

OneBase InSite® Connect Sample Audit:

What a little insight can tell you about your network.

Base station operations are becoming increasingly complex. As network technology advances, the number of subsystems inside base transceiver station (BTS) sites increases as well. In addition to the basic systems, such as power to the equipment, security, and environmental control, today's BTS also incorporate RET (remote electrical downtilt) control systems and digital surveillance. These individual systems represent a variety of manufacturers, interfaces, and operating platforms.

At the same time, the sheer number of cell sites within the network continues to mushroom to meet growing customer demand. In the U.S., the total number of cell sites has jumped 41% over the last five years. In emerging markets where mobile penetration is less dense, the increase, and headroom for growth, is even more dramatic.

The complexity and number of BTS locations have made monitoring the operating status of subsystems across the network increasingly unmanageable. Many operators find themselves responding to problems only after they become severe enough to warrant attention. Often, the job of monitoring conditions at each BTS so overwhelms the operator's resources that it may be months between visits to check on the status of any one BTS.

Such was the case at one of Eastern Europe's largest wireless providers.

One Operator's Need for a Proactive Solution

Since 1994, the operator's subscriber base has grown to more than 33 million. Its 54% market share is more than all other competitors combined. The operator's network infrastructure now includes more than 6,000 cell sites.

Yet, aside from very limited OEM-based remote monitoring, the operator has neither the resources nor the personnel to track conditions at each BTS. Instead, engineers select a few hundred sites each month for inspection. An inspection involves technicians visiting the base transceiver station to ensure, among other things, that the doors are secure, to record energy usage, and investigate and reset any dry alarm contacts.

In 2010, the operator met with representatives of CommScope® to learn more about OneBase InSite Connect, a tool that allows remote monitoring and control of the various subsystems across a network.

The InSite Connect solution consists of two main components. The first component is a Remote Controller Unit (RCU), deployed at each BTS that monitors and manages up to 88 individual subsystems. Each RCU is linked to the second component, a Control Management System (CMS) that manages BTS conditions and subsystem performance across the entire network. The system provides a seamless interface with virtually any subsystem regardless of the subsystem's

manufacturer or platform. Site conditions can be monitored from any location in the country with a secure network connection.

The operator agreed to a trial deployment to determine how InSite Connect could monitor and /or control their site subsystems. CommScope installed RCUs at 200 BTS sites.

In August 2011, a CommScope engineer with remote access to the operator's InSite Connect server spent less than 60 minutes taking a "snapshot" of the operator's network. The goal was to see the number and severity of the issues that were going unchecked. The remainder of this paper details exactly what 60 minutes with InSite Connect revealed.

Network Overview

The InSite Connect user interface is intuitive while providing a comprehensive look at all aspects of the BTS subsystems. The main screen features a file tree listing all sites being monitored. The sites that appear magenta in color indicate a location where a BTS device issue has been detected.

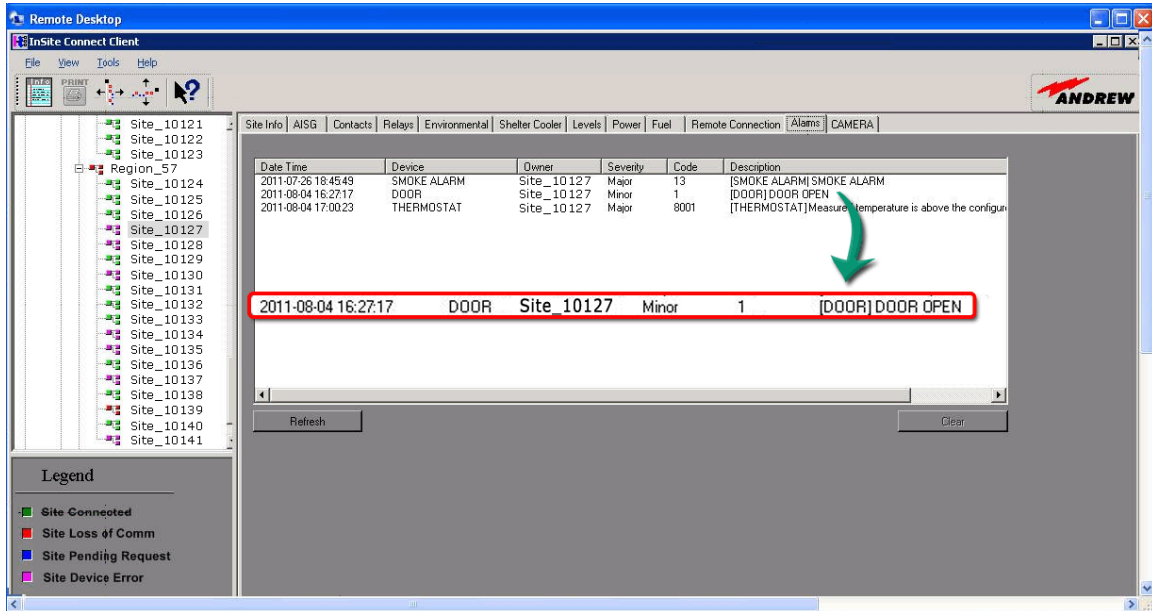
Issues can range in severity from a false alarm that simply needs to be reset to a major problem such as an overheated enclosure or interrupted power supply. Tabs across the top of the main screen enable the operator to view the operational status, settings, and other key information for each subsystem at the selected site.

In this particular case, 56 of the 200 locations – 28% of all sites being monitored - indicated a device issue. The CommScope engineer conducting the audit selected a single location, Site #1, for investigation. The following illustrates some of the key findings, and the value of a solution like InSite Connect.

Understanding the Issues

Because the site has reported one or more device errors, the first step is to check the Alarms tab to see which systems are in error.

Alarms



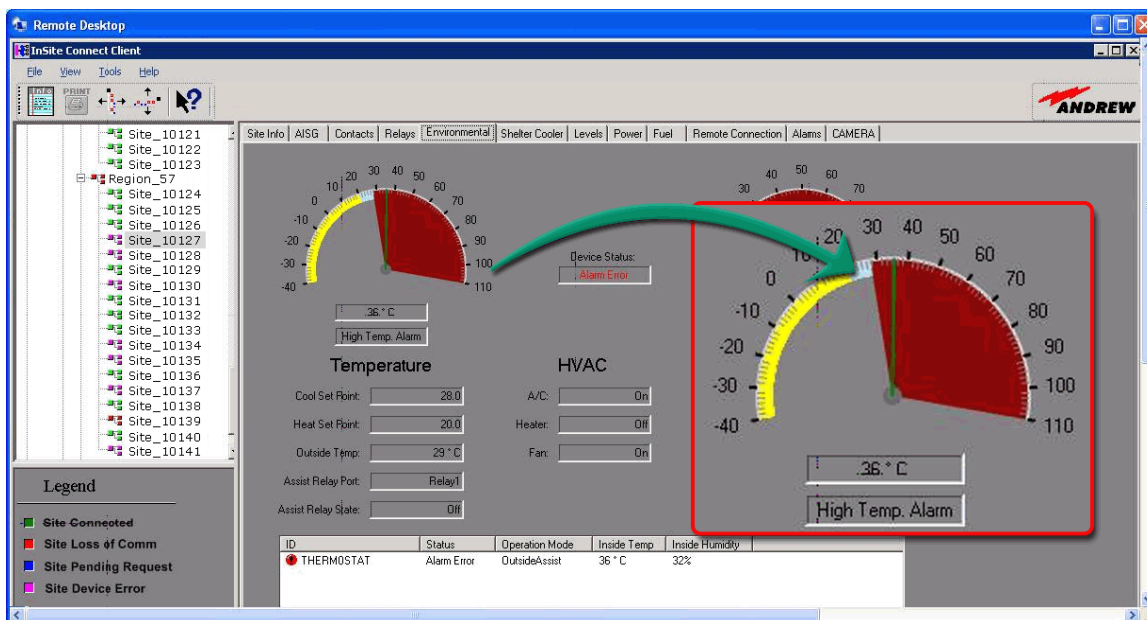
In this case, three alarms have been triggered: Open Door Alarm, Smoke Alarm, and High Temperature Alarm. There is always a chance of a false alarm, but which one? Of those that represent actual problems, what is the cause and how severe are they? Which problems can wait for the next scheduled maintenance and which must be addressed immediately?

Two of the three alarm errors - High Temperature and Smoke - relate to the environment inside the enclosure. The logical next step is to investigate further using the Environment tab.

Environment Tab

The Environment tab monitors the temperature and humidity levels within the enclosure. It also provides the various parameter settings for the HVAC systems. A quick look indicates an operating temperature of 36°C – 28% higher than it should be, indicating a potentially serious condition at Site #1.

Environment

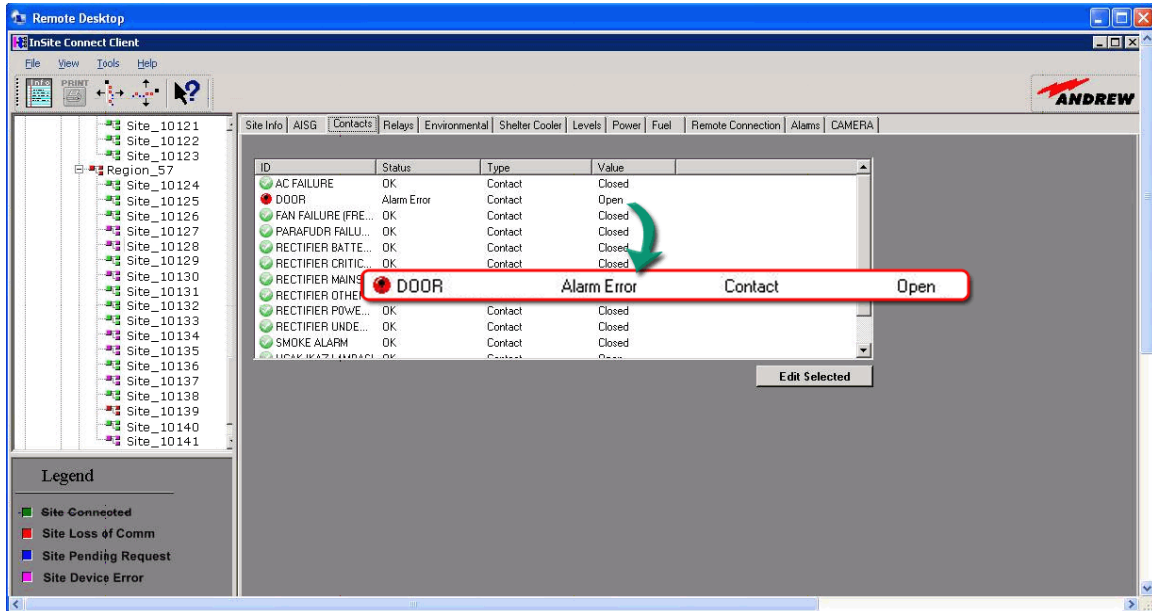


The bigger issue, however, is discovering what is responsible for the elevated temperature. Note the air conditioning Cool Set Point is 28°. The air conditioner, therefore, is either running but not cooling or it is not running at all. Either way, the fact that the equipment is overheating is a serious issue, driving up maintenance expense and energy costs while jeopardizing network uptime.

Is the Door Alarm Related or Coincidental? The Contacts tab

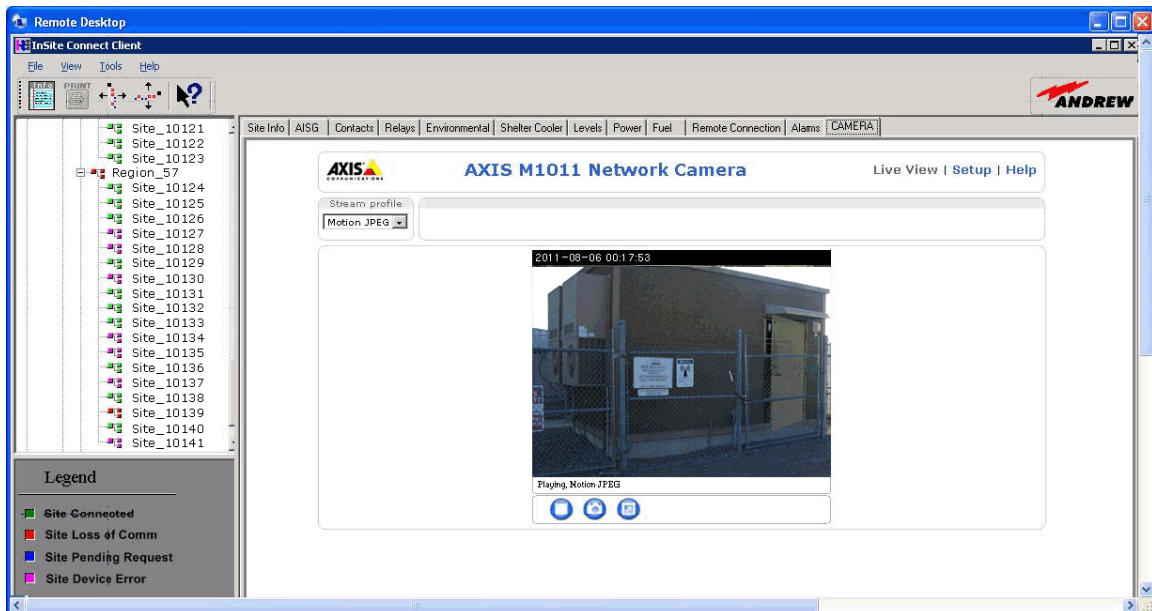
Then there is the issue of the Open Door Alarm and the potential role it plays in the elevated temperature in the enclosure. A look at the Contacts tab verifies that the door is open. Based on the time stamp shown on the Alarms tab, it has been open for at least a day.

Contacts



Using the Camera tab provides visual confirmation of the open door and now root cause of the high internal temperature becomes clear.

Camera

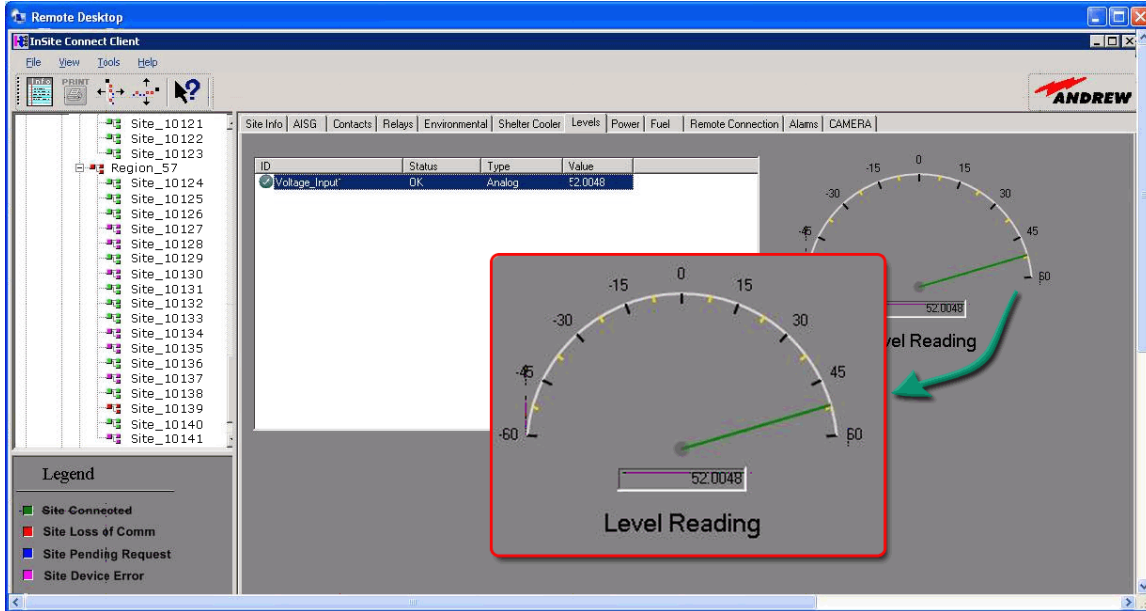


The air conditioner most likely is running and doing all it can to cool the site. However, the equipment inside is generating considerable heat. The open door disturbs the airflow between the vents and the return, allowing the site to overheat even with the air conditioner running continually.

The result is a triple threat to the operator's network. The open door poses a security risk; moreover, it prevents the cooling system from doing its job. This not only degrades the life and performance of the equipment, it pushes the air conditioner to its limit and wastes a significant amount of energy. Given that approximately 30% of a site's operating cost is spent on energy, this issue at Site #1 warrants immediate attention.

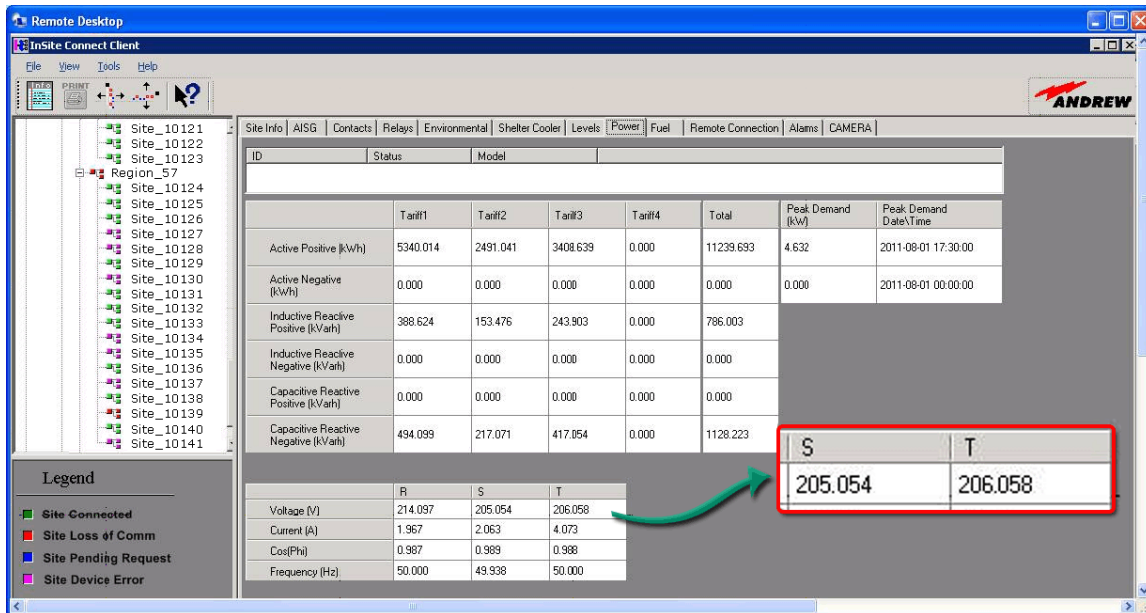
Additional Insights

Levels



The engineer continued the audit by clicking on the Levels tab. This provided a snapshot of the voltage input to the rectifiers. The reading registered 52.0048 volts. Normally this reading should be around 54 volts. While it is not a major issue, the rectifier is sufficiently low to warrant looking at the Power tab to see if the power supply is providing enough energy.

Power



Indeed the Power tab shows voltage readings for the S and T phases in the 205-206 V range. This should be higher. Now we understand why the rectifier reading is lower than it should be. Why the power output is lower than needed is another question. It may be due to the higher temperature in the site or may be a case of poor power. Either way, the condition needs to be investigated further, sooner rather than later.

Additional Findings Suggest a Bigger Problem

As noted, the open door, strained air conditioner, and overheating enclosure represent a serious issue. Based on a quick look at three additional sites within the network, these problems also may be symptomatic a larger issue.

During further investigation, the CommScope engineer performed a cursory check of three additional sites that reported a device error. All three BTS locations indicated similar problems. The dry contact alarms and the security cameras detected and confirmed an open door and High Temperature alarm - the same triple threat detected at Site #1. This suggests a problem with the network's maintenance protocol. If left unchecked, it will continue to reoccur month after month.

Site #2

Alarms

The screenshot shows the 'Alarms' tab in the InSite Connect Client. A table displays the following data:

Date Time	Device	Owner	Severity	Code	Description
2011-08-08 21:47:23	DOOR	Site_20244	Minor	1	[DOOR] DOOR OPEN
2011-08-12 14:58:19	THERMOSTAT	Site_20244	Major	8001	[THERMOSTAT] Measured temperature is above the configu
2011-08-12 17:08:19	AC FAILURE	Site_20244	Minor	2	[AC FAILURE] AC FAILURE
2011-08-12 17:08:31	RECTIFIER MAINS	Site_20244	Major	3	[RECTIFIER MAINS] RECTIFIER MAINS
2011-08-12 17:08:34	RECTIFIER CRITICAL	Site_20244	Minor	4	[RECTIFIER CRITICAL] RECTIFIER CRITICAL

Buttons for 'Refresh' and 'Clear' are visible at the bottom of the table area.

Camera - Door Open

The screenshot shows the 'CAMERA' tab in the InSite Connect Client. It displays a live video feed from an 'AXIS M1011 Network Camera'. The interface includes a 'Stream profile' dropdown set to 'MPEG-4' and a timestamp of '2011-08-12 17:20:31'. The video feed shows a door area. Below the video, it says 'Playing Motion JPEG' and has playback controls.

Environmental - High Temperature

The screenshot shows the 'Environmental' tab in the InSite Connect Client. It features two large semi-circular gauges: one for Temperature (ranging from -40 to 110) and one for Humidity (ranging from 0 to 100). The Temperature gauge is in the red zone, indicating a high temperature of 37°C. A 'High Temp. Alarm' is active. The Humidity gauge is in the green zone, showing 18%. Below the gauges are controls for HVAC (A/C, Heater, Fan) and Humidity (Humidity Set Point, Dehumidifier Set Point, Humidifier, Dehumidifier). A table at the bottom shows the status of the THERMOSTAT device.

ID	Status	Operation Mode	Inside Temp	Inside Humidity
THERMOSTAT	Alarm Error	OutsideAssist	37 °C	18%

Site #3

Alarms

The screenshot shows the 'Alarms' tab in the InSite Connect Client. It displays a table of recent alarm events. The table has columns for Date Time, Device, Owner, Severity, Code, and Description.

Date Time	Device	Owner	Severity	Code	Description
2011-08-08 21:47:55	DOOR	Site_30346	Minor	1	[DOOR] DOOR OPEN
2011-08-08 21:47:55	PARAFUDR FAILURE	Site_30346	Minor	9	[PARAFUDR FAILURE] PARAFUDR FAILURE
2011-08-08 21:47:55	SMOKE ALARM	Site_30346	Major	13	[SMOKE ALARM] SMOKE ALARM
2011-08-12 12:51:18	THERMOSTAT	Site_30346	Major	8001	[THERMOSTAT] Measured temperature is above the configu...

Camera - Door Open

The screenshot displays the InSite Connect Client interface. On the left is a tree view of sites grouped into regions (Region_200, Region_300, Region_400). The main window shows the 'AXIS M1011 Network Camera' live view. The video feed shows an outdoor area with a fence and a door. The status bar at the bottom indicates 'CMS - OK' and provides system information like IP address (10.210.54.141) and user (su).

Environmental - High Temperature

The screenshot displays the InSite Connect Client interface for environmental monitoring. It features two large circular gauges: Temperature (showing 38°C with a 'High Temp. Alarm') and Humidity (showing 22%). Below the gauges are HVAC controls for Temperature (Cool Set Point: 28.0, Heat Set Point: 20.0, Outside Temp: 32°C, Assist Relay Port: Relay1, Assist Relay State: Off) and Humidity (Humidity Set Point: 0, Dehumidifier: Off). A table at the bottom shows the status of the THERMOSTAT device.

ID	Status	Operation Mode	Inside Temp	Inside Humidity
THERMOSTAT	Alarm Error	OutsideAssist	38 °C	22%

Site #4

Alarms

Date Time	Device	Owner	Severity	Code	Description
2011-08-08 21:48:37	SMOKE ALARM	Site_40416	Major	13	[SMOKE ALARM] SMOKE ALARM
2011-08-08 21:48:37	DOOR	Site_40416	Minor	1	[DOOR] DOOR OPEN
2011-08-08 21:48:37	THERMOSTAT	Site_40416	Major	8001	[THERMOSTAT] Measured temperature is above the configur
2011-08-12 14:38:49	RECTIFIER OTHER	Site_40416	Minor	7	[RECTIFIER OTHER] RECTIFIER OTHER

Camera - Door Open

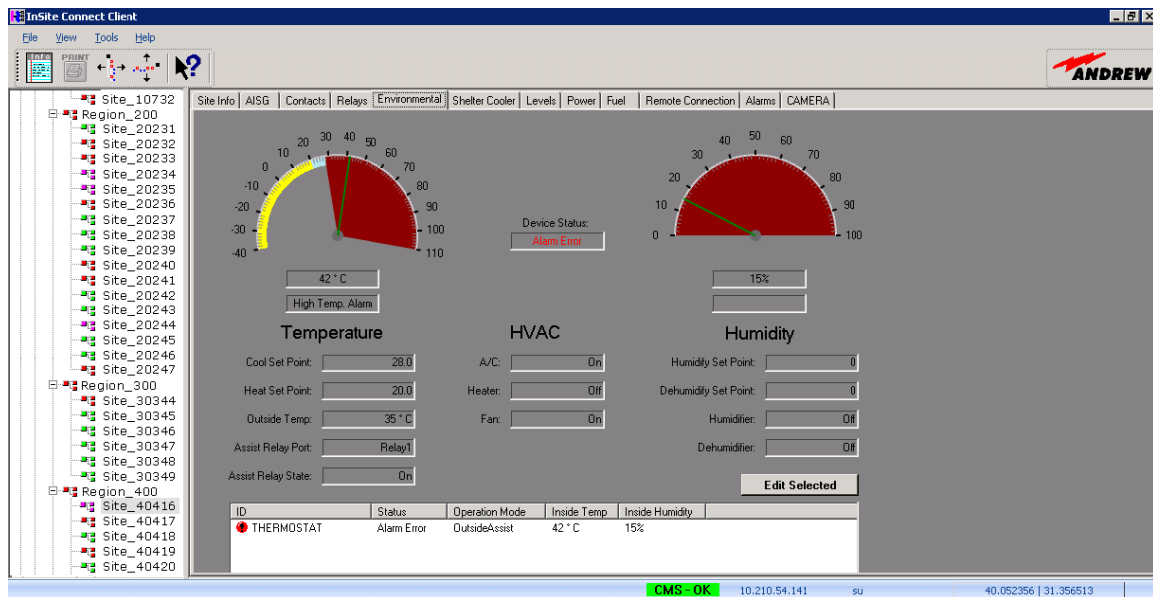
AXIS M1011 Network Camera

Stream profile: Motion JPEG

2011-08-11 09:22:35

Playing Motion JPEG

Environmental - High Temperature



The Value of InSite Connect

It is important to realize that the findings listed here are the results of a very cursory look. In just 60 minutes, InSite Connect:

- Caught multiple potentially major alarm triggers
- Spotted significant security threats
- Detected overheating equipment
- Anticipated an overloaded air conditioning unit
- Prevented the continued waste of cooling dollars
- Identified a possible power and voltage issue.

Most importantly, these issues were identified and localized before any significant damage could be done. This fact alone suggests that InSite Connect may be able to save significant money by enabling the operator to be proactive in terms of site maintenance. At the same time, InSite Connect also provides remote control capabilities so that many of the issues discovered can be fixed without a site visit.

Among the many BTS subsystems InSite Connect can monitor and control are:

- | | | |
|----------------------------|--------------------|-----------------|
| AC Power Transfer Switches | Generators | Temperature |
| Battery Discharge | Humidity Sensors | Thermostats |
| Battery Monitors | Hydrogen Detectors | TMA |
| CSU | MCPA | Tower Light |
| DACS | Microwave | Water Intrusion |
| Entry alarms | Power Fail | Camera |
| Fire/Smoke | RET Antennas | |
| Fuel Cell | RXAIT | |

Potential Savings System Wide

It is also critical to note that these findings represent the investigation of a single BTS site. Based on the data at the time of the audit, 28% of the sites being monitored registered one or more device errors. With more than 6,000 sites across the network, this suggests that – at any given time - 1680 sites could be experiencing thousands of issues. Some of these issues will be critical, others will represent a false alarm, and most of them can be resolved with a site visit. For this particular operator, the potential savings systemwide are widespread and very significant.

Implications Industry Wide

This specific case study is far from an isolated anomaly. In fact, it represents the reality many operators are facing. With personnel resources already stretched thin, wireless operators worldwide are increasingly being forced into a reactive position when it comes to site monitoring and maintenance. At the same time, networks are under greater pressure than ever to reduce OPEX costs and squeeze more efficiency from their systems. For those charged with maximizing BTS performance, it is a perfect storm.

With the ability to centralize the monitoring process, remotely control subsystem operations, and significantly reduce manpower requirements, InSite Connect provides operators a powerful tool as they move ahead.