Application Note

Cold Weather Operation
Test Results

OVERVIEW
Wireless equipment can have issues operating at extreme temperatures – hot or cold. In this application note, we present test data for the cold temperature performance of the SignalFire equipment.

The equipment that was tested included:

- Sentinels
- 300mW-Based Systems (A2, Field Monitor,…)
- Stick Units (Gateway, Modbus, RSD, Counter,…)
- Lithium Primary Battery Packs
- Sealed Lead Acid rechargeable Packs

TEST SETUP
We used dry ice to set the temperature to approximately -45 to -50 degrees C inside of an insulated enclosure. All SignalFire equipment is rated to -40 degrees C, but we wanted to test past this range.

RESULTS
The test results were very good. All radios experienced a small frequency shift in the same direction. The magnitude of the shift was within acceptable tolerances – especially if you consider that all units would be operating at similar temperatures. See the chart on the next page:
Note – You can see that the frequency shift is less than the limit. Also, if all the units are similar temperature, only the frequency difference matters, so that is much smaller.

**Battery Performance**

The battery performance degradation was minimal. The following is the battery voltage readings under full load (4-20mA Sensor):

<table>
<thead>
<tr>
<th></th>
<th>Room Temp</th>
<th>-40 to -45 C</th>
<th>Voltage drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium</td>
<td>3.326</td>
<td>3.159</td>
<td>0.167</td>
</tr>
<tr>
<td>Solar</td>
<td>3.699</td>
<td>3.48</td>
<td>0.219</td>
</tr>
</tbody>
</table>

The voltage drops here are negligible as the system will work well under 3.0 V. A low power sensor (like a HART or Voltage) sensor (drawing 3-5 mA) would result in less of a voltage drop and would be recommended for low temperatures.