Experiments

Below are the definitions of the experiments to be done for the testing the proposed and implemented solutions in VHF/UHF Uplink Solutions for Remote Wireless Sensor Networks project. All experiments will be done in an open field with clear line of sight. Some of the experiments below are marked as optional, which means they will be performed only if the time allows. Else they will be put under the title of Further Work.

1. Experiments with radiotftp

These experiments will cover the radiotftp and radiotftp_process solutions. For testing, two Ubuntu laptops will be set up to use radiotftp to transfer files. Builtin data logger of radiotftp will be used to collect the below stated data. No experiments will be done with radiotftp_process, since their base codes –therefore the protocol stacks and timings- are the same. Transfer sizes are chosen as single and 16 packets to observe the differences between single packet and many-packet transfers. Since we are using amateur radio bands, we are actually not allowed to use ~100% channel utilization, but in the name of science we will test it. In the application notes for Radiometrix devices, it is said that lower baud rates have a direct impact on the range. Therefore we are going to use fixed average baud rates. The transmission power will be fixed to 10 mW (10 dBm). The VHF frequency to be used is 433.925 Mhz, and UHF frequency to be used will be decided in field (which will be between 144 and 146 MHz). Measurements will be done four times and will be averaged for increased accuracy. They will be performed separately for Bim2A and UHX1.

Parameters:

1. Distance
2. Transfer Size
3. Baud Rate

Input Range:

1. Distance = [2m:2km] (7 points)
2. Transfer Size = [127 bytes, 16*128 bytes],

Outputs:

1. Transfer Time
2. Throughput
3. Packet Error Rate
4. Energy consumption
5. Power consumption

Notes:

-Throughput will be derived from transfer time.
-Packet error rate will be derived from number of retransmissions.
-Energy consumption will be derived from datasheet data and amount of Tx enabled/disabled time.
-Power consumption will be derived from energy consumption by differentiating over transfer time.

2. Experiments with radio_tunnel & soundmodem

These experiments will cover the radio_tunnel and soundmodem solutions. Below explained measurements will be done with radio_tunnel and soundmodem separately. For radio_tunnel baud rates will be fixed to 19200 for Bim2A and 2400 for UHX1. For soundmodem the bitrate is already fixed to 1200 bps due to the usage of AFSK. The transfer sizes are chosen as 127 bytes and 2 kbytes to observe the difference between single packet and many packet transactions (MTU is 255 bytes). The transmission power will be fixed to 10 mW (10 dBm). The VHF frequency to be used is 433.925 Mhz, and UHF frequency to be used will be decided in field (which will be between 144 and 146 MHz). Measurements will be done four times to increase accuracy.

Parameters:

1. Transfer Size
2. Copy Software to be Used

Input Range:

1. Distance = [2m:2km] (4 points)
2. Transfer Size = [127 bytes, 2048 bytes]
3. Copy Software = [wput(ftp)]

Outputs:

1. Transfer time
2. Throughput
3. Instantaneous Channel Utilization
4. Average Channel Utilization
5. Energy Consumption
6. Power Consumption

Notes:

-Throughput will be derived from transfer time.

-Energy consumption will be derived from datasheet data and amount of Tx enabled/disabled time

-Power consumption will be derived from energy consumption by differentiating over transfer time

-Instantaneous channel utilization will be derived from measuring the Tx enabled/disabled time

-Average channel utilization will be derived from instantaneous channel utilization by integrating over transfer time.

3. General Experiments with Bim2A and UHX1

Without the use of any software, the performances of Bim2A and UHX1 will be measured. To do this, the carrier signal will carry no information but a complete set of zeros (grounded Tx). On the receiver side, RSSI output of the radiometrix devices will be measured. Later on, this data can be used to map RSSI level to the performance data obtained in first two experiments.

-Measurement wrt Distance

Parameters:

1. Distance

Input Range:

1. Distance = [2m:inf*] (16 points)

Outputs:

1. Rssi Voltage
2. Rssi

-Only the signal strength will be tested in the experiment.
-Rssi will be derived from using the RSSI voltage data by mapping it with the plots provided in datasheet (if provided).

4. General Experiments for UHX1 (Optional)

Without the use of any software, the performance of UHX1 will be measured. To do this, the carrier signal will carry no information but a complete set of zeros (grounded Tx). On the receiver side, RSSI output of the Radiometrix devices will be measured. Later on, this data can be used to map Tx Power level to the performance data obtained in first three experiments.
-Measurement wrt Distance

Parameters:

1. Distance
2. Tx Power (dBm)

Input Range:

1. Distance = [2m:inf*] (16 points)
2. Tx Power = [10:1:30] (10 to 30 dBm with 1 dBm steps)

-Only the signal strength will be tested in this experiment.
-Rssi will be derived from using the RSSI voltage data and mapping it with the plots provided in datasheet.
-Distance will be increased exponentially.
*inf means until the connection is lost, which means rssi is less than or equal to the carrier detect level.

Project Plan explaining the proposed solutions and the underlying technologies can be found in http://alpsayin.com in PDF or DOCX format.