



RepNode User's Manual

Version 1.2

Revision History

Date	Revision	Description	Author
07/06/2006	1.0	Initial Release	Edward Castro
07/17/2006	1.1	Updated FCC Statements & FCC ID Numbers	Dan Cornescu
08/17/2006	1.2	Added pictures of Reprnode enclosure; Removed Section 6 "OEM Responsibility to the FCC Rules and Regulations"	Dan Cornescu

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1. Purpose and Scope of Document

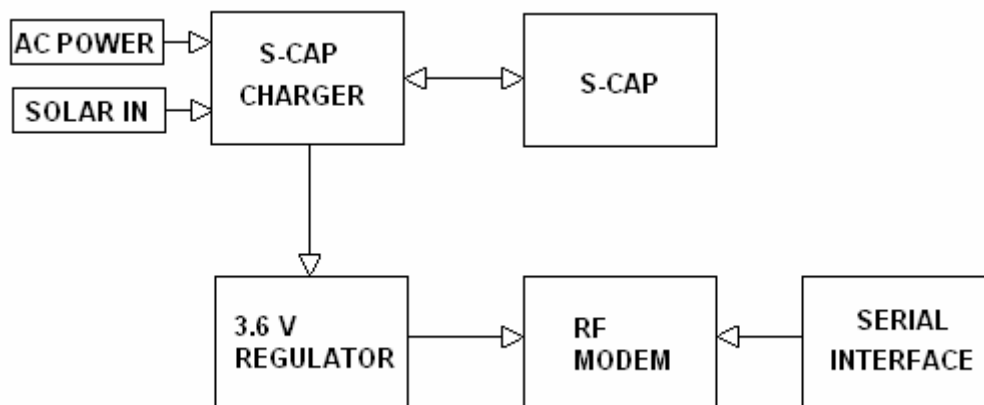
The purpose of this document is to provide the user with instructions on how to properly operate the RepNode.

2. Overview of the RepNode

The RepNode is a 900MHz frequency-hopping self-contained deployment tool which provides a link between a device running specially designed software and the mesh network. The RepNode uses a 10 Farad Super Capacitor to provide operating power during AC power outages.

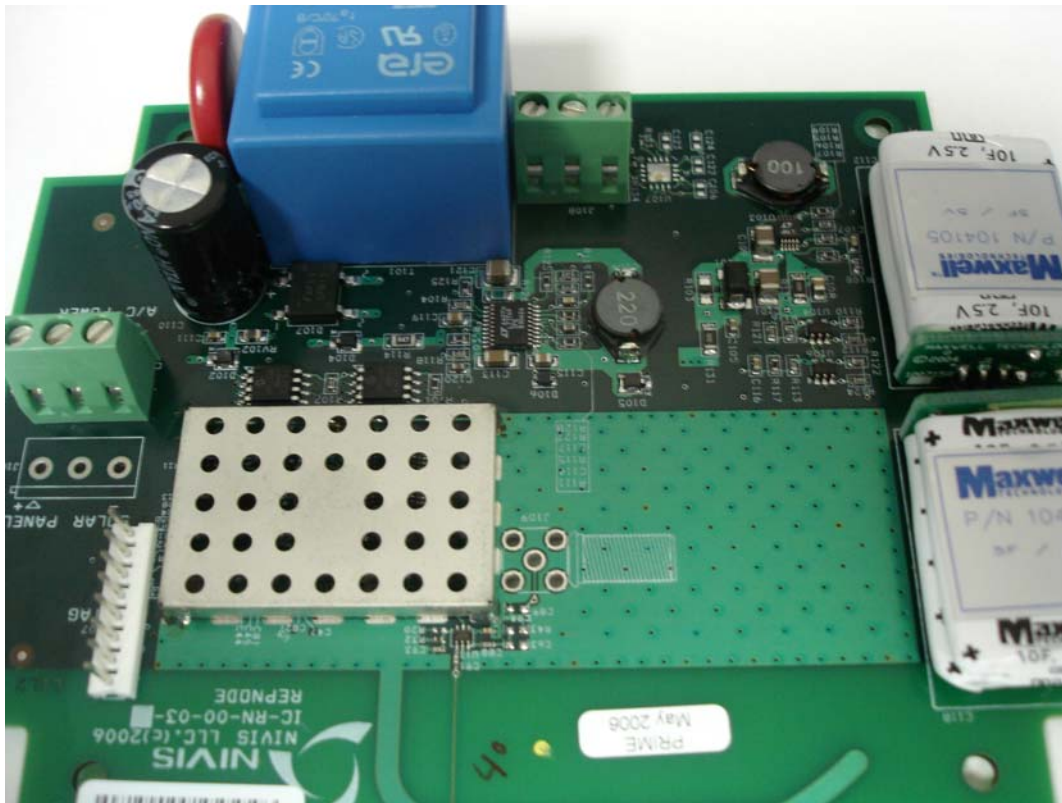
2.0 Block diagram

Below you will find the block diagram for the main functions of this device.

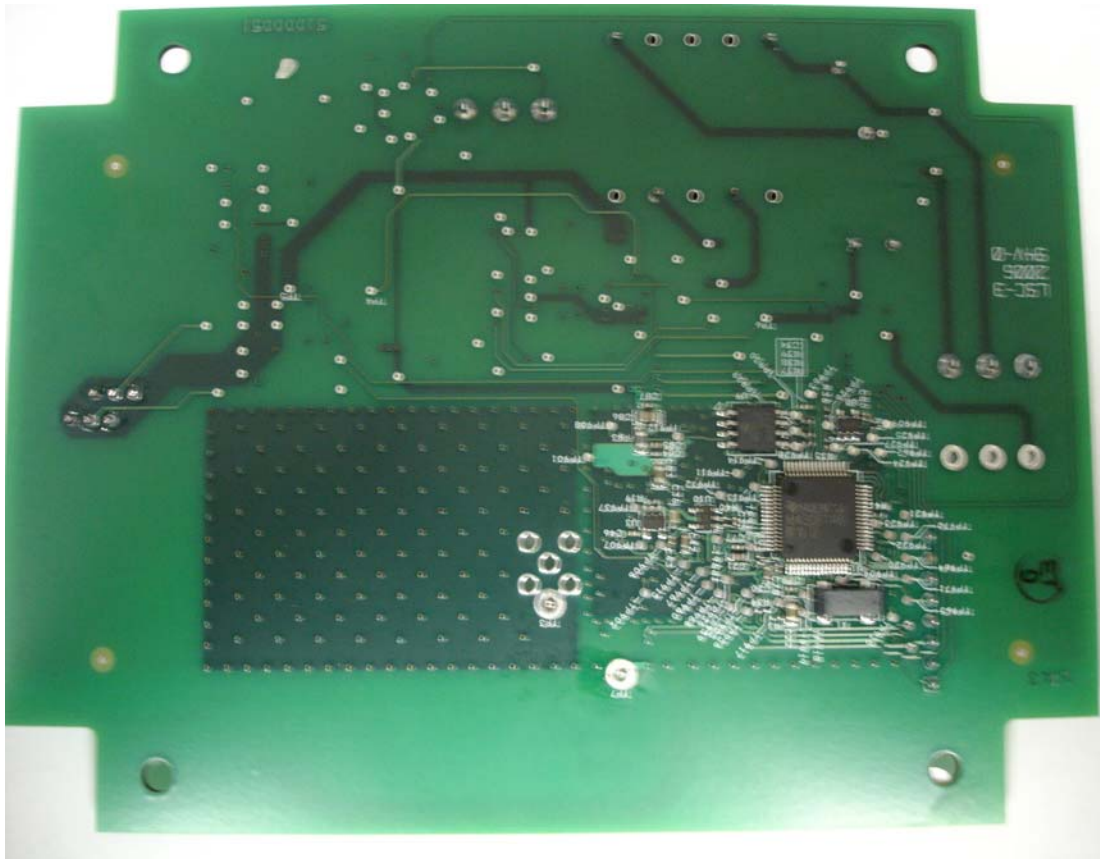


2.1 General presentation of the board and enclosure

Below is a picture of RepNode circuit board



On the top side of the board (pictured above) you will find the RF components, (underneath the RF shield), the power supply section, transformer and the PCB antenna. The opposite side of the board contains the microcontroller and digital section as can be seen in the picture below.



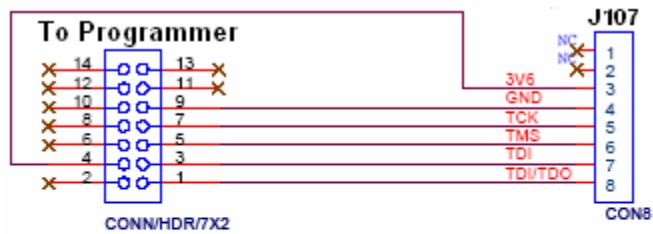


External view of RepNode enclosure

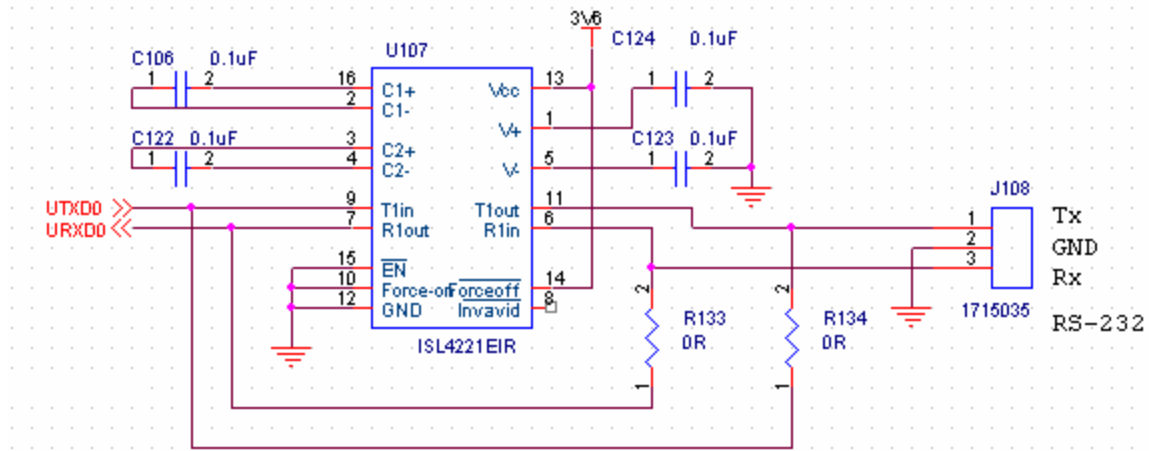


View of RepNode circuit board mounted inside enclosure

The JTAG connector is located above and to the right of the RF shield on the front side of the circuit board. This is used for development purposes, loading firmware etc. A typical adapter cable schematic is shown bellow:

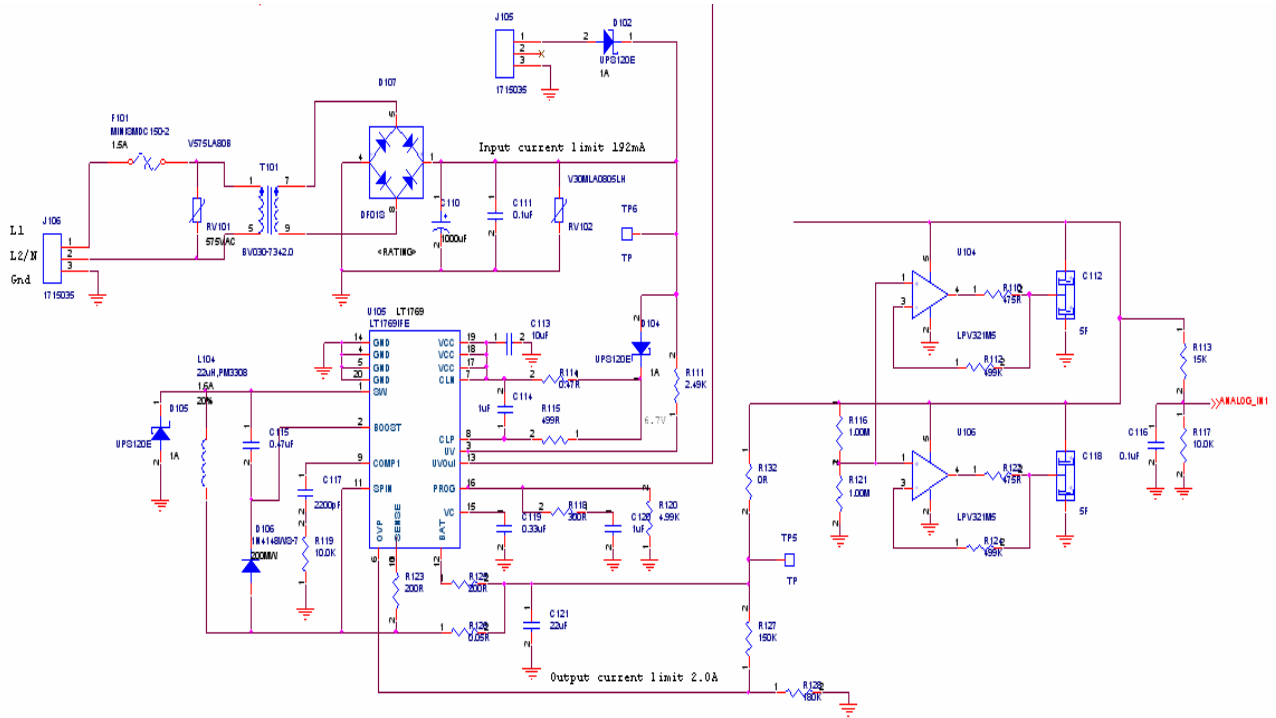


2.1.1 RS232 Interface block



The RS232 interface uses a ISL4221EIR level converter chip, U107 which translates the logic levels from the microcontrollers 3.3V to RS232 levels. This is an option and is not normally populated. The zero ohm resistors, R133 and R134 bypass the signals when the option is not used.

2.1.2 Super Cap Charger block

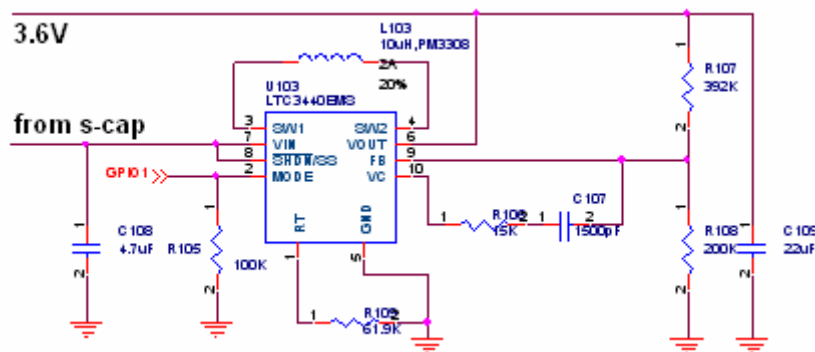


The RepNode is available as a 115 VAC unit or as a 230 VAC unit. This is determined at the time of manufacture by selecting either the 115 V or the 230 V transformer, T101. The RepNode uses an LT1769 battery charger, U105 which charges two parallel connected five Farad super capacitors, a total of 10 Farads. This design allows up to 200 mA charge current drawn from the transformer, which is rated at 2.3 VA. The charge current is programmed by the value of resistor R114. Op-Amps U104 and U106 keep the cells balanced by providing a low resistance return path between the cells at exactly $\frac{1}{2}$ the charge voltage.

Refer to the schematic above. The input AC line is connected to terminal block J106. The transformer is protected from over voltage transients by varistor RV101 and resettable fuse F101. The voltage at the secondary of transformer T101 is rectified by bridge rectifier D107 and filtered by capacitor C110. The filtered DC voltage is further protected from damaging voltage spikes by varistor RV102. There is an optional connection for a solar panel input at J105. This voltage is ORed with the transformer voltage by diode D102.

2.1.3 Buck / Boost Regulator block

The power supply block uses a switch-mode regulator circuit shown below which operates as a buck / boost regulator. This design maintains high efficiency due to a built in power switch and burst-mode control. The radio current demands can be as high as 500mA in the transmit mode. During receive, the radio typically requires 35mA. This design allows firmware control of the switching mode via microcontroller port bit GPIO1. A high selects burst mode operation and a low selects fixed frequency operation. Fixed frequency is selected by default by R132. Burst mode may be selected by defining port bit GPIO1 as an output bit and outputting a high. Refer to the drawing below.



2.1.4 RF modem block

The radio modem consists of the following functional entities:

Digital section:

Processor - U1 MSP430F149IPM

EEPROMs - U9 24LC512T-I/SM, U8 24LC08BT-I/OT

RF section:

Chipcon RF transceiver - U2 CC1020 and LNA U7 SGL-0163/SOT363

Power amplifier – U6 MAX2235 power amplifier

RF switch – U4 UPG2010TB-E3 is switching in between receiver and transmitter according with network hopping protocol.

3. Operation of the RepNode

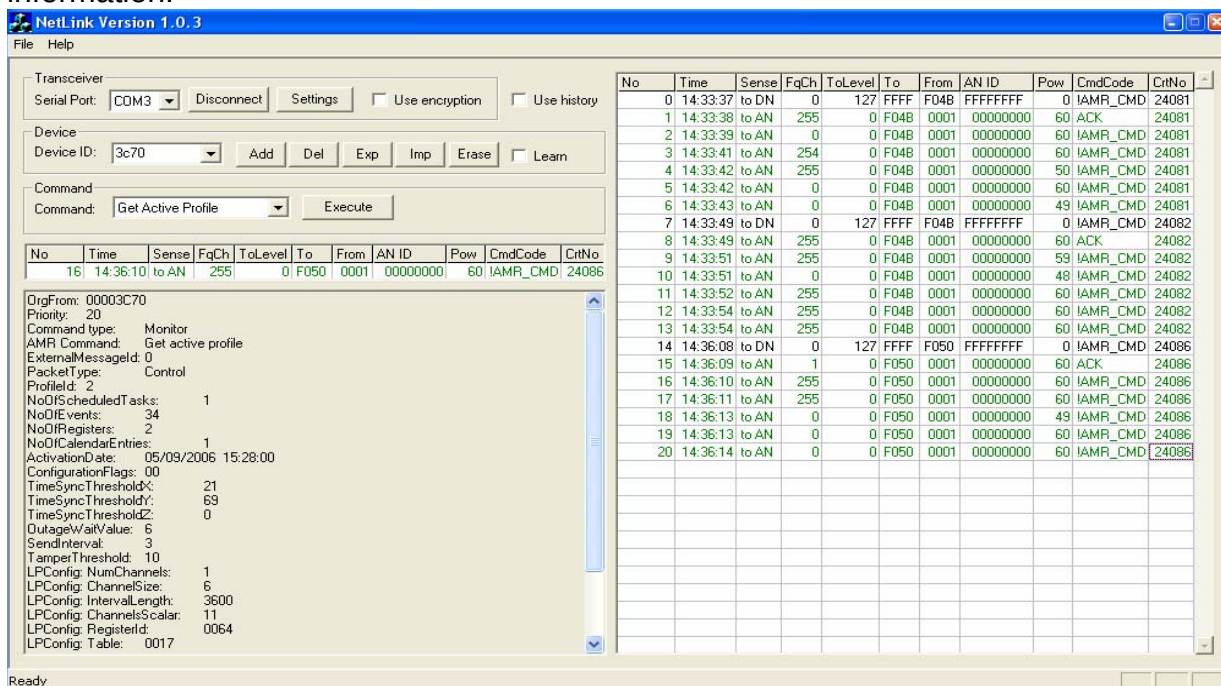
The Nivis NetLink (*NetLink Application.exe*) application was developed in order to exercise the features of the Radio Modem via the RF link. The NetLink application is a

PC software program containing a GUI that controls various features of the Radio Modem which is an integral part of the RepNode.

3.1. Getting started; Using The NetLink Application

Install the NetLink application and connect an RF Sniffer to a PC USB port using a standard USB to Mini-B cable. Depress the power button, the red LED should light. When the Sniffer enumerates, Windows will assign the next available COM port number to the Sniffer. This can be verified by opening the Windows Device Manager and making a note of the new COM port number. The assigned COM port number can change each time the Sniffer is connected to the PC. This is a Windows function and the user has no control over COM port assignment.

Open the NetLink application GUI and select the newly assigned com port number. Press the 'Connect' button. Type in the serial number of the RepNode you are testing in the box 'Device SN'. At this point you are ready to interrogate the RepNode, read registers and execute commands. Refer to the NetLink application manual for more information.



4. RF Exposure Limit Warning

To comply with FCC's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5. Compliance Statement (Part 15.19)

This Device complies with Part 15 of the 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.

6. Information to the User {Part 15.105(b)}

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. This equipment generates, uses and can radiated radio frequency energy and, if not installed and used in accordance with the instructions, 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:

- Reorient 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.

7. Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.