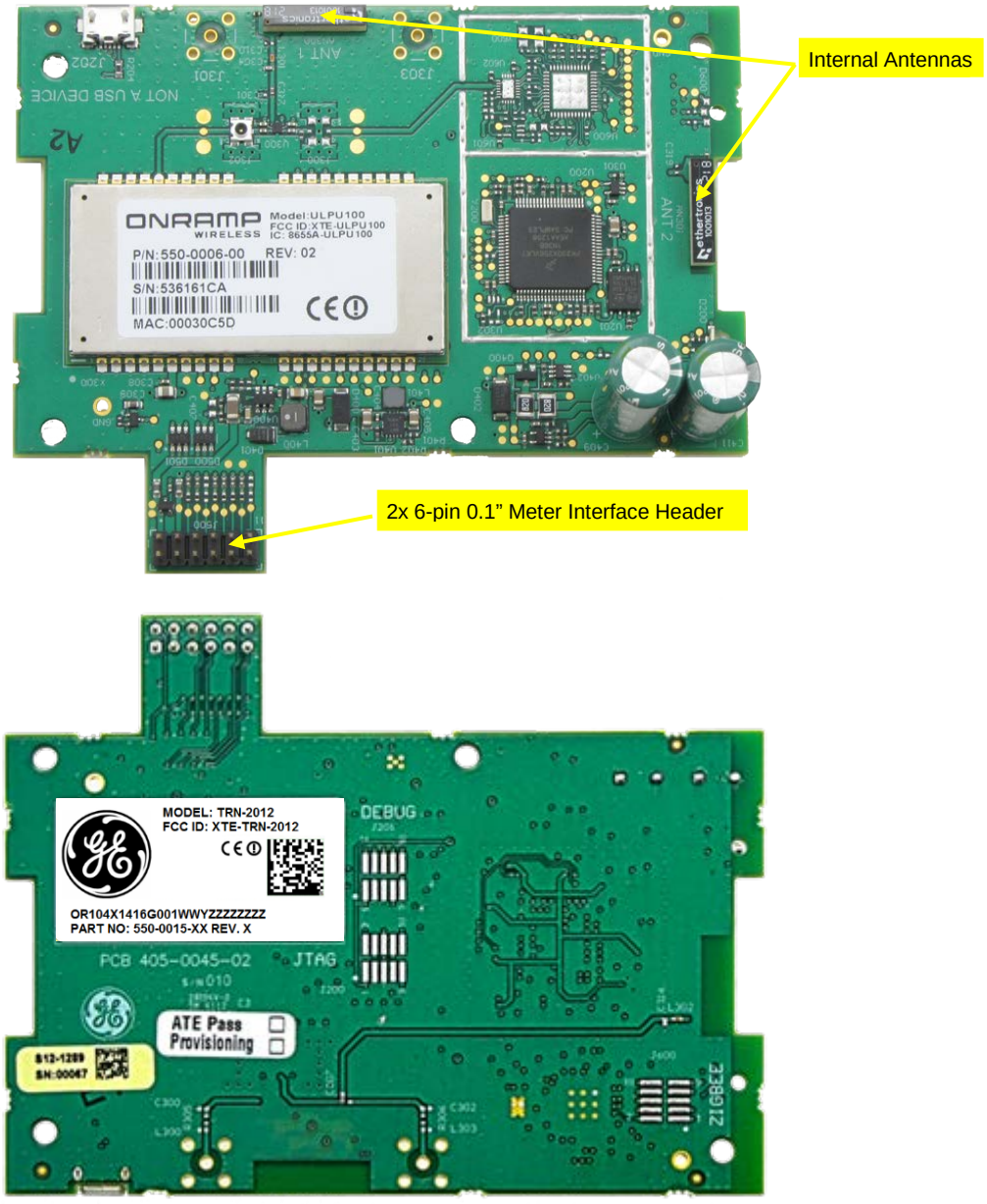


Figure 2. TRN-2012 with Internal Antennas (Top and Bottom Views)

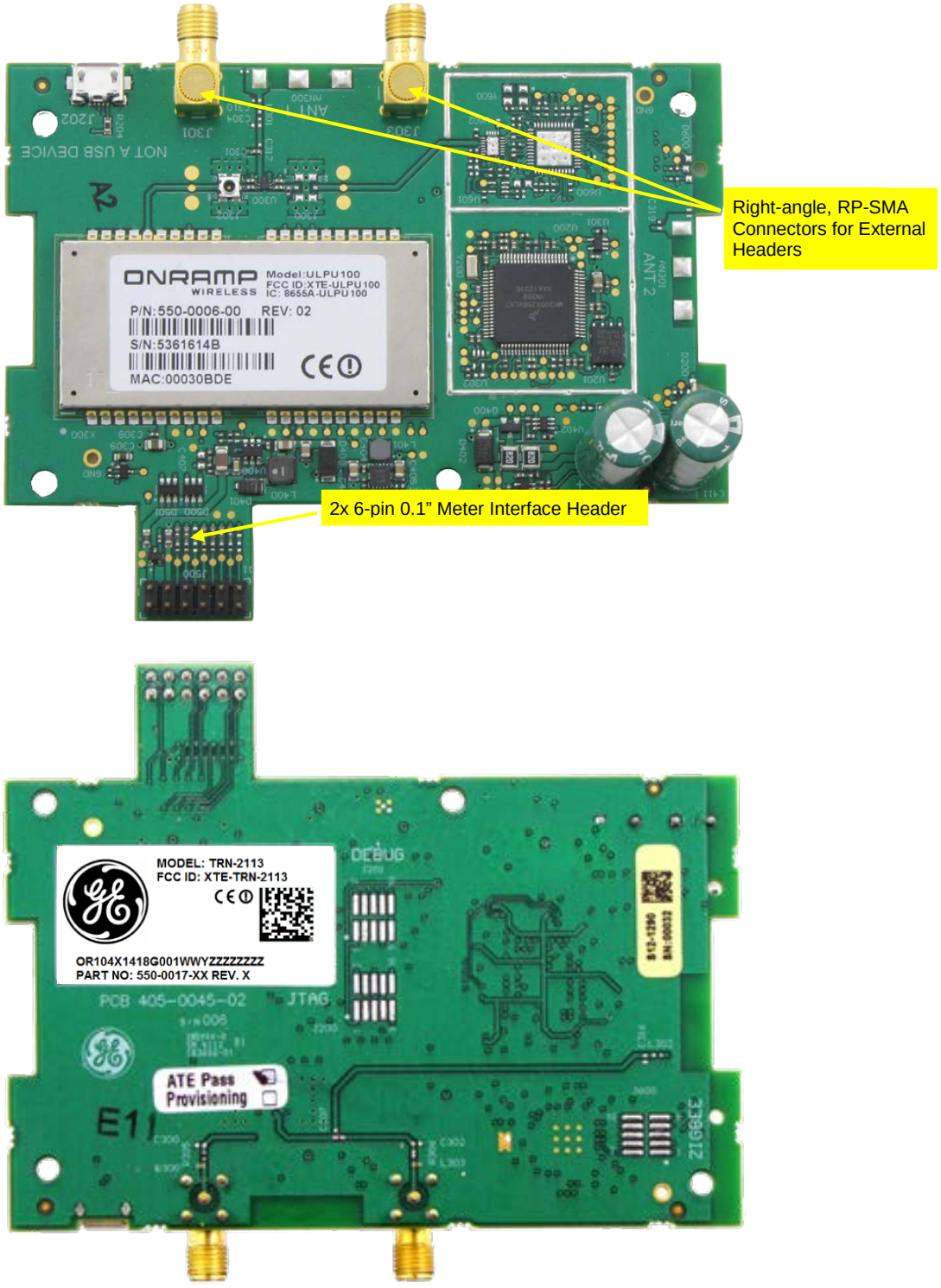


Figure 3. TRN-2113 with External Antennas (Top and Bottom Views)

3.2 Pin and Signal Descriptions

3.2.1 Main signal connector

The following table lists the pins and signals for J500, the signal, and the power connector.

Table 4. Pins and Signals for J500 Signal and Power Connector

MCM Pin #	Pin Name	Signal Description
1	DC Power input	12VDC input to the TRN-2012 / TRN-2113 from the meter.
2	3.3VDC Power output	3.3V regulated power supply from the TRN-2012 / TRN-2113 to the meter interface.
3	GROUND	Meter ground
4	GROUND	Meter ground
5	RESET_b	Reset signal from meter, active low.
6	M_RXD	Meter UART TXD, 9600 baud rate, 8bit data, 0 stop, 1 parity.
7	M_TXD	Meter UART RXD
8	M_SPARE0_F	Spare 0 is not used.
9	M_PWR_FAIL	Power fail signal from meter, active low = fail.
10	M_TROUBLE_MTR	Trouble signal from meter; 3.3V active high = trouble.
11	M_SPARE1_F	Spare 1 is not used.
12	M_TROUBLE_AMI	Trouble signal from the TRN-2012 / TRN-2113; 3.3V active high = trouble.

3.2.2 RF Connectors

The model TRN-2113 has two reverse polarity SMA jack connectors for connection to external antennas. The proper mating connector is an SMA reverse polarity plug. The proper tightening torque is 80 N-cm (7 in-lbs).

3.3 Environmental

3.3.1 ESD

The TRN-2012/TRN-2113 has ferrite beads, series resistors, and bidirectional ESD protection diodes on its 8 digital I/O pins providing protection to IEC 61000-4-2; level 4.

Table 5. ESD Rating

ESD Model	Class and Minimum Voltage
HBM	Class 1C (>1000V)
MM	Class A (>100V)

The SMA connectorized models have protection in the form of an inductor to ground, thus allowing some robustness to direct ESD strikes. The internal antenna models are encapsulated in the polycarbonate housing of the meter – so there is little chance of high voltages on the antennas.

3.3.2 Harsh Environments

The TRN-2012 and the TRN-2113 are designed to be embedded circuit boards in an enclosed protective shell. It is not designed to be exposed to outdoor environments without a case or similar protection. The casing of the meter nominally provides robustness to harsh environments and has been tested to and meets IP 54 standards.

4 Safety Considerations

Danger: High Voltages

When the TRN-2012 or TRN-2113 is integrated into a meter, high voltages may be present:

CAUTION: When the TRN-2012 or TRN-2113 is mounted in an SGM3000 series meter, the term "GND" or "Ground" does NOT refer to Earth ground. The SGM3000 is designed to provide isolation to the AMI module (i.e., TRN-2012 or TRN-2113); however, it is recommended to use additional isolation as a precaution.

The power supply from the SGM3000 to the TRN-2012/TRN-2113 is isolated to 18kV. However, it is recommended that you use the following isolation/drivers as an added safety precaution.

Isolator:

http://www.bb-elec.com/product_family.asp?FamilyId=651&webSyncID=85656815-ad8a-a188-b050-1143ad0dee45&sessionGUID=bc450985-a6c1-9981-a0d7-6391dcb1c046

UART:

This cable is defined by On-Ramp Wireless PN 210-0023-00.

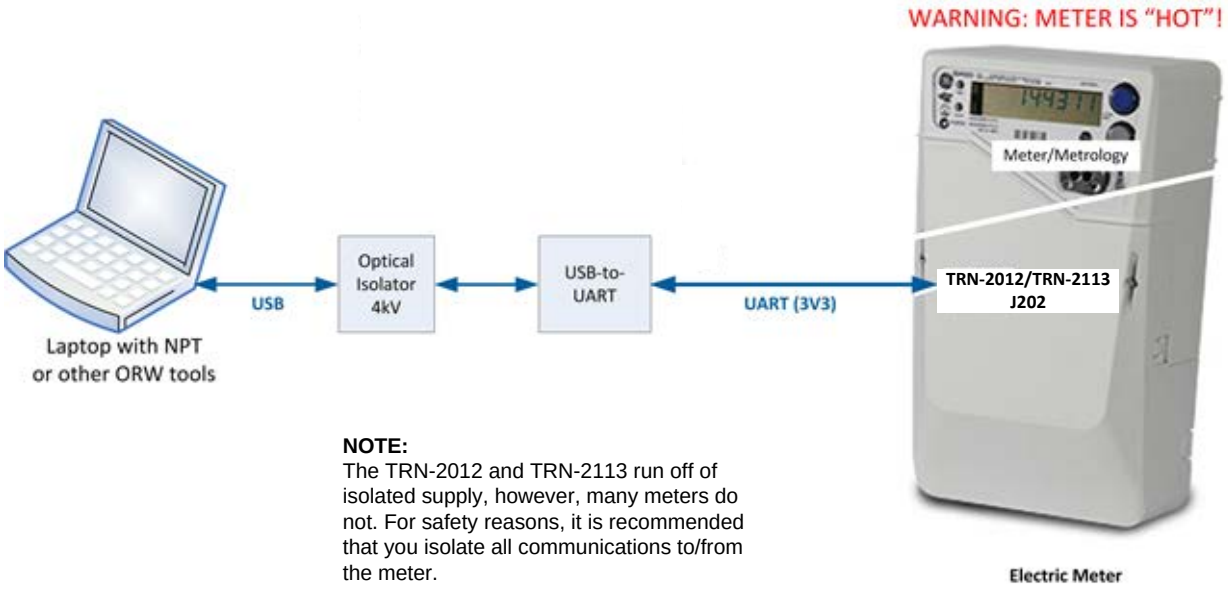


Figure 4. Meter Test Connection Diagram

5 Regulatory Considerations

The TRN-2012 uses two integral diversity antennas for half-duplex communication. In contrast, the TRN-2113 uses reverse polarity SMA connectors for external antenna connections. On-Ramp Wireless provides FCC modular approval certification as well as ETSI certification for both models. The two models were used for certification. Documents and test results are available to system integrators for review.

5.1 Block Diagrams

Some regulatory domains require a block diagram of the module for their documentation similar to that shown in the following figures.

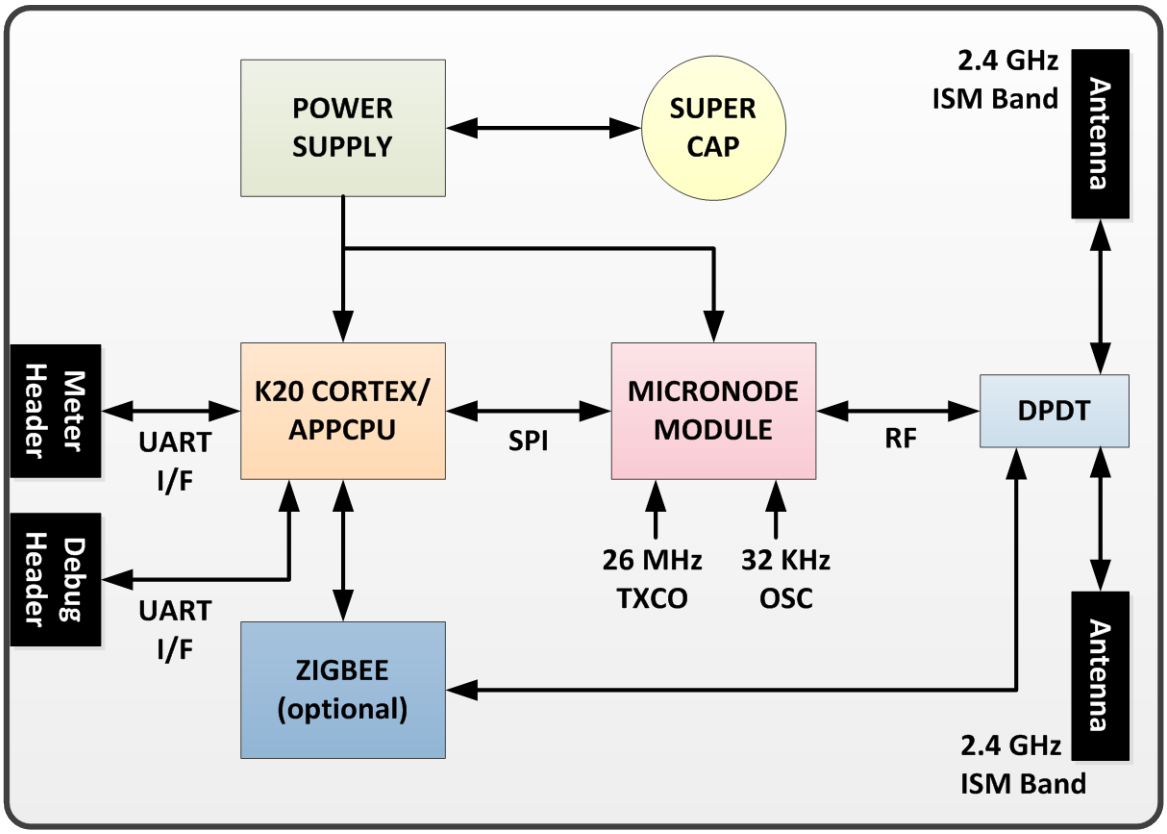


Figure 5. Block Diagram for TRN-2012 with Internal Antennas

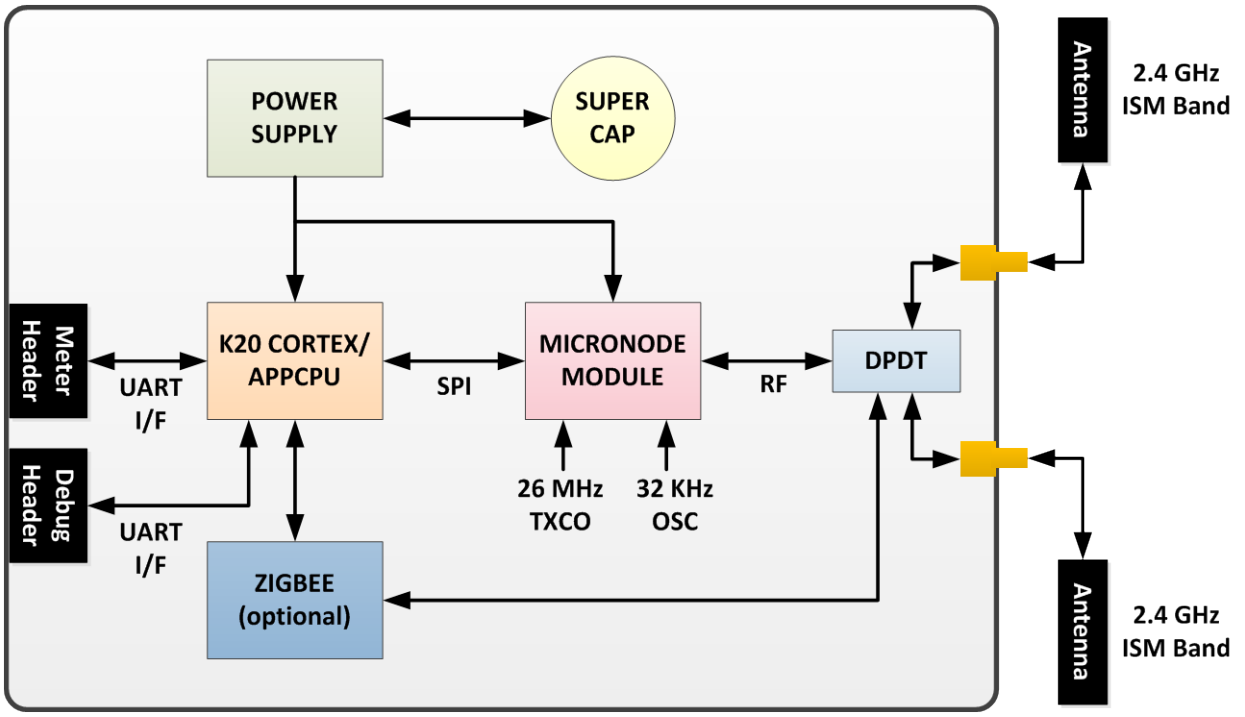


Figure 6. Block Diagram for TRN-2113 with External Antennas

5.2 Antennas

The TRN-2012 has been certified to operate with the built-in (PCB chip) antenna (Ethertronics, PN: 1001013) and the TRN-2113 has been certified to operate with the external paddle antenna (L-COM, PN: SP70550). Adherence to these EMC certifications requires that only these antennas be used. All other antennas with greater peak gain are strictly prohibited for use with the TRN-2012/TRN-2113 unless new EMC certifications are obtained.

Table 6. On-Ramp Wireless EMC Certified Antenna

Product	Manufacturer	Part Number	Gain	Type	Comments
TRN-2012	Ethertronics	1001013	2.1 dBi	Monopole	Internal PCB chip antenna
TRN-2113	L-COM	SP70550	4.72 dBi	Monopole	External SMA connectorized paddle antenna

For the TRN-2113, customers are free to follow one of two paths in their final product:

- Customers can use an antenna type with a gain ≤4.72 dBi. This path allows customers to use On-Ramp Wireless' certifications. While ideal from the perspective of program cost and schedule, the ability to reuse this antenna is highly dependent on the application.
- Customers can recertify the final product with any antenna type and gain desired. In the case of FCC EMC certifications, it is almost always required for the final product to be recertified with the Node. If this is the case, note that the recertification is the required time to introduce the final product's actual antenna.

5.3 EMC Certifications

The TRN-2012 and the TRN-2113 are designed to meet regulations for world-wide use. It has EMC modular approval certifications in Europe and South Africa and certification is pending in the United States. These certifications allow the TRN-2012 and the TRN-2113 to be installed in any final product in Europe, South Africa, and the United States and only Unintentional Radiator testing is required for the final product. This saves cost and time for System Integrators. The certifications currently achieved are listed in the following table.

Table 7. TRN-2012 / TRN-2113 EMC Compliance Certifications

Country	Certifying Agency	Certification(s)
United States (Certification Pending)	Federal Communications Commission (FCC)	■ 15.207 for power-line conducted emissions. ■ 15.215 for RF TX bandwidth, power, conducted and radiated emissions.
Europe	European Telecommunications Standards Institute (ETSI)	■ 300 440-1 and 440-2, ETSI Emissions. ■ 301 489-1, ETSI Immunity.
South Africa	ICASA	■ SABS CoC (EMC, based on ETSI)

The integrator of the final product is often required to do additional compliance tests. The integration application and market will determine the specifics. The integrator is advised to consult with local experts in compliance certifications for complete information.

- **FCC**
  Both the TRN-2012 and the TRN-2113 are Single-Modular Certified, therefore the final product may only need Class B unintentional radiator and power-line conducted emissions tests. This should be done with the actual production antenna.
- **ETSI**
  Europe's system is a self-declaration system. There are no documents to submit or certification grants to obtain. One must have the passing test results available for all applicable requirements at any time if challenged.
- Other countries will vary.

5.4 FCC Warnings

This device complies with part 15 of the Federal Communications Commission (FCC) Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

WARNING: **This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, this equipment may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:**

- **Re-orient or relocate the receiving antenna.**
- **Increase the separation between the equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- **Consult the dealer or an experienced radio/TV technician for help.**

5.5 ETSI Warnings

None known.

5.6 Usage

FCC ID: XTE-TRN-2012 (or XTE-TRN-2113). This device is only authorized for use in fixed and mobile applications. To meet FCC and other national radio frequency (RF) exposure requirements, the antenna for this device must be installed to ensure a separation distance of at least 20cm (8 inches) from the antenna to a person.

5.6.1 Product Labels

A label showing the FCC ID designator, listed above, must be affixed to the exterior of any device containing the TRN-2012 or TRN-2113 (if the TRN-2012/TRN-2113 is not visible). The exterior label must include: *Contains FCC ID: XTE-TRN-2012 (or XTE-TRN-2113)*.

Product labels for both the TRN-2012 and the TRN-2113 are shown in Figure 7 and Figure 8. A carton label sample is shown in Figure 9.

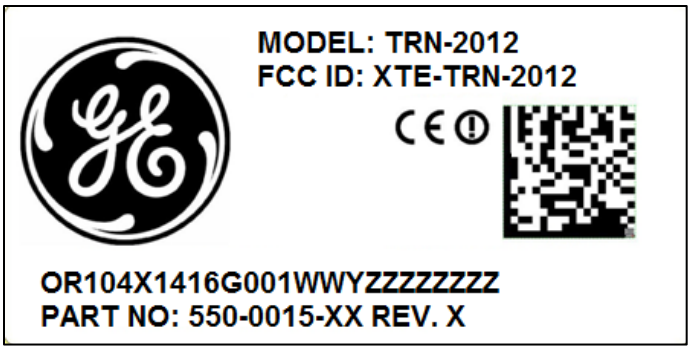


Figure 7. TRN-2012 Product Label

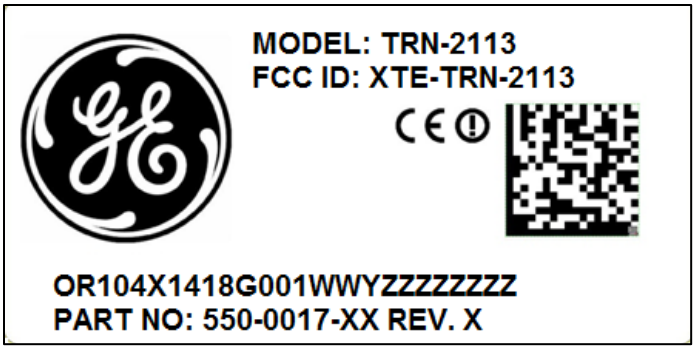


Figure 8. TRN-2113 Product Label

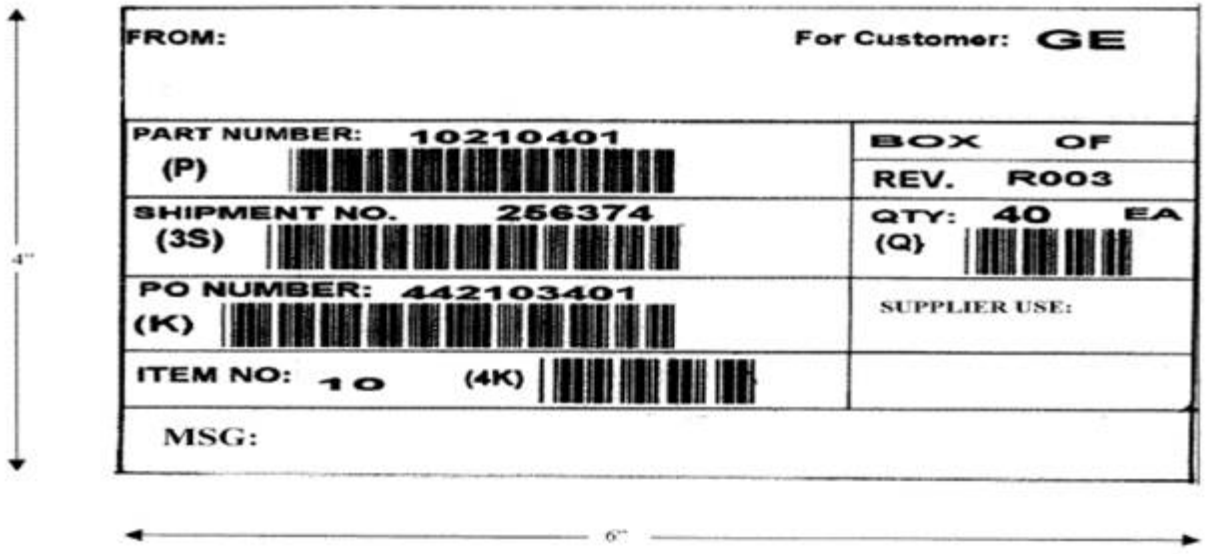


Figure 9. Carton Label

5.6.2 RF Exposure Statement

The air interface supports operation on channels in the 2402 MHz – 2476 MHz range for FCC/IC regulatory domains and 2402 MHz – 2481 MHz for the ETSI regulatory domain.

Before this product becomes operational, it must undergo a commissioning procedure, during which critical information required for operation is entered into the device and stored in non-volatile storage. It is during the initial commissioning procedure that the regulatory domain, under which the device will operate, is set. Subsequent configuration of the device during operation is checked against the commissioned regulatory domain and non-permitted channels or transmit power levels are rejected and the device will not transmit until a permissible configuration per the commissioned regulatory domain is set.

5.7 WEEE Directive

The TRN-2012, TRN-2113, and microNode are not considered “end products” that put them under the WEEE initiatives in the EU. The WEEE directives do not apply to the TRN-2012/TRN-2113 products.

5.8 REACH Directive

As of August 2012 the TRN-2012 and the TRN-2113 are REACH compliant under 1907/2006/EC. On-Ramp Wireless expects to receive a declaration of conformance from the Taiwan-based manufacturer of the Node starting in September 2012. REACH compliance statements are found in Appendix C.

5.9 RoHS Directive

The TRN-2012, TRN-2113, and Node all comply with RoHS directive 2002/95/EC. On-Ramp Wireless has received Certificates of Conformance (CoC) for all components, printed circuit boards and contract manufacturers for the TRN-2012, TRN-2113, and Node. Copies of the CoCs are stored at On-Ramp Wireless and available upon request.

6 Installation of TRN-2012/TRN-2113 Boards

The TRN-2012 and TRN-2113 boards are simply inserted and removed as shown in the following figures. The two plastic side tabs of the SGM30xx lock the TRN-2012/TRN-2113 module into place and the 12-pin connector is easily guided into the SGM30xx connector by form fit. Figure 10 and Figure 11 show how the TRN-2012 and TRN-2113 boards are mounted inside the GE meter.

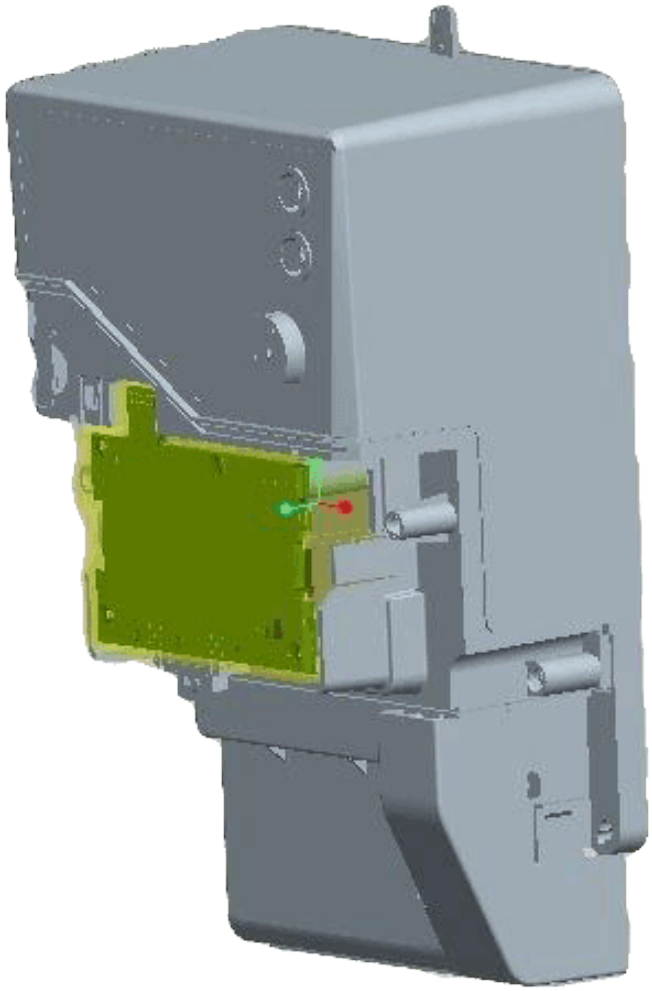


Figure 10. Meter Assembly with TRN-2012 or TRN-2113 Board

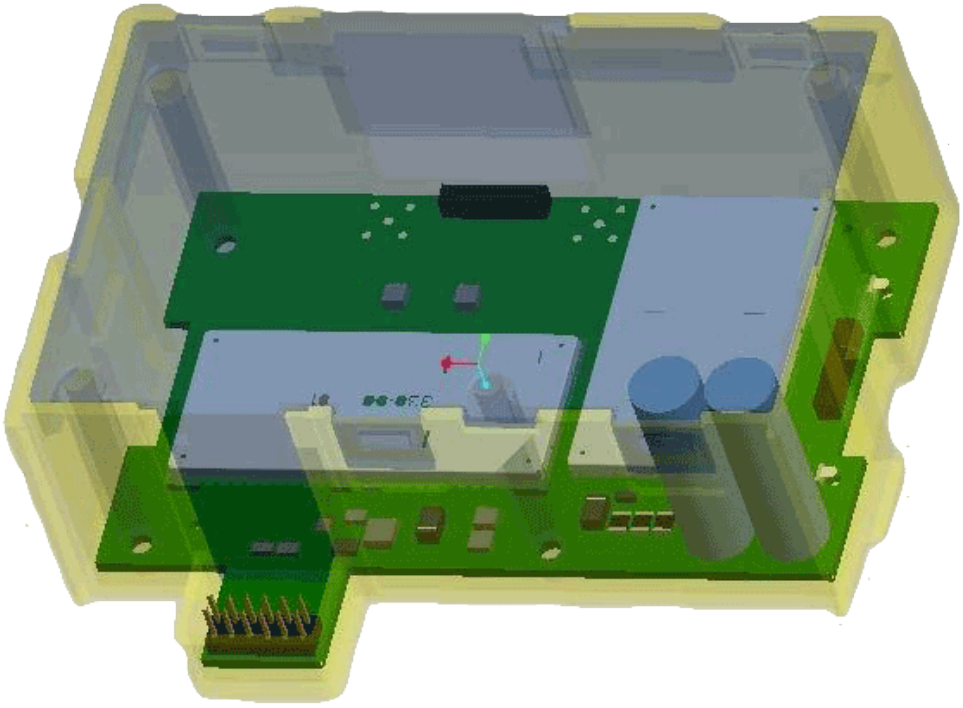


Figure 11. Detail of TRN-2012 or TRN-2113 Board Mounting in Plastic Case

NOTE: When mounting the TRN-2113, which has external antennas, you must first remove the perforated tabs on the plastic case to allow the antenna connectors to extend outside the plastic case.

7 Operating and Troubleshooting

This section provides an overview of the functionality and how best to troubleshoot a module.

7.1 Operating

The operating mode of the TRN-2012/TRN-2113 is simple in concept but has many nuances. For a pictorial view of the system, refer to Figure 1. On-Ramp Wireless Total Reach Network.

1. When the TRN-2012/TRN-2113 powers up, it looks for a wireless Access Point (AP). This could take up to a minute or so, depending on a number of factors.
2. The TRN-2012/TRN-2113 uses a channel list that is set up and configured during provisioning at the factory. Provisioning configures what radio channels the APs should use and the security keys required. The provisioned security keys keep customers isolated so that the TRN-2012/TRN-2113 will not join a non-authorized network.
3. When the TRN-2012/TRN-2113 finds an appropriate AP, it sends a registration request to the AP and is accepted onto the network, assuming all its security is good and intact.
4. Once enabled on the RF network, the TRN-2012/TRN-2113 can be controlled by the network and share its meter readings with the network.
5. At a low level, the TRN-2012/TRN-2113 is connected to the SGM3000 meter via a 3.3V UART interface (12-pin connector). The physical interface of the TRN-2012/TRN-2113 is powered through the meter and gathers other detailed operational status of the meter. Another signal example of the physical interface is a power fail signal. This signal, when asserted, alerts the TRN-2012/TRN-2113 that power is about to go away; the TRN-2012/TRN-2113 then must clean up services and send a radio “power fail” message back to the network.
6. Across this physical interface, the TRN-2012/TRN-2113 communicates via an ANSI C12.19 protocol. The meter and the TRN-2012/TRN-2113 share information in this way.
7. When the network requests a demand reading of the meter’s current energy consumption, the following occurs:
   - The message is sent wirelessly to the TRN-2012/TRN-2113.
   - The TRN-2012/TRN-2113 decodes the messages and determines the actions.
   - The TRN-2012/TRN-2113 sends a request to the meter.
   - The meter responds to the TRN-2012/TRN-2113 with the requested information.
   - The TRN-2012/TRN-2113 wirelessly transmits the requested information back to the network, thus completing the action.
8. An asynchronous event in the TRN-2012/TRN-2113 is the Power Fail. When the meter detects power has disappeared, it generates a “power fail” to the TRN-2012/TRN-2113. The TRN-2012/TRN-2113 receives this digital signal and sends a power-fail back to the network control center. Since there is no power from the meter, the TRN-2012/TRN-2113 resorts to its own super-capacitors. The super-capacitors in the TRN-2012/TRN-2113 are two tall (usually green) electrolytic capacitors. These special capacitors are charged with enough

energy to allow the TRN-2012/TRN-2113 to run for a period of time and transmit the required “last gasp” message.

9. There are two LEDs (Red/Green) on the TRN-2012/TRN-2113 to indicate its status. These LEDs help troubleshoot the status of the TRN-2012/TRN-2113 in a meter. For more information about the LEDs, see Table 9. LED Blinking Patterns/States.

7.2 Troubleshooting

When the TRN-2012/TRN-2113 is properly inserted into the SGM3000, the LEDs blink during a brief self-check. If the power-on is successful, the LEDs blink for only a short time. However, if there is an issue, troubleshooting is minimal. This section provides some brief troubleshooting guidelines.

Table 8. Troubleshooting Guidelines

Problem	Action
Fatal error when powering on the TRN-2012 / TRN-2113	Note the LED color and pattern. Refer to Table 9. LED Blinking Patterns/States to determine the cause of the failure.
TRN-2012 / TRN-2113 failed to power on	Try another known working TRN-2012 / TRN-2113 module to determine if the failure is due to the TRN-2012 / TRN-2113 module or the SGM30xx meter.
TRN-2012 / TRN-2113 failed due RF disadvantaged area (e.g., excessive foliage or metal objects nearby)	Presuming that you are using a TRN-2012 with internal antennas (PN 550-0045), try using the TRN-2113 that has two, 2dBi external antennas (PN 550-0048). For more information, refer to Table 6. On-Ramp Wireless EMC Certified Antenna. For installation of the TRN-2012 or the TRN-2113 into the SGM30xx, refer to Chapter 6 Installation of TRN-2012/TRN-2113 Boards .

Table 9. LED Blinking Patterns/States

LED Color	LED Light Pattern	Activity Indicated
Green	Blinks quickly – on for 0.3 seconds, off for 0.3 seconds	Node has not JOINED or the eMCM application is ***not*** in RUN state.
Green	Blinks slowly – on for 1 second, off for 1 second	The Node has not JOINED and the eMCM application is in RUN state. In this state, the LEDs will soon turn off when the TRN-2012/TRN-2113 reaches its run state.
Red	Blinks slowly	Error initializing the wireless modem or getting the meter information was unsuccessful.
None	LEDs do not blink	There is a serious error and the device is not powering on. The module is likely defective, unless the meter itself is suspect.

7.3 RMA Process

Follow the RMA process outlined in the document entitled, *Operating Level Procedure (OLP): On-Ramp Wireless’ Meter Communication Module*.

8 Provisioning

The tools and software required for provisioning the TRN-2012/TRN-2113 are described in this section. The Provisioning process can be handled in two main ways:

- Manual for small runs
- Automatic for full production

8.1 Manual Provisioning

The Node Provisioning Tool (see referenced tools/documents) can be used to provision TRN-2012/TRN-2113 units in small quantity. The PC attaches to the DUT (device under test) TRN-2012/TRN-2113 via its Provisioning header (UART is 3.3V) and a USB Isolator, as shown in Figure 12. The J202 connector on the TRN-2012/TRN-2113 module requires a “TE Connectivity” connector (PN 1470364-3) to mate with it, as shown in Figure 13. Use the WECO provisioning software to provision one TRN-2012/TRN-2113 module at a time.

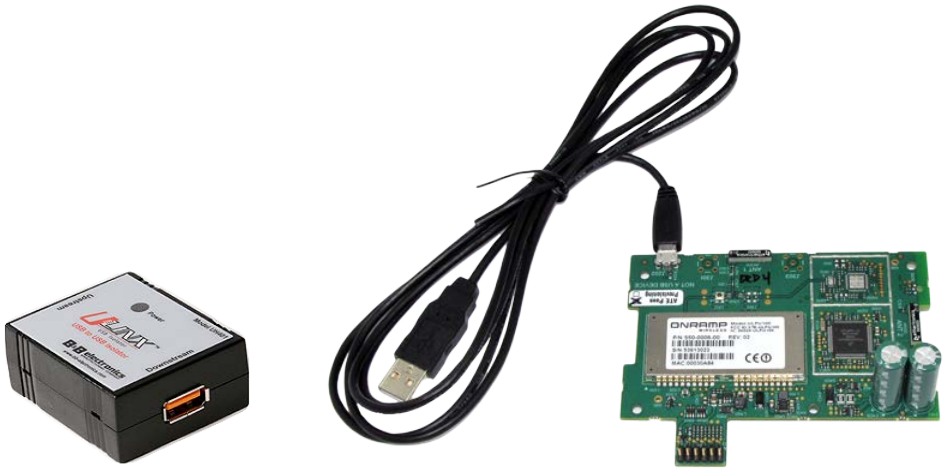


Figure 12. Manual Provisioning with Provisioning Cable and USB Isolator

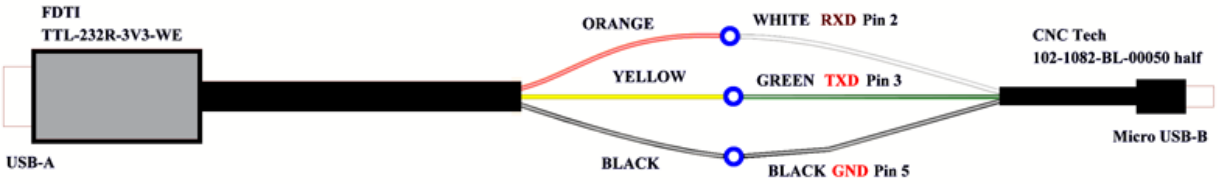


Figure 13. Provisioning Cable for TRN-2012 and TRN-2113

CAUTION: When the TRN-2012/TRN-2113 is mounted in an SGM3000 meter, the term “GND” or “Ground” does NOT refer to earth ground. All signals will have a 240VAC power imposed onto those lines. ***All signals to/from the TRN-2012/TRN-2113 board need to be isolated.*** No grounded instruments, or computers, should touch the TRN-2012/TRN-2113 board signals. ***USE A USB ISOLATOR*** in the setup as shown in Figure 4.

8.2 Automatic Provisioning

The automatic process is defined and built by the customer. On-Ramp Wireless has assisted in development of these tools but those tools are not the property of On-Ramp Wireless. The customer owns, defines, develops, documents and maintains the manufacturing tools.

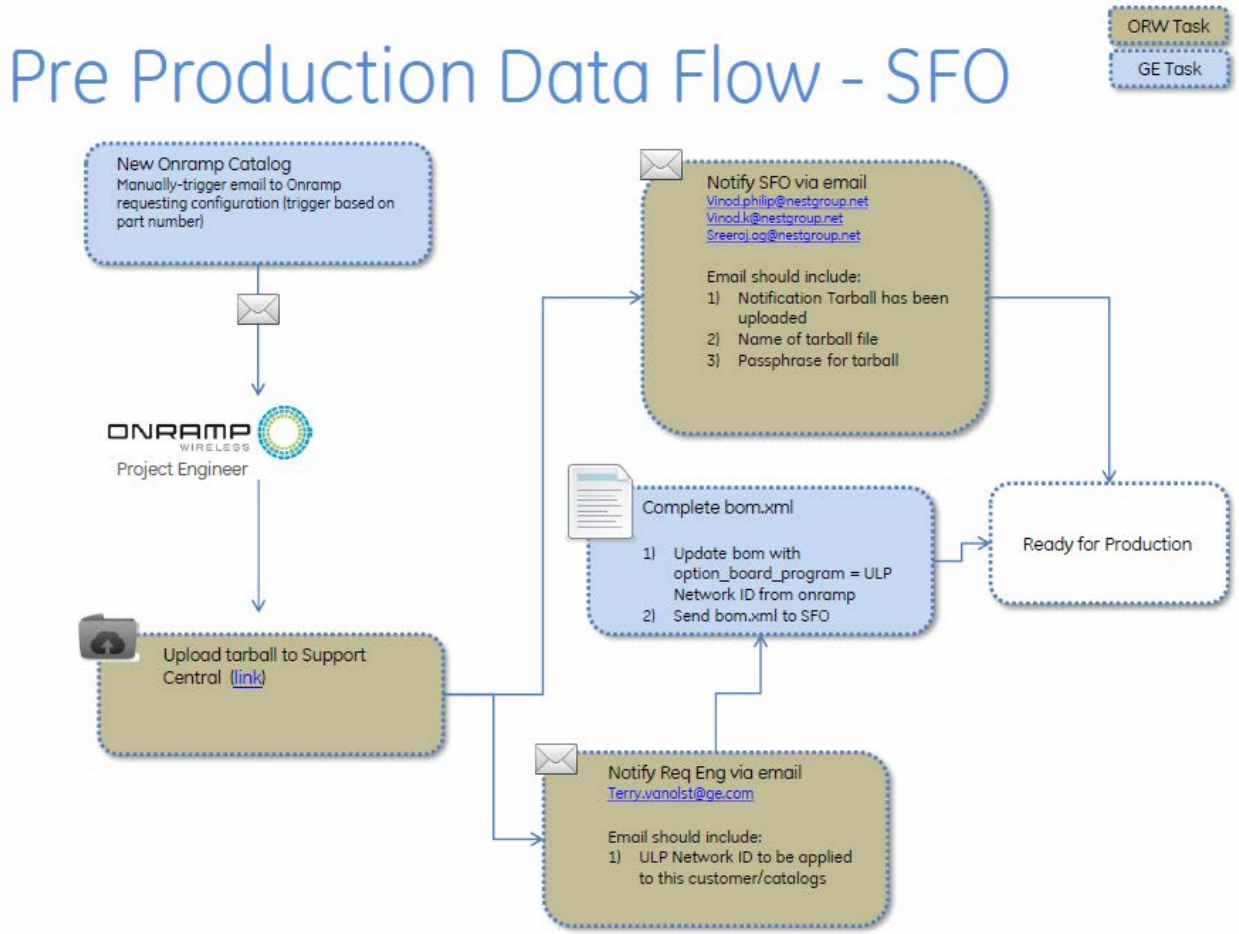
The provisioning process entails:

- Loading in current versions of software to microNode and K20 processors;
- Configuring (channels, TX power, etc.);
- Setting and configuring security keys (via LKS server);
- Performing an OTA test to ensure that the complete meter-to-TRN-2012/TRN-2113 antenna chain is verified;
- Locking down all access ports such as UART header and JTAG.

A graphical representation of the provisioning process is shown in Appendix A.

Appendix A Provisioning Process and Work Flow

The following illustration shows a graphical representation of the provisioning process.



Appendix B Test Mode Interface

The test modes, described below, are set by setting the "testMode" parameter in the configuration file for the eMCM.

B.1 Normal Operating Mode 0

This mode is entered based on a flash configuration setting. This mode is persistent across boots. This is the normal operating mode of the eMCM. UNIL is initialized to communicate with the Node. The meter software layer is initialized to communicate with the meter. Although the eMCM is in its normal operating mode, as determined by the flash configuration setting, other factors may subsequently cause the eMCM to change to a non-normal operating mode (e.g., meter is not in metering mode).

B.2 Non-Persistent Idle / Factory Test Mode 1

This mode is entered based on the testMode flash configuration setting. This mode is not persistent across boots (self-clearing). UNIL is initialized to pass-through mode. Meter software layer is not initialized. The UART on the AMR (automatic meter reading) serial interface is placed in loopback mode (using the same baud rate as the meter, e.g., 9600). Same as mode 2 except the flash testMode setting is automatically cleared to mode 0 when entering this mode. A subsequent "set test mode" command can set the cleared value to some other test mode value.

B.3 Persistent Idle / Factory Test Mode 2

This mode is entered based on the testMode flash configuration setting. This mode is persistent across boots. UNIL is initialized to pass-through mode. Meter software layer is not initialized. The UART on the AMR serial interface is placed into loopback mode (using the same baud rate as the meter, e.g., 9600). Same as mode 1 except the flash testMode setting is persistent across boots. To exit this mode, the test mode configuration setting must be set to another value which will take effect on eMCM reset.

B.4 Non-Persistent Node RF Test Mode 3

This mode is entered based on the testMode flash configuration setting. This mode is not persistent across boots (self-clearing). UNIL is initialized to pass-through mode. The meter software layer is not initialized. Same as mode 4 except the flash testMode setting is automatically cleared to mode 0 when entering this mode. A subsequent "set test mode" command can set the cleared value to some other test mode value.

- The TX test mode is controlled by the "txTestMode" parameter in the configuration file.
  - 1 = CW_CENTER
  - 2 = CW_OFFSET
  - 3 = MODULATED

- The antenna is controlled by the "txTestAntenna" parameter in the configuration file.
  - 0 or 1.
- The frequency is controlled by the "txTestCenterFreqKhzOffset" parameter in the configuration file.
  - KHz offset from 2.4 GHz
  - 2000 - 100000
  - Example: 50000 = 2.45 GHz
- The VGA is controlled by the "txTestVga" parameter in the configuration file.
  - 0 - 63, 255
- The on/off duration is controlled by the "txTestModeSec" and "txTestModeUsec" parameters in the configuration file.

B.5 Persistent Node RF Test Mode 4

This mode is entered based on the testMode flash configuration setting. This mode is persistent across boots. UNIL is initialized to pass-through mode. The meter software layer is not initialized. Same as mode 3 except the flash testMode setting is persistent across boots. To exit this mode, the test mode configuration setting must be set to another value which will take effect on eMCM reset.

B.6 Non-Persistent Manufacturing Cal Mode 5

This mode is entered based on the testMode flash configuration setting. This mode is not persistent across boots (self-clearing). UNIL is initialized normally so that it communicates with the Node. The meter software layer is not initialized. The UART on the AMR serial interface is not initialized or used. Same as mode 6 except the flash testMode setting is automatically cleared to mode 0 when entering this mode. A subsequent "set test mode" command can set the cleared value to some other test mode value.

B.7 Persistent Manufacturing Cal Mode 6

This mode is entered based on the testMode flash configuration setting. This mode is persistent across boots. UNIL is initialized normally so that it communicates with the Node. The meter software layer is not initialized. The UART on the AMR serial interface is not initialized or used. Same as mode 5 except the flash testMode setting is persistent across boots. To exit this mode, the test mode configuration setting must be set to another value which will take effect on eMCM reset.

B.8 Non-Persistent Meter Diagnostic Mode (Not Yet Implemented)

This mode is entered based on a flash configuration setting. This mode is not persistent across boots (self-clearing). UNIL is initialized normally so that it communicates with the Node. The meter software layer is initialized and communication to the meter is tested and validated. If communication with either the Node or the meter fails (or any other error condition detected), then the red LED is blinked with an error code indefinitely (or until the deployment mode LED timer expires). If no errors are detected, the green LED is blinked normally to indicate network connection state (scanning, joined, etc.). A reset is required to recover. Note: this mode may not be needed if a basic diagnostic or POST check is done by the eMCM as part of its initialization process.

B.9 Setting eMCM to Test Mode 1 - Non-Persistent Idle Factory Test Mode

How to Enter

- Set the 'testMode' flag in the configuration file to one.

  Example: ./emcm_set_cfg.py -d /dev/ttyS0 --testMode=1

- Reset the eMCM to take effect.

  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

How to Exit

- Because this mode is non-persistent, it can be exited via an eMCM reset.
- Reset the eMCM to exit the test mode. By default, the eMCM will return to normal operational mode 0 after reset unless another mode was explicitly specified with the emcm_set_cfg.py command prior to resetting.

  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

- If a different mode is desired upon reset, explicitly

Description

- UNIL is in pass-through mode.
- Meter UART is in loopback mode.
- AHP debug port is functional.
- Mode is not persistent after resets.

B.10 Setting eMCM to Test Mode 2 - Persistent Idle Factory Test Mode

How to Enter

- Set the 'testMode' flag in the configuration file to two.
  Example: ./emcm_set_cfg.py -d /dev/ttyS0 --testMode=2
- Reset the eMCM to take effect.
  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

How to Exit

- Because this mode is persistent, it will remain in effect across eMCM resets.
- Set the 'testMode' flag to the new desired mode, e.g., normal operational mode 0.
  Example: ./emcm_set_cfg.py -d /dev/ttyS0 --testMode=0
- Reset the eMCM for the new mode to take effect.
  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

Description

- UNIL is in pass-through mode.
- Meter UART is in loopback mode.
- AHP debug port is functional.
- Mode is persistent across resets.

B.11 Setting eMCM to Test Mode 3 - Non-Persistent RF Test Mode

How to Enter

- Set the 'testMode' flag in the configuration file to three.
  Example: ./emcm_set_cfg.py -d /dev/ttyS0 --testMode=3
- Reset the eMCM to take effect.
  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

How to Exit

- Because this mode is non-persistent, it can be exited via an eMCM reset.
- Reset the eMCM to exit the test mode. By default, the eMCM will return to normal operational mode 0 after reset unless another mode was explicitly specified with the emcm_set_cfg.py command prior to resetting.
  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm
- If a different mode is desired upon reset, explicitly

Description

- UNIL is partially operational.
- Meter UART is disabled.
- AHP debug port is functional.
- Mode is not persistent after resets.

B.12 Setting eMCM to Test Mode 4 - Persistent RF Test Mode

How to Enter

- Set the 'testMode' flag in the configuration file to four.
  Example: ./emcm_set_cfg.py -d /dev/ttyS0 --testMode=4
- Reset the eMCM to take effect.
  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

How to Exit

- Because this mode is persistent, it will remain in effect across eMCM resets.
- Set the 'testMode' flag to the new desired mode, e.g., normal operational mode 0.
  Example: ./emcm_set_cfg.py -d /dev/ttyS0 --testMode=0
- Reset the eMCM for the new mode to take effect.
  Example: ./emcm_dev_reset.py -d /dev/ttyS0 --emcm

Description

- UNIL is partially operational.
- Meter UART is disabled.
- AHP debug port is functional.
- Mode is persistent across resets.

Appendix C REACH Compliance Statements

DDi

Building Tomorrow's Technology . . . Today

February 25, 2012

To Whom It May Concern:

Subject: REACH Regulations, http://echa.europa.eu/reach_en.asp

The European Union Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Directive has become of significant interest to our customers. DDi considers manufactured Printed Circuit Boards (PCBs) to be an "article" per REACH, Article 3(3); thus, exempt from the REACH Regulations, unless;

1. DDi ships an article to the EU that exceeds a SVHC (Substance of Very High Concern) concentration of 0.1%w/w. , or
2. Greater than one metric ton per year is intended to be released under normal or reasonably foreseeable conditions of use.

The European Chemicals Agency (ECHA) issued its first list of Substances of Very High Concern (SVHC) in 2008. Various other chemicals have been published and included in the SVHC candidate list every year thereafter. The tables below contain all known chemicals that have been submitted by ECHA thus far; additional chemicals will be added to this statement as soon as they become available. It is DDi's commitment to insure current and accurate information is provided to our customers. We will continue to monitor updates to the SVHC list as they are submitted for consultation.

Candidate List Tables

2008 List			
Anthracene (CAS# 120-12-7)	4,4'-diaminodiphenylmethane (CAS# 101-77-9)	Dibutyl phthalate (CAS# 84-74-2)	Benzyl butyl phthalate (CAS# 85-68-7)
Hexabromocyclododecane (HBCDD) and all major diastereoisomers (CAS# 3194-55-6; 25637-99-4)	Cobalt dichloride (CAS# 7646-79-9)	Diarsenic pentoxide (CAS# 1303-28-2)	Diarsenic trioxide (CAS# 1327-53-3)
Sodium dichromate, dehydrate (CAS# 7789-12-0/ 10588-01-9)	Musk xylene (CAS# 81-15-2)	Bis (2-ethyl(hexyl)phthalate (CAS# 117-81-7)	Bis (tributyltin) oxide (CAS# 56-35-9)
Lead hydrogen arsenate (CAS# 7784-40-9)	Triethyl arsenate (CAS# 15606-95-8)	C10-C13 chlorinated paraffins (CAS# 85535-84-8)	

2009 List			
Anthracene oil (CAS# 90640-80-5)	Coal tar pitch, high temperature (CAS# 65996-93-2)	Diisobutyl Phthalate (CAS# 84-69-5)	Anthracene oil, Anthracene paste, (CAS# 90640-81-6)
Anthracene oil, Anthracene paste, distin. Lights (CAS# 91995-17-4)	Acrylamide (CAS# 79-06-1)	**Lead chromate** * (CAS# 7758-97-6)	2,4-Dinitrotoluene (CAS# 121-14-2)
Anthracene oil, Anthracene paste, Anthracene fraction (CAS# 91995-15-2)	Lead Sulfochromate yellow (C.I. Pigment Yellow 34) (CAS# 1344-37-2)	Lead Chromate Molybdate Sulphate red (C.I. Pigment Red 104) (CAS# 12656-85-8)	Tris (2-chloroethyl) Phosphate (CAS# 115-96-8)
Anthracene oil, Anthracene-low distin. (CAS# 90640-82-7)	Zirconia Aluminosilicate Refractory *Ceramic Fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.2 of Regulation (EC) No 1272/2008*	Aluminosilicate Refractory *Ceramic Fibres are fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.2 of Regulation (EC) No 1272/2008*	

1220 N. Simon Circle, Anaheim, CA 92806 • Tel 714.688.7200 • Fax 714.688.7400 • www.ddiglobal.com

Gemtek
Wireless Broadband Anywhere

Gemtek Technology Co., Ltd
No.1 Jen Ai Road,Hsinchu Industrial Park,
Hukou,Hsinchu, Taiwan, R.O.C. 303
TEL: 886-3-598-5535
FAX: 886-3-597-2103

DECLARATION OF CONFORMITY WITH RoHS DIRECTIVE AND REACH REGULATION

Gemtek declares that the product or part set forth below,

Customer Product Name: uNode/ 550-0006-00
Product Name: WMDO-142 jNode
Product Number: 990-900-0124R

has been manufactured in compliance with the EU Directive 2011/65/EU Restriction of Hazardous Substance (RoHS) and the regulation concerning Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) by meeting the following demand,

1. Said Gemtek Product is through utilization of exemption as below:

1) Copper alloy containing up to 4% lead by weight
2) Lead in high melting temperature type solders (i.e., lead-based alloys containing 85% by weight or more lead)
3) Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors ,e.g. piezoelectronic devices, or in a glass or cramic matrix compound。

2. In regard to the information on substances in the said product, in case a concentration therein is above 0.1 % weight by weight (w/w), Gemtek will provide customers with the information outlined in addendum A to allow safe use of the product.

Compliance with RoHS and REACH has been verified via internal design controls and/or analytical test data. The person undersigned below is entitled and authorized to furnish this letter to customers.

WMDO-142 jNode is under development and will follow RoHS & REACH rule.

Signature:
Printed Name: Eddy Chen
Title: A.V.P Quality
Date: 2012/08/20
Contact Information: Eddy chen@gemtek.com.tw +886 3 5985535 Ext.1060

Appendix D Abbreviations and Terms

Abbreviation/Term	Definition
AGC	Automatic Gain Control
ALC	Automatic Level Control
AMI	Advanced Metering Infrastructure
AMR	Automatic Meter Reading
AP	Access Point (this product)
API	Application Programming Interface
ASIC	Application-Specific Integrated Circuit
BOM	Bill of Materials
BW	Bandwidth
CMOS	Complementary Metal-Oxide-Semiconductor
CPOL	Clock Polarity (for SPI)
CPU	Central Processing Unit
DFS	Dynamic Frequency Selection
DPLL	Digital Phase-Locked Loop
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
EVM	Error Vector Magnitude
FCC	Federal Communications Commission
FER	Frame Error Rate
GND	Ground
GPIO	General Purpose Input/Output
HBM	Human Body Model
IC	Industry Canada
IIP3	Input Third-Order Intercept Point
LDO	Low Drop Out
LNA	Low Noise Amplifier
LO	Local Oscillator
microNode	The second generation of the On-Ramp Wireless module that communicates sensor data to an Access Point. The microNode forms the basis for On-Ramp Wireless Total Reach Network communications with the TRN-2012 / TRN-2113 products.
MISO	Master Input, Slave Output
MM	Machine Model
MOSI	Master Output, Slave Input
MRQ	Master Request
MSL	Moisture Sensitivity Level
Node	The generic term used interchangeably with eNode, microNode, or dNode.

Abbreviation/Term	Definition
NPT	Node Provisioning Tools
On-Ramp Wireless Total Reach	On-Ramp Wireless proprietary wireless communication technology.
OTA	Over-the-Air
PA	Power Amplifier
PAPR	Peak-to-Average Power Ratio
PCB	Printed Circuit Board
POR	Power On Reset
QoS	Quality of Service
RF	Radio Frequency
RFIC	Radio Frequency Integrated Circuit
RoHS	Restriction of Hazardous Substances
RSSI	Receive Signal Strength Indicator
RT	Remote Terminal
RTC	Real Time Clock
RX	Receive/Receiver
SCLK	Serial Clock
SMT	Surface Mount Technology
SNR	Signal-to-Noise Ratio
SPI	Synchronous Peripheral Interface
SRDY	Slave Ready
SRQ	Slave Request
TRN-2012	On-Ramp Wireless AMI circuit board (PCB). An MCM for GE IEC meters with internal antennas; Zigbee is optional.
TRN-2113	On-Ramp Wireless AMI circuit board (PCB). An MCM for GE IEC meters with external antennas; Zigbee is optional.
TX	Transmit/Transmitter
UART	Universal Asynchronous Receiver/Transmitter
VCO	Voltage Controlled Oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VSWR	Voltage Standing Wave Ratio
XO	Crystal Oscillator

Appendix E TRN-2012 / TRN-2113 Mechanical Drawings and Schematics

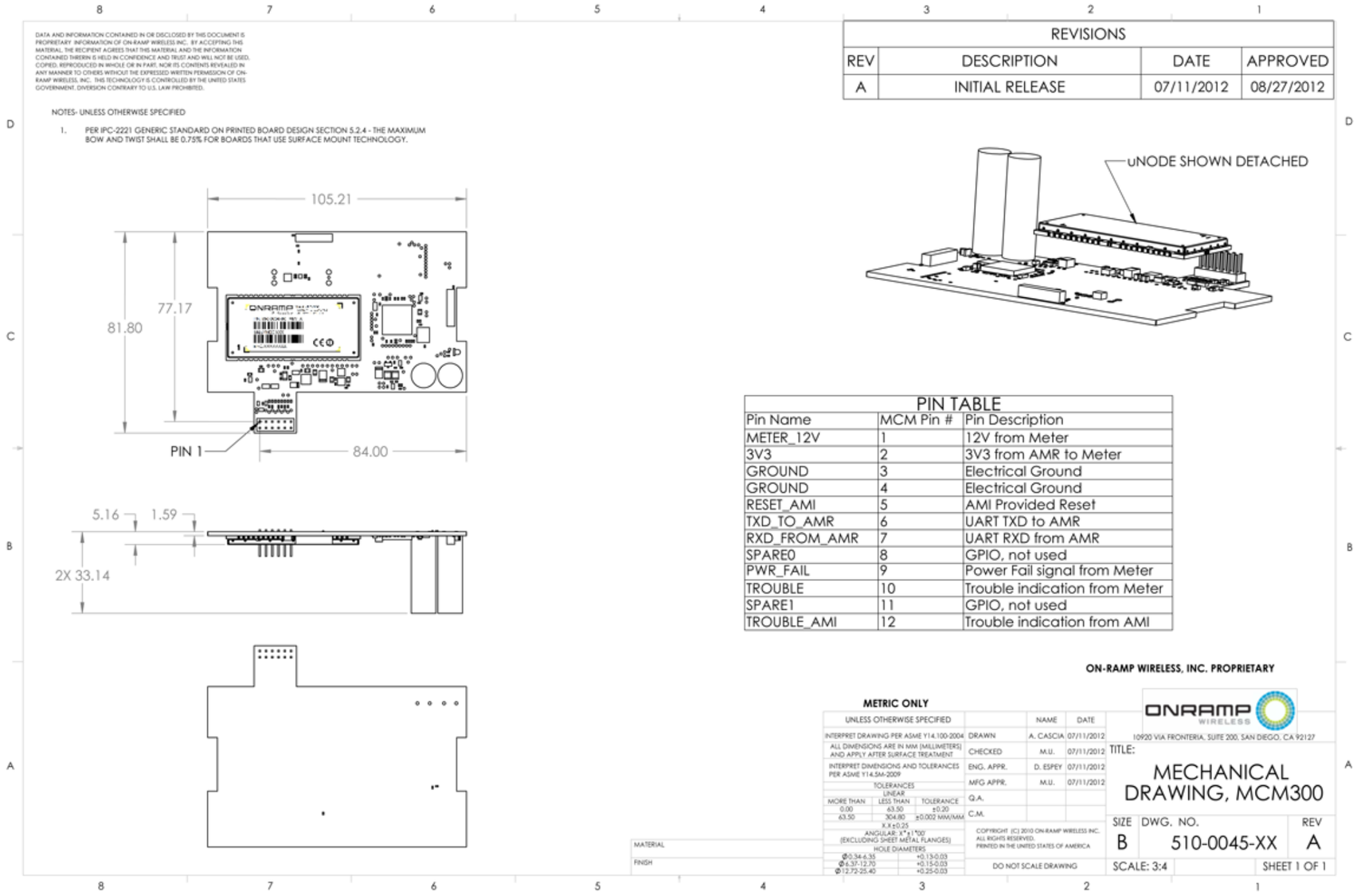


Figure 14. Mechanical Dimensions for TRN-2012 and TRN-2113

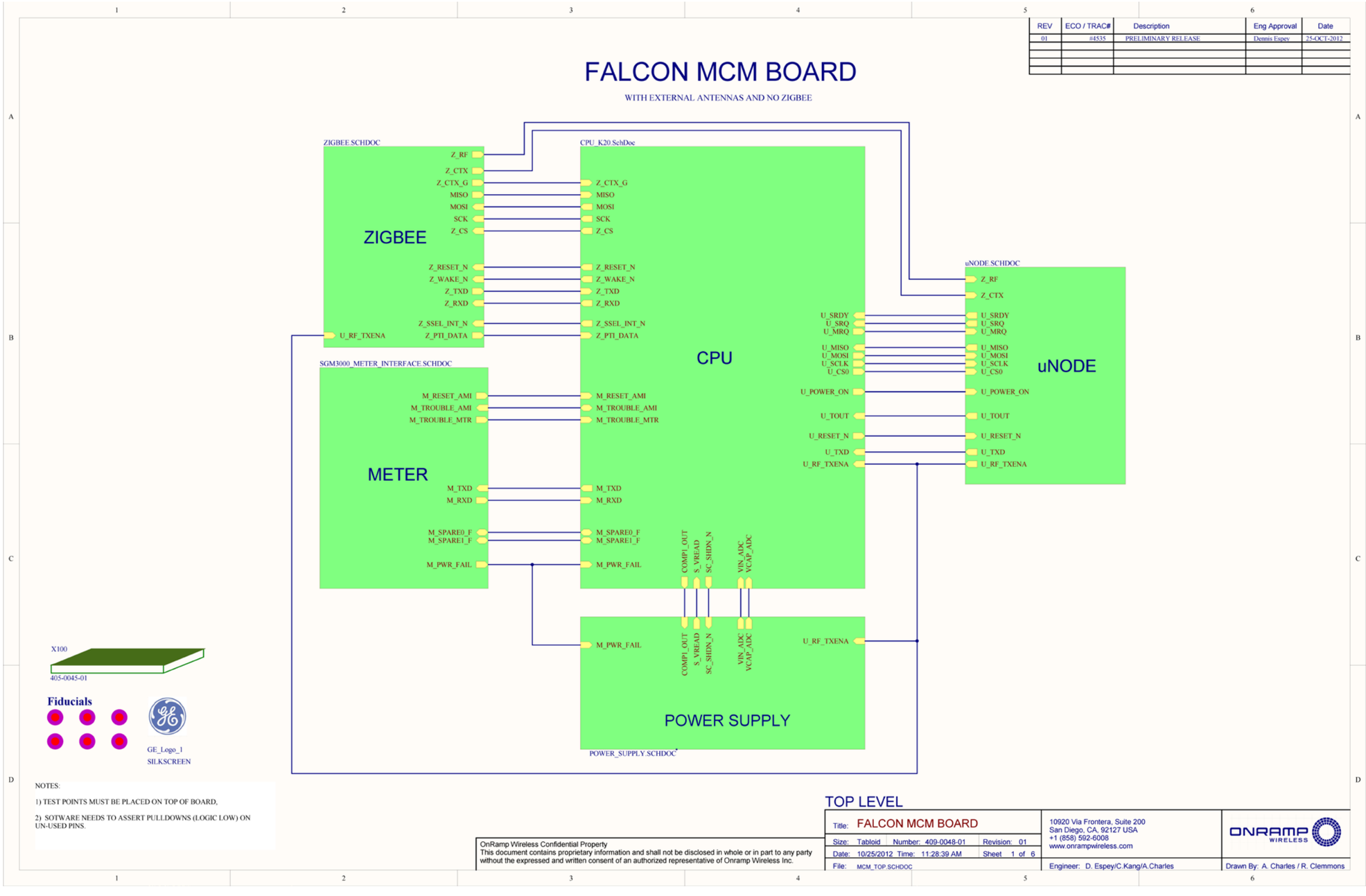
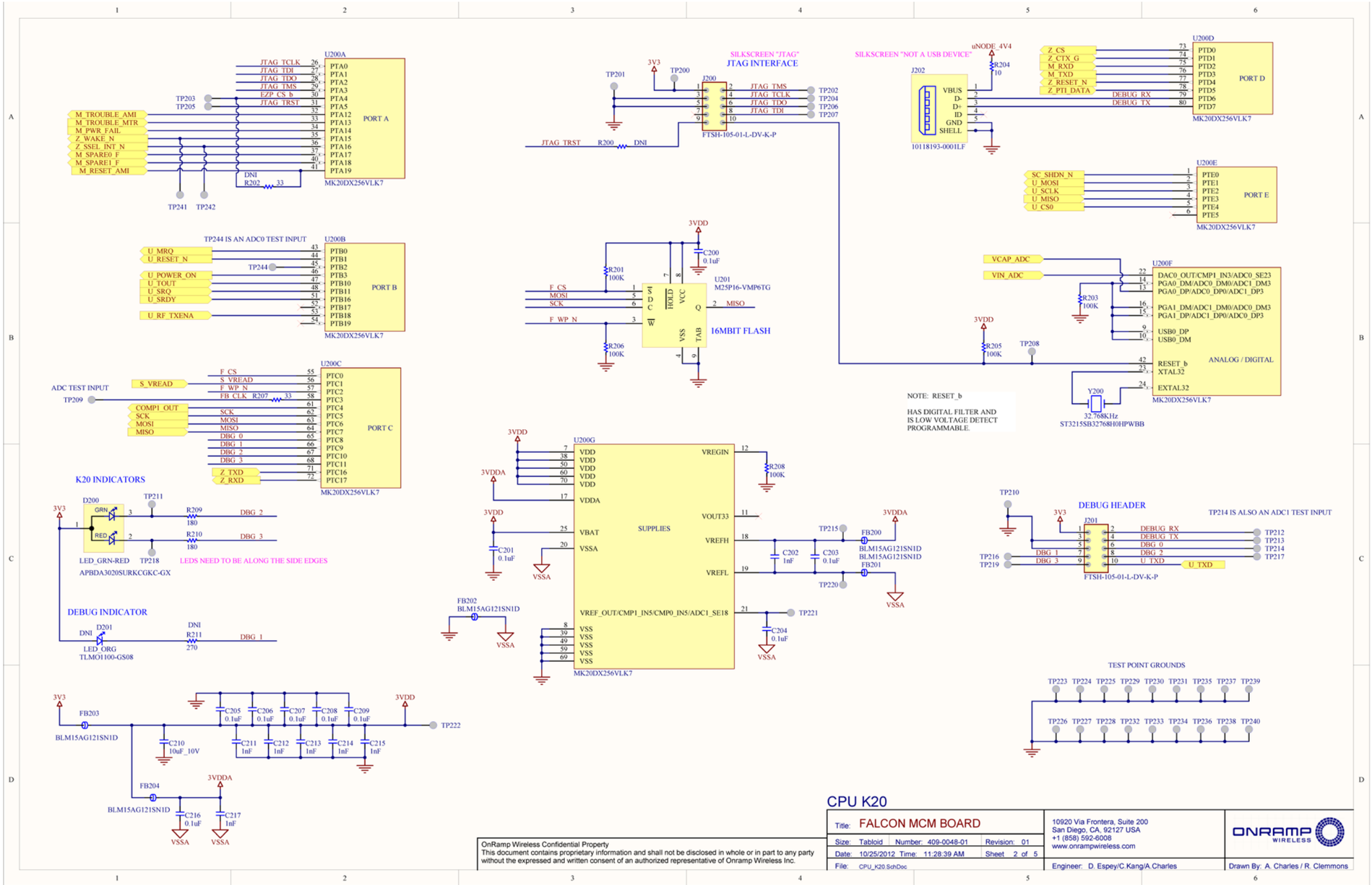


Figure 15. Schematics for TRN-2012 and TRN-2113


U200A
PTA0
PTA1
PTA2
PTA3
PTA4
PTA5
PTA12
PTA13
PTA14
PTA15
PTA16
PTA17
PTA18
PTA19
PORT A
MK20DX256VLK7
JTAG_TCLK
JTAG_TDI
JTAG_TDO
JTAG_TMS
EZP_CS_b
JTAG_TRST
M_TROUBLE_AMI
M_TROUBLE_MTR
M_PWR_FAIL
Z_WAKE_N
Z_SSEL_INT_N
M_SPARE0_F
M_SPARE1_F
M_RESET_AMI
TP203
TP205
TP241
TP242
DNI
R202
33
SILKSCREEN "JTAG"
JTAG INTERFACE
J200
FTSH-105-01-L-DV-K-P
TP201
TP200
3V3
TP202
TP204
TP206
TP207
R200
DNI
SILKSCREEN "NOT A USB DEVICE"
uNODE_4V4
R204
10
J202
10118193-0001LF
VBUS
D-
D+
ID
GND
SHELL
U200D
PTD0
PTD1
PTD2
PTD3
PTD4
PTD5
PTD6
PTD7
PORT D
Z_CS
Z_CTX_G
M_RXD
M_TXD
Z_RESET_N
Z_PTI_DATA
DEBUG_RX
DEBUG_TX
U200E
PTE0
PTE1
PTE2
PTE3
PTE4
PTE5
PORT E
SC_SHDN_N
U_MOSI
U_SCLK
U_MISO
U_CS0
TP244 IS AN ADC0 TEST INPUT
U200B
PTB0
PTB1
PTB2
PTB3
PTB10
PTB11
PTB16
PTB17
PTB18
PTB19
PORT B
U_MRQ
U_RESET_N
TP244
U_POWER_ON
U_TOUT
U_SRQ
U_SRDY
U_RF_TXENA
3VDD
C200
0.1uF
R201
100K
U201
M25P16-VMP6TG
HOLD
VCC
VSS
TAB
F_CS
MOSI
SCK
F_WP_N
MISO
R206
100K
16MBIT FLASH
VCAP_ADC
VIN_ADC
U200F
DAC0_OUT/CMP1_IN3/ADC0_SE23
PGA0_DM/ADC0_DM0/ADC1_DM3
PGA0_DP/ADC0_DP0/ADC1_DP3
PGA1_DM/ADC1_DM0/ADC0_DM3
PGA1_DP/ADC1_DP0/ADC0_DP3
USB0_DP
USB0_DM
RESET_b
XTAL32
EXTAL32
ANALOG / DIGITAL
R203
100K
R205
100K
TP208
Y200
32.768KHz
ST3215SB32768H0HPWBB
NOTE: RESET_b
HAS DIGITAL FILTER AND
IS LOW VOLTAGE DETECT
PROGRAMMABLE.
U200C
PTC0
PTC1
PTC2
PTC3
PTC4
PTC5
PTC6
PTC7
PTC8
PTC9
PTC10
PTC11
PTC16
PTC17
PORT C
F_CS
S_VREAD
F_WP_N
FB_CLK_R207
33
SCK
MOSI
MISO
DBG_0
DBG_1
DBG_2
DBG_3
Z_TXD
Z_RXD
ADC TEST INPUT
TP209
COMP1_OUT
K20 INDICATORS
D200
GRN
RED
LED_GRN-RED
APBDA3020SURKCGKC-GX
TP211
TP218
R209
180
R210
180
LEDS NEED TO BE ALONG THE SIDE EDGES
DEBUG INDICATOR
D201
LED_ORG
TLMO1100-GS08
R211
270
3VDDA
U200G
VDD
VDDA
VBAT
VSSA
VREGIN
VOUT33
VREFH
VREFL
VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18
SUPPLIES
VSS
MK20DX256VLK7
R208
100K
C201
0.1uF
C202
1nF
C203
0.1uF
C204
0.1uF
FB200
BLM15AG121SN1D
FB201
FB202
FB203
FB204
TP215
TP220
TP221
DEBUG HEADER
TP214 IS ALSO AN ADC1 TEST INPUT
J201
FTSH-105-01-L-DV-K-P
TP210
TP212
TP213
TP214
TP216
TP217
TP219
U_TXD
TEST POINT GROUNDS
TP223
TP224
TP225
TP229
TP230
TP231
TP235
TP237
TP239
TP226
TP227
TP228
TP232
TP233
TP234
TP236
TP238
TP240
C205
C206
C207
C208
C209
C210
10uF_10V
C211
C212
C213
C214
C215
1nF
C216
C217
TP222
CPU K20
Title: FALCON MCM BOARD
Size: Tabloid
Number: 409-0048-01
Revision: 01
Date: 10/25/2012
Time: 11:28:39 AM
Sheet 2 of 5
File: CPU_K20.SchDoc
10920 Via Frontera, Suite 200
San Diego, CA, 92127 USA
+1 (858) 592-6008
www.onrampwireless.com
Engineer: D. Espey/C.Kang/A.Charles
Drawn By: A. Charles / R. Clemmons
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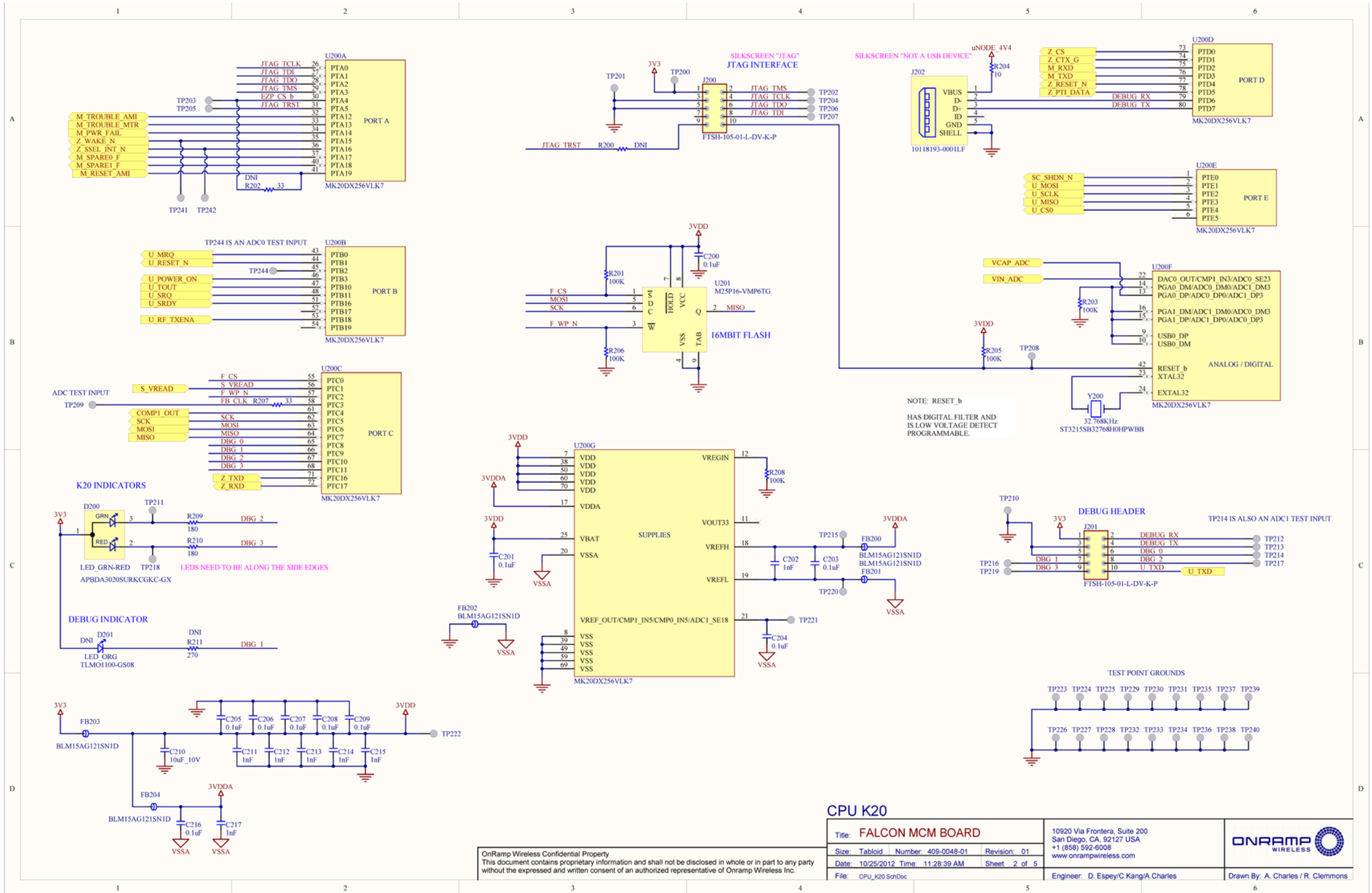
U200A
JTAG_TCLK
JTAG_TDI
JTAG_TDO
JTAG_TMS
EZP_CS_b
JTAG_TRST
M_TROUBLE_AMI
M_TROUBLE_MTR
M_PWR_FAIL
Z_WAKE_N
Z_SSEL_INT_N
M_SPARE0_F
M_SPARE1_F
M_RESET_AMI
PORT A
MK20DX256VLK7
TP203
TP205
TP241
TP242
DNI
R202 33
TP244 IS AN ADC0 TEST INPUT
U200B
U_MRQ
U_RESET_N
TP244
U_POWER_ON
U_TOUT
U_SRQ
U_SRDY
U_RF_TXENA
PORT B
MK20DX256VLK7
U200C
ADC TEST INPUT
TP209
S_VREAD
F_CS
F_WP_N
FB_CLK R207 33
COMP1_OUT
SCK
MOSI
MISO
DBG_0
DBG_1
DBG_2
DBG_3
Z_TXD
Z_RXD
PORT C
MK20DX256VLK7
K20 INDICATORS
D200
GRN
RED
TP211
R209 180
R210 180
DBG_2
DBG_3
LED_GRN-RED
APBDA3020SURKCGKC-GX
TP218
LEDS NEED TO BE ALONG THE SIDE EDGES
DEBUG INDICATOR
D201
DNI
LED_ORG
TLMO1100-GS08
R211 270
DBG_1
3V3
3VDD
3VDDA
FB203
BLM15AG121SN1D
FB204
BLM15AG121SN1D
C205 0.1uF
C206 0.1uF
C207 0.1uF
C208 0.1uF
C209 0.1uF
C210 10uF_10V
C211 1nF
C212 1nF
C213 1nF
C214 1nF
C215 1nF
C216 0.1uF
C217 1nF
TP222
VSSA
SILKSCREEN "JTAG"
JTAG INTERFACE
TP201
TP200
J200
JTAG_TMS
JTAG_TCLK
JTAG_TDO
JTAG_TDI
JTAG_TRST
R200 DNI
FTSH-105-01-L-DV-K-P
TP202
TP204
TP206
TP207
SILKSCREEN "NOT A USB DEVICE"
uNODE_4V4
R204 10
J202
VBUS
D-
D+
ID
GND
SHELL
10118193-0001LF
U200D
Z_CS
Z_CTX_G
M_RXD
M_TXD
Z_RESET_N
Z_PTI_DATA
DEBUG_RX
DEBUG_TX
PTD0
PTD1
PTD2
PTD3
PTD4
PTD5
PTD6
PTD7
PORT D
MK20DX256VLK7
U200E
SC_SHDN_N
U_MOSI
U_SCLK
U_MISO
U_CS0
PTE0
PTE1
PTE2
PTE3
PTE4
PTE5
PORT E
MK20DX256VLK7
R201 100K
C200 0.1uF
U201
M25P16-VMP6TG
F_CS
MOSI
SCK
F_WP_N
MISO
16MBIT FLASH
R206 100K
VCAP_ADC
VIN_ADC
R203 100K
R205 100K
TP208
U200F
DAC0_OUT/CMP1_IN3/ADC0_SE23
PGA0_DM/ADC0_DM0/ADC1_DM3
PGA0_DP/ADC0_DP0/ADC1_DP3
PGA1_DM/ADC1_DM0/ADC0_DM3
PGA1_DP/ADC1_DP0/ADC0_DP3
USB0_DP
USB0_DM
RESET_b
XTAL32
EXTAL32
ANALOG / DIGITAL
MK20DX256VLK7
Y200
32.768KHz
ST3215SB32768H0HPWBB
NOTE: RESET_b
HAS DIGITAL FILTER AND
IS LOW VOLTAGE DETECT
PROGRAMMABLE.
U200G
VDD
VDDA
VBAT
VSSA
VREGIN
VOUT33
VREFH
VREFL
VREF_OUT/CMP1_IN5/CMP0_IN5/ADC1_SE18
VSS
SUPPLIES
MK20DX256VLK7
R208 100K
C201 0.1uF
C202 1nF
C203 0.1uF
C204 0.1uF
TP215
TP220
TP221
FB200
BLM15AG121SN1D
FB201
BLM15AG121SN1D
FB202
BLM15AG121SN1D
TP210
DEBUG HEADER
J201
DEBUG_RX
DEBUG_TX
DBG_0
DBG_1
DBG_2
DBG_3
U_TXD
FTSH-105-01-L-DV-K-P
TP214 IS ALSO AN ADC1 TEST INPUT
TP212
TP213
TP214
TP217
TP216
TP219
TEST POINT GROUNDS
TP223 TP224 TP225 TP229 TP230 TP231 TP235 TP237 TP239
TP226 TP227 TP228 TP232 TP233 TP234 TP236 TP238 TP240
CPU K20
Title: FALCON MCM BOARD
Size: Tabloid Number: 409-0048-01 Revision: 01
Date: 10/25/2012 Time: 11:28:39 AM Sheet 2 of 5
File: CPU_K20.SchDoc
10920 Via Frontera, Suite 200
San Diego, CA, 92127 USA
+1 (858) 592-6008
www.onrampwireless.com
Engineer: D. Espey/C.Kang/A.Charles
Drawn By: A. Charles / R. Clemmons
ONRAMP WIRELESS
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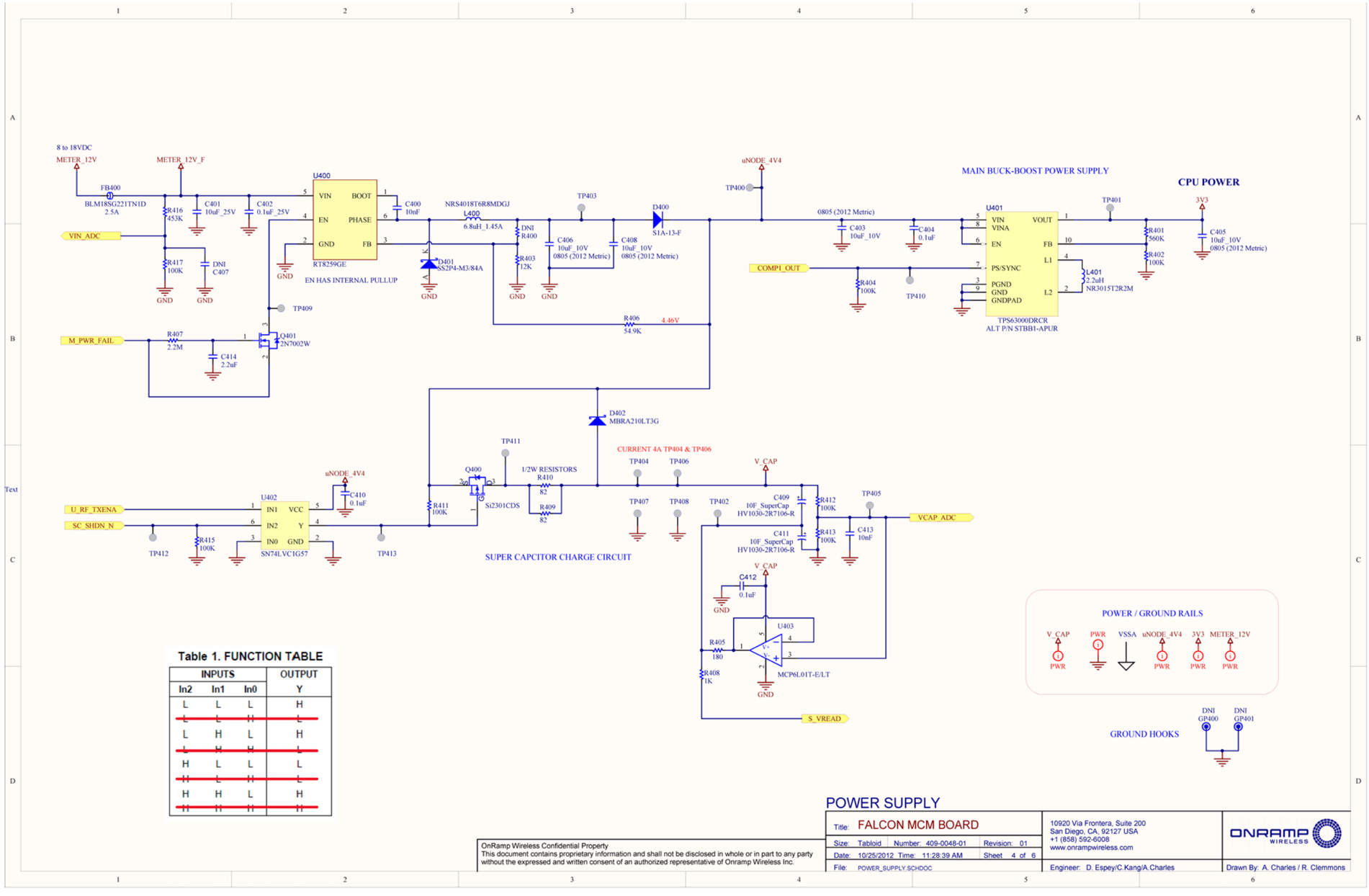
8 to 18VDC
METER_12V
METER_12V_F
FB400
BLM18SG221TN1D
2.5A
R416
453K
C401
10uF_25V
C402
0.1uF_25V
U400
VIN
BOOT
EN
PHASE
GND
FB
RT8259GE
EN HAS INTERNAL PULLUP
C400
10nF
NRS4018T6R8MDGJ
L400
6.8uH_1.45A
DNI
R400
R403
12K
D401
SS2P4-M3/84A
C406
10uF_10V
0805 (2012 Metric)
C408
10uF_10V
0805 (2012 Metric)
TP403
D400
S1A-13-F
uNODE_4V4
TP400
MAIN BUCK-BOOST POWER SUPPLY
CPU POWER
0805 (2012 Metric)
C403
10uF_10V
C404
0.1uF
U401
VIN
VINA
EN
PS/SYNC
PGND
GND
GNDPAD
VOUT
FB
L1
L2
TPS63000DRCR
ALT P/N STBB1-APUR
TP401
3V3
R401
560K
R402
100K
L401
2.2uH
NR3015T2R2M
C405
10uF_10V
0805 (2012 Metric)
VIN_ADC
COMP1_OUT
R404
100K
TP410
M_PWR_FAIL
R407
2.2M
C414
2.2uF
Q401
2N7002W
TP409
R406
54.9K
4.46V
D402
MBRA210LT3G
TP411
CURRENT 4A TP404 & TP406
TP404
TP406
TP407
TP408
TP402
V_CAP
Q400
Si2301CDS
1/2W RESISTORS
R410
82
R409
82
R411
100K
C409
10F_SuperCap
HV1030-2R7106-R
C411
10F_SuperCap
HV1030-2R7106-R
R412
100K
R413
100K
TP405
C413
10nF
VCAP_ADC
U402
IN1
IN2
IN0
VCC
Y
GND
SN74LVC1G57
U_RF_TXENA
SC_SHDN_N
uNODE_4V4
C410
0.1uF
R415
100K
TP412
TP413
SUPER CAPCITOR CHARGE CIRCUIT
C412
0.1uF
U403
MCP6L01T-E/LT
R405
180
R408
1K
S_VREAD
POWER / GROUND RAILS
V_CAP
PWR
VSSA
uNODE_4V4
3V3
METER_12V
GROUND HOOKS
DNI
GP400
DNI
GP401
Table 1. FUNCTION TABLE
INPUTS
OUTPUT
In2 In1 In0 Y
L L L H
L L H L
L H L H
L H H L
H L L L
H L H L
H H L H
H H H H
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POWER SUPPLY
Title: FALCON MCM BOARD
Size: Tabloid Number: 409-0048-01 Revision: 01
Date: 10/25/2012 Time: 11:28:39 AM Sheet 4 of 6
File: POWER_SUPPLY.SCHDOC
10920 Via Frontera, Suite 200
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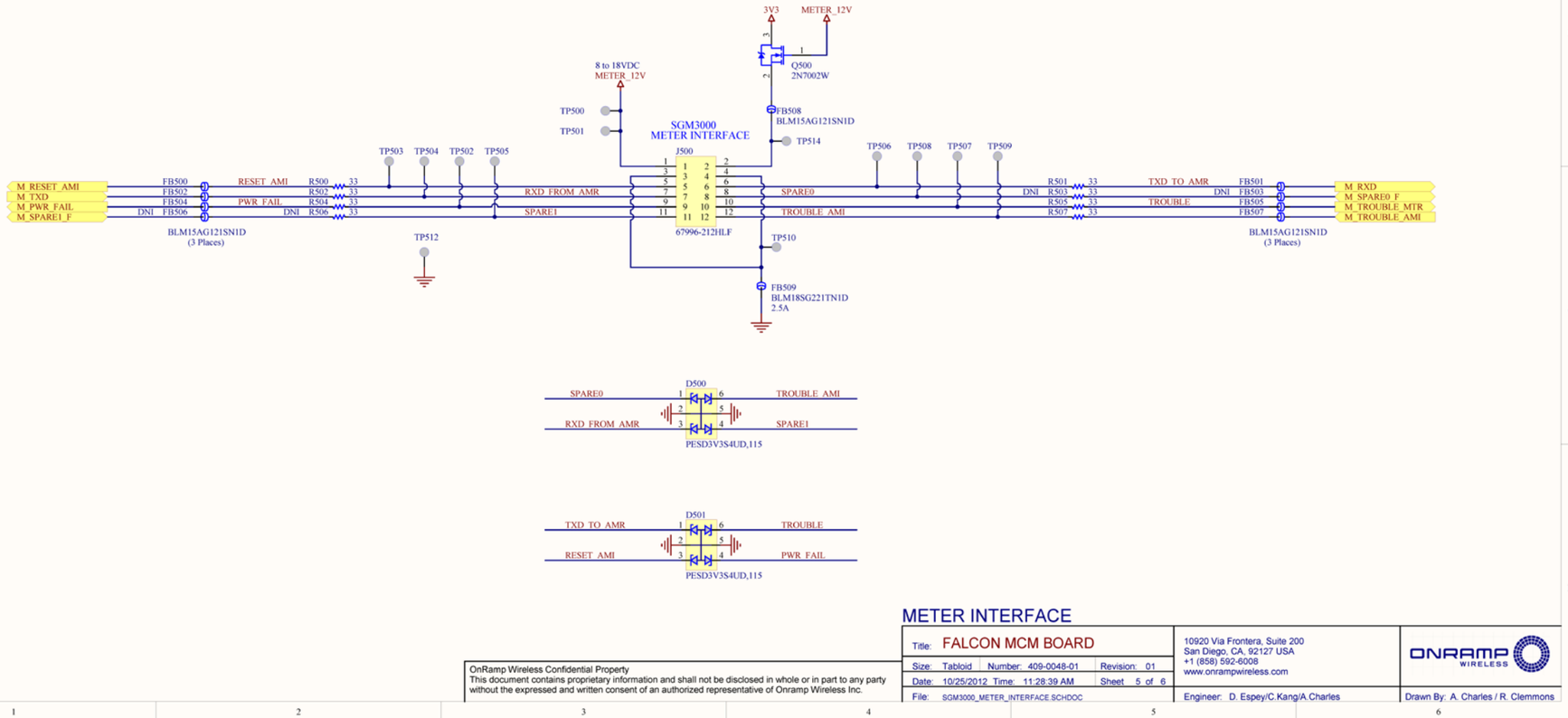
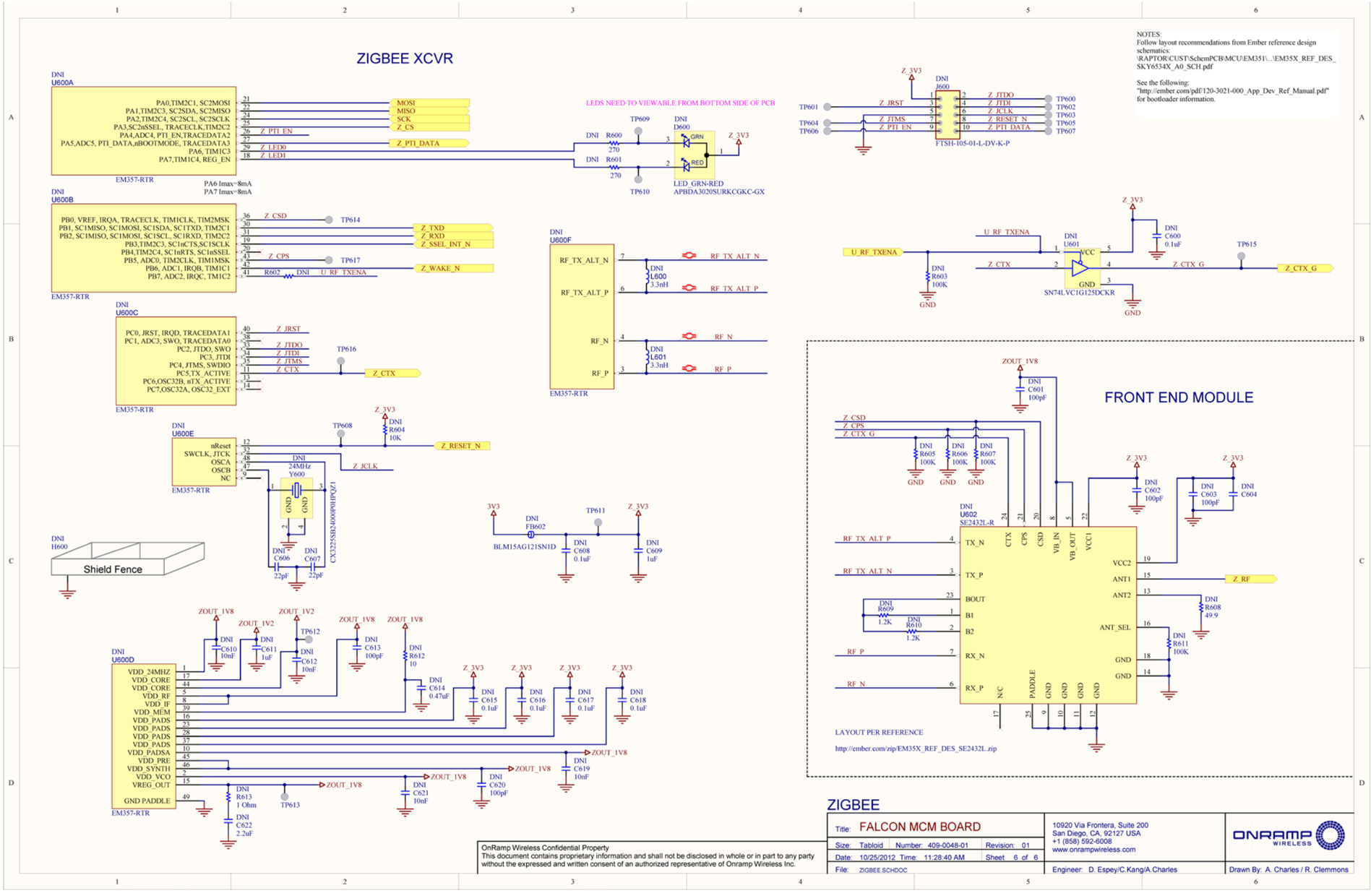
www.onrampwireless.com
Engineer: D. Espey/C.Kang/A.Charles
Drawn By: A. Charles / R. Clemmons

Pin #	Signal Name	AMI direction	Description
1	12V	--	+12V Regulated power supply
2	3V3_AMI	Output	+3.3VV Regulated power supply
3	IGND	--	Isolated Ground from Mains
4	IGND	--	Isolated Ground from Mains
5	RESET_AMI	Input	Reset Input to AMI
6	TXD/MOSI	Input	Meter Transmit/AMI Receive line or Master output / Slave input
7	RXD/MISO	Output	Meter Receive/AMI Transmit line or Master input / Slave output
8	SPI2_SPCK	Input	SPI Clock
9	PF_AMR	Input	Power fail signal from Meter
10	TROUBLE_MTR/CSM_AMI	Input	Trouble signal from Meter/SPI Chip Select Master
11	CSS_AMI/TROUBLE_MTR	Output/Input	SPI Chip Select Slave/Trouble signal from Meter
12	TROUBLE_AMI	Output	Trouble signal from AMI




ZIGBEE XCVR
NOTES:
Follow layout recommendations from Ember reference design schematics:
\RAPTOR\CUST\SchemPCB\MCU\EM351\...\EM35X_REF_DES_SKY6534X_A0_SCH.pdf
See the following:
"http://ember.com/pdf/120-3021-000_App_Dev_Ref_Manual.pdf" for bootloader information.
LEDS NEED TO VIEWABLE FROM BOTTOM SIDE OF PCB
FTSH-105-01-L-DV-K-P
LED_GRN-RED APBDA3020SURKCGKC-GX
EM357-RTR
PA6 Imax=8mA
PA7 Imax=8mA
Shield Fence
SN74LVC1G125DCKR
FRONT END MODULE
SE2432L-R
LAYOUT PER REFERENCE
http://ember.com/zip/EM35X_REF_DES_SE2432L.zip
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ZIGBEE
Title: FALCON MCM BOARD
Size: Tabloid Number: 409-0048-01 Revision: 01
Date: 10/25/2012 Time: 11:28:40 AM Sheet 6 of 6
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