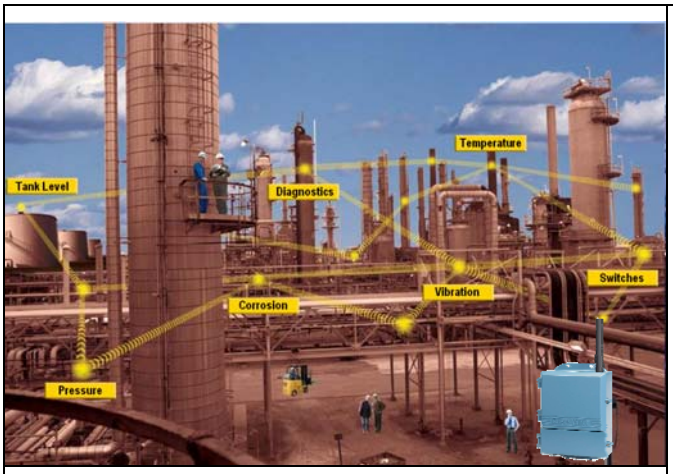
Tank Gauging Project - Smart Wireless Audit Report

Cahill Instrumentation / BELCO

Hamilton, Bermuda, May 25 & 26th 2010



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1 Objective of the wireless audit

The objective of the wireless audit was to validate the strength and reliability of the wireless communication paths between the Wireless 1420 Gateway and the twelve (12) tank level gauging wireless transmitter's locations as proposed in our Tank Gauging Proposal that was sent to Mr. Raymond Hann of Cahill Instrumentation.

One of main concerns raised by Cahill was the signal propagation of the four (4) wireless measurements level devices located at the lube oil tanks north of the East Power Station while having the Rosemount 1420 gateway located south of the power station.

The East Power Station building was the main obstruction of concern in bridging the wireless transmitter's signals which needed to be validated during the site audit tests.

The figure below (Figure 1) represents the twelve (12) wireless measurement points consisting of four (4) level devices at the Lube Oil Tanks located north of the East Power Station building and eight (8) at the sludge, heavy fuel & light fuel tanks located south of the East Power Station building.

Figure 1. Satellite overview of BELCO installations

2 Wireless demo equipment used for the audit

The wireless audits were done on site by locating the following wireless demo equipment:

1) Rosemount 1420 Wireless Gateway ***"hg1420"*** (x1)
2) Rosemount 848T Wireless Multiplexer Transmitter "*TX_Multipoint_TT-2009ABCD*"(x1)
3) Rosemount 648T Wireless Transmitter ***"TT-2002"*** (x1)
4) Rosemount 3051S DP Wireless Transmitter ***"DPT_2001"***(x1)
5) Rosemount 702 Discrete Wireless Transmitter with Long Range Antenna "***DI_2003"*** (x1)
6) Rosemount 705 THUM Wireless HART Transmitter wired to conventional 2051 PT "***THUM_2051"*** (x2)

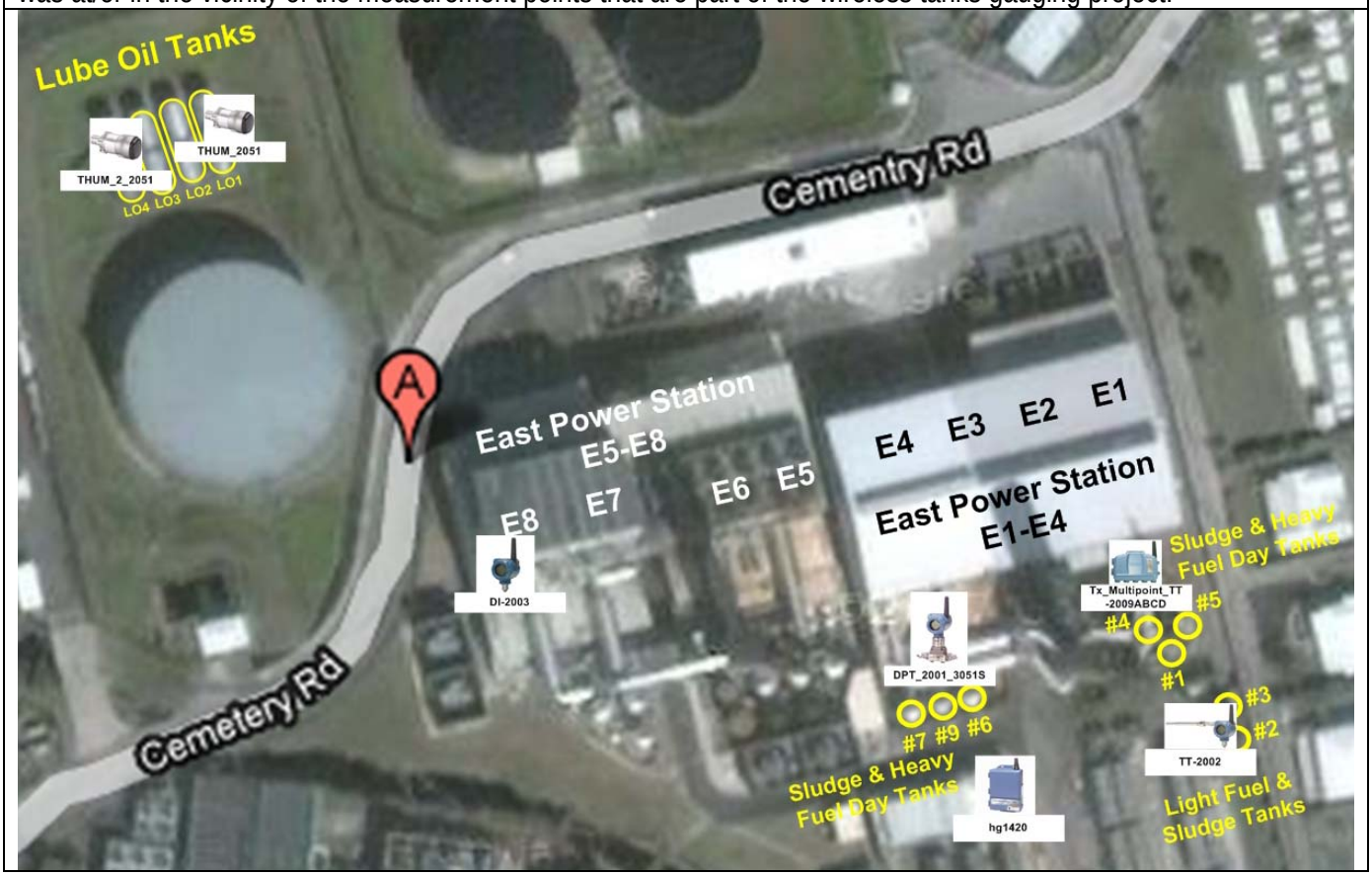
The wireless equipment highlighted above was first powered in proximity of the 1420 Wireless Gateway and then were positioned to the various tank gauging locations once the initial communication to the wireless gateway was established.

3 Wireless Audit

3.1 Trial #1

3.1.1 Trial #1 Wireless Equipment Location

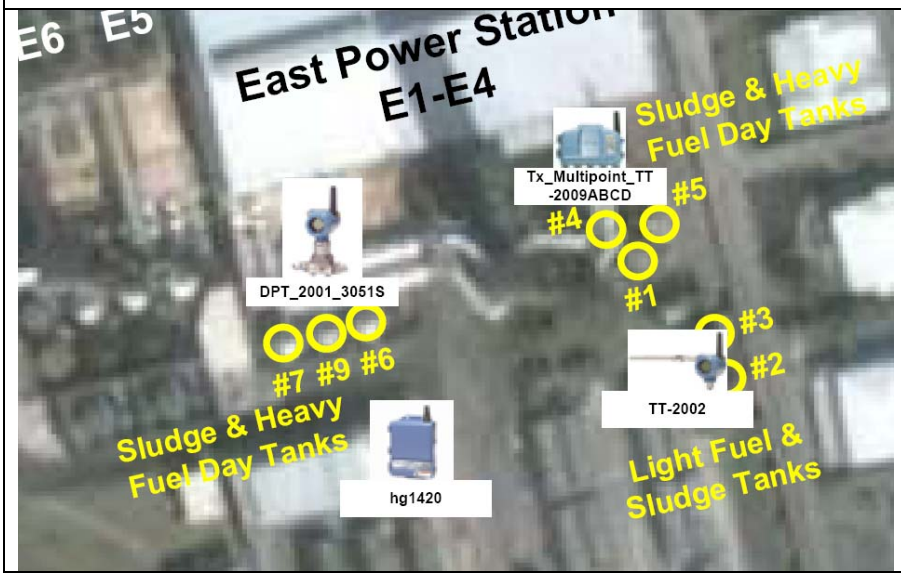
Below is the overview map of the wireless equipment locations used for the first trial. At least one (1) wireless device was at/or in the vicinity of the measurement points that are part of the wireless tanks gauging project.



The Rosemount 1420 Wireless Gateway *(hg1420)* was installed on top of the contractor's office, just south of the sludge and Heavy Fuel day tanks #6, #7 & #9.

The wireless gateway had clear line of sight with the Light Fuel & Sludge Tanks (#2 & #3), Sludge & Heavy Fuel Day Tanks (#1 & #5) and the Sludge & Heavy Fuel Day tanks (#7, #9, #6) and had obstructed view of Tank #4.

It was later decided that we could not consider this location for the gateway's location as it would eventually be replaced by a Reverse Osmosis (RO) water treatment building.



The Rosemount 3051S differential Pressure Transmitter *(DPT_2001)* was installed on top of Heavy Fuel Day Tank #9. This transmitter had clear line of sight with the temperature transmitter (TT-2002) located on top of the Light Fuel & sludge tanks #2 & #3	
The Rosemount 848T Wireless Multiplexer Temperature Transmitter *(tx_Multipoint_TT-2009ABCD)* was installed on top of sludge & heavy fuel day tank #4. This transmitter had clear line of sight with the temperature transmitter (TT-2002) but had obstructed view to the 1420 Gateway and other wireless devices.	
The Rosemount 648T Wireless Temperature Transmitter (TT-2002) was installed between fuel & sludge tanks #2 & #3	

The Rosemount 702 Discrete (DI-2003)Long Range Transmitter was used as a repeater to bridge the wireless signals coming from the transmitters located north of the East power Station building (Lube Oil Tanks) to the 1420 Gateway located south of the building.

The repeater was installed on the south-west corner roof of the East Power Station building (E8) and had direct line of sight with the 1420 Gateway (hg1420)

The Rosemount 705 THUM (THUM_2051) adapters were mounted onto standard 4-20mA HART Rosemount 2051 transmitters and installed on Lube Oil Tanks #1 and #4.

The Lube Oil Tanks were located north of the East Power Station building, and had obstructed view to the wireless gateway & other wireless devices located south of the building.

The THUM adapter installed at Lube Oil tank #LO1 had semi-obstructed view of the Wireless 702 long-range repeater (DI-2003).

3.1.2 Trial #1 results

The system was powered up in the afternoon and was left running overnight to be able to get a thorough reporting of the various signal propagations paths along with their reliability and path stability factors.

The following figure shows a live mode snapshot that was taken the following morning using Emerson's AMS Device Manager Software equipped with the Wireless Snap-on utility. The Wireless SNAP-ON utility allows viewing of measured process variables, remaining battery voltage, data reliability and other diagnostics. Additionally, it allows to view parent/child communication paths between wireless nodes as seen in the figure below to identify potential strangle points in the network.

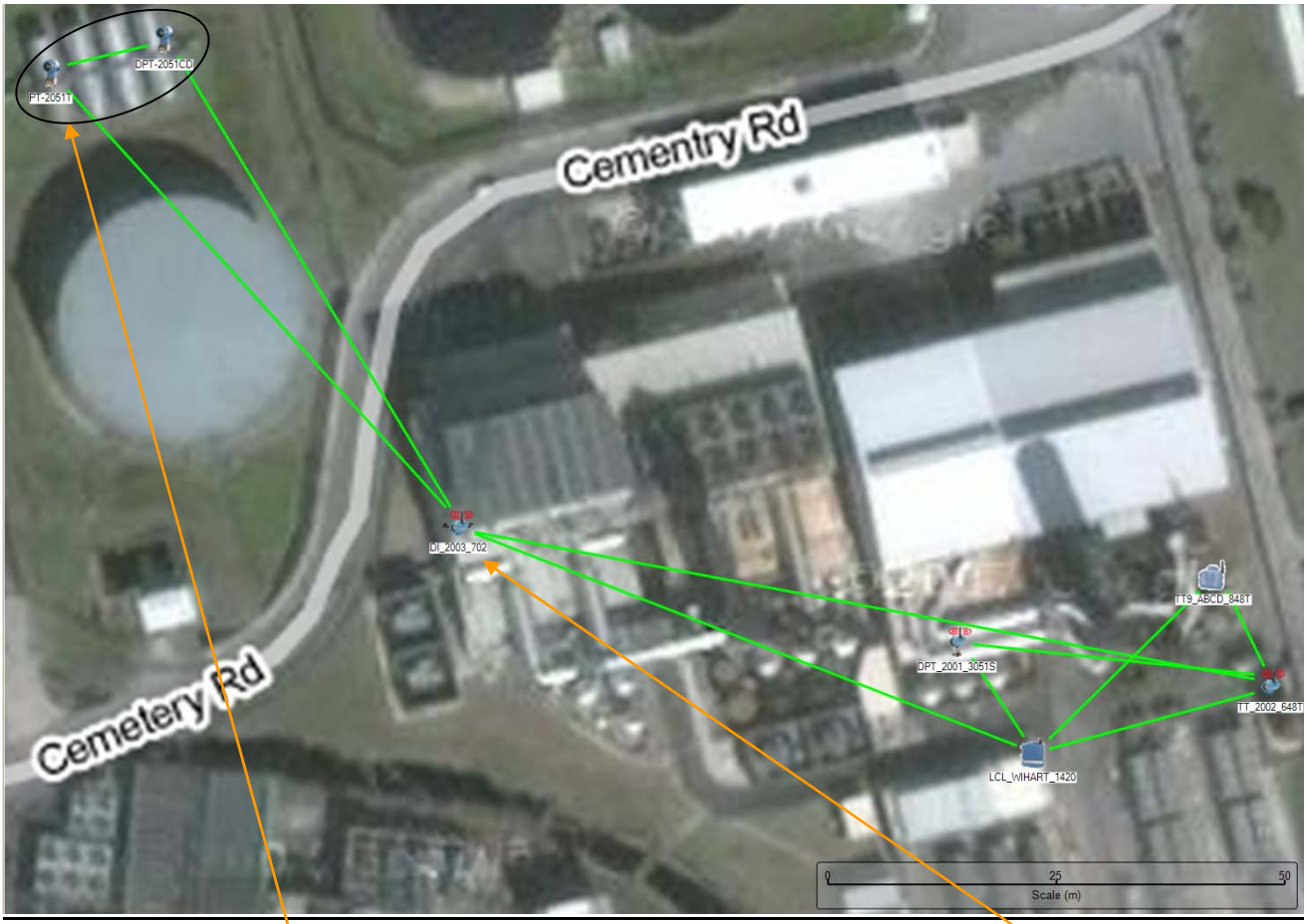


Figure 2. Trial #1 AMS Wireless Snap-on LIVE mode May 26th at 8h00 AM

Both of the Lube Oil **Wireless THUM adapters** were able to be attained by the **Rosemount 702 repeater**. The repeater as seen in this live mode is considered as a **strangle point** to the wireless network as the two (2) THUMS located at the Lube Oil tanks depend on this transmitter to be able to bridge their communications to the 1420 gateway. It will be recommended later in this report the installation of a second (2nd) repeater on the north east corner roof of the East Power Station building (E7) to alleviate this strangle point.

The transmitters located south of the East Power Station building can all be seen by each other and have direct wireless connection to the 1420 Gateway.

The following figure shows the current network status of the wireless devices within the wireless network. This page can be accessed from any computer web browser (i.e. Internet Explorer) that is on the same Ethernet network as the 1420 Gateway as long as proper login security rights access have been validated.

Smart Wireless Gateway

Network Device Status admin

HART Tag	Node state	Active neighbors	Neighbors	Service denied	Reliability	Missed updates	Path stability	RSSI	Joins	Join Time
DI-2003	●	hg1420 TT-2002 THUM_2_2051 THUM_2051	4	●	99.6 %	35	92.3 %	-69 db	2	05/25/10 16:55:57
DPT-2001	●	hg1420 TT-2002	2	●	99.9 %	10	96.1 %	-62 db	1	05/25/10 13:50:20
THUM_2051	●	DI-2003 THUM_2_2051	2	●	53.7 %	1808	100.0 %	-69 db	2	05/25/10 21:16:59
THUM_2_2051	●	DI-2003 THUM_2051	2	●	82.0 %	579	100.0 %	-69 db	3	05/25/10 18:18:38
TT-2002	●	hg1420 DPT-2001 DI-2003 Tx Multipoint TT-2009ABCD	4	●	100.0 %	3	95.6 %	-61 db	1	05/25/10 13:53:58
Tx Multipoint TT-2009ABCD	●	hg1420 TT-2002	2	●	100.0 %	0	92.7 %	-68 db	1	05/25/10 13:55:00

Figure 3. Trial #1 1420 Gateway Network Status web page Screenshot

The following figure is the "Explorer" mode that shows the live data that is collected from each wireless device along with the "last update" timestamp which was transmitted to the gateway. When the line highlights to GREEN, it indicates that a live transmission coming from a remote device has been transmitted to the gateway

Smart Wireless Gateway

Explorer

HART Tag	HART status	Last update	PV	SV	TV	QV	Burst rate
2051CD	●	05/26/10 07:55:48	1.176 InH2O 68F ●	23.918 DegC ●			00:01:00
2051T	●	05/26/10 07:59:32	0.281 PSI ●	24.461 DegC ●			00:01:00
DI-2003	●	05/26/10 08:03:28	1.000 ●	0.000 ●	24.750 DegC ●	9.128 V ●	8
DPT-2001	●	05/26/10 08:03:26	-0.027 InH2O 68F ●	22.957 DegC ●	23.500 DegC ●	9.031 V ●	4
THUM_2051	●	05/26/10 07:59:32	23.375 DegC ●				00:01:00
THUM_2_2051	●	05/26/10 07:55:48	22.563 DegC ●				00:01:00
TT-2002	●	05/26/10 08:03:24	25.360 DegC ●	NaN DegC ⚠	25.500 DegC ●	9.150 V ●	8
Tx Multipoint TT-2009ABCD	●	05/26/10 08:03:28	26.148 DegC ●	24.763 DegC ●	-0.747 DegC ●	-0.589 DegC ●	4

Figure 4. Trial #1 1420 Gateway Explorer web page Screenshot

Both figures above shows that all devices are live and are communicating with each other which validate this first trial as feasible installation.

3.2 Trial #2

3.2.1 Trial #2 Wireless Equipment Location

The Rosemount 702 Repeater DI-2003 was lowered from the roof to the intermediate floor of the East Power Station in an effort to improve the overall communication between the 1420 Gateway and the Lube Oil Tanks THUM units.	

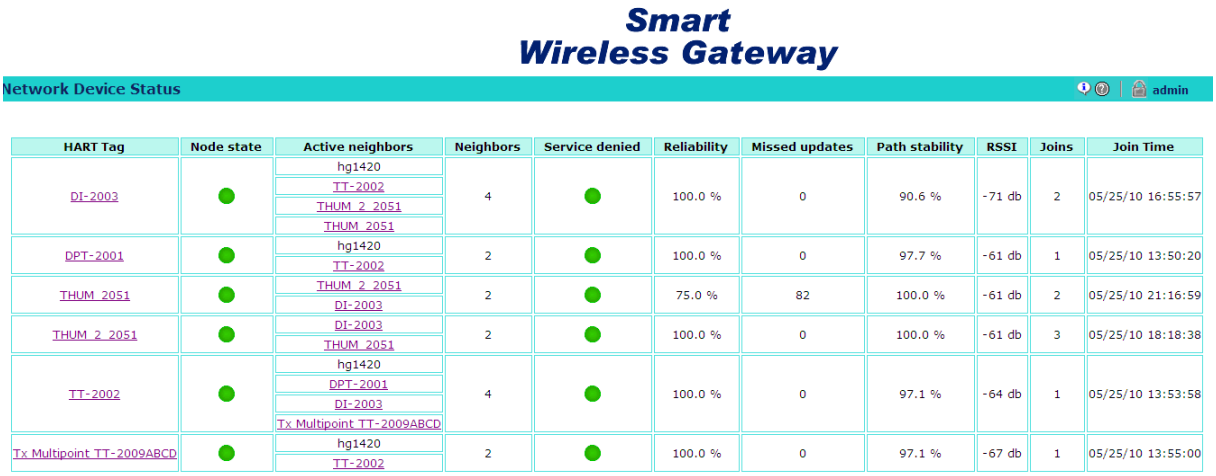
3.2.2 Trial #2 results

The system was left powered on and the Rosemount 702 repeater was relocated. Once installed, the system was left running for one (1) hour. During the tests, one of the DEMO units was found defective (DPT-2051CD) and was not considered in the final test results.

Figure 5. Trial #2 AMS Wireless Snap-on LIVE mode May 26th at 12h30 PM

The Lube Oil **Wireless THUM adapter** was able in this 2nd trial to be attained by the **Rosemount 702 repeater**.

The transmitters located south of the East Power Station building continued to be seen by each other and have direct wireless connection to the 1420 Gateway as no changes were brought to their locations.



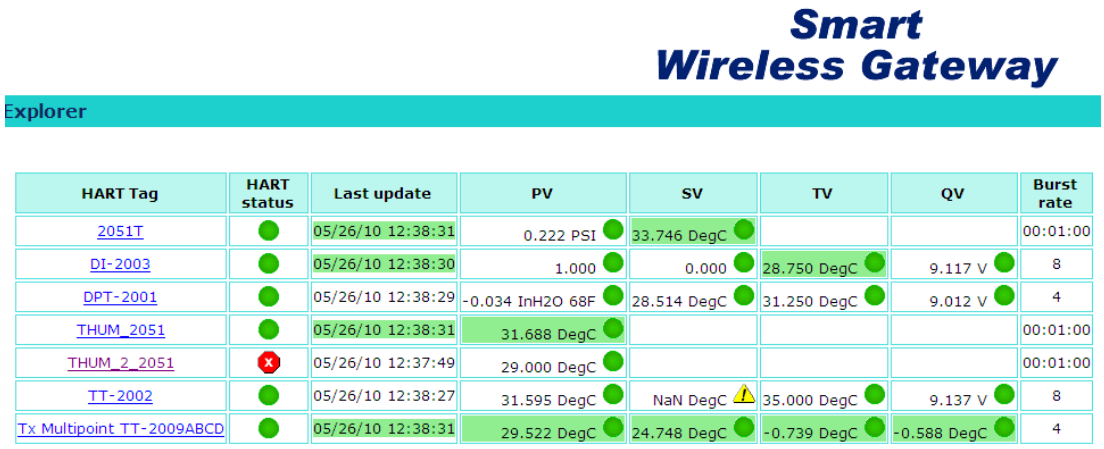
Smart Wireless Gateway

Network Device Status

admin

HART Tag	Node state	Active neighbors	Neighbors	Service denied	Reliability	Missed updates	Path stability	RSSI	Joins	Join Time
DI-2003		hg1420 TT-2002 THUM_2_2051 THUM_2051	4		100.0 %	0	90.6 %	-71 db	2	05/25/10 16:55:57
DPT-2001		hg1420 TT-2002	2		100.0 %	0	97.7 %	-61 db	1	05/25/10 13:50:20
THUM_2051		THUM_2_2051 DI-2003	2		75.0 %	82	100.0 %	-61 db	2	05/25/10 21:16:59
THUM_2_2051		DI-2003 THUM_2051	2		100.0 %	0	100.0 %	-61 db	3	05/25/10 18:18:38
TT-2002		hg1420 DPT-2001 DI-2003 Tx Multipoint TT-2009ABCD	4		100.0 %	0	97.1 %	-64 db	1	05/25/10 13:53:58
Tx Multipoint TT-2009ABCD		hg1420 TT-2002	2		100.0 %	0	97.1 %	-67 db	1	05/25/10 13:55:00

Figure 6. Trial #2 1420 Gateway Network Status web page Screenshot



Smart Wireless Gateway

Explorer

HART Tag	HART status	Last update	PV	SV	TV	QV	Burst rate
2051T		05/26/10 12:38:31	0.222 PSI	33.746 DegC			00:01:00
DI-2003		05/26/10 12:38:30	1.000	0.000	28.750 DegC	9.117 V	8
DPT-2001		05/26/10 12:38:29	-0.034 InH2O 68F	28.514 DegC	31.250 DegC	9.012 V	4
THUM_2051		05/26/10 12:38:31	31.688 DegC				00:01:00
THUM_2_2051		05/26/10 12:37:49	29.000 DegC				00:01:00
TT-2002		05/26/10 12:38:27	31.595 DegC	NaN DegC	35.000 DegC	9.137 V	8
Tx Multipoint TT-2009ABCD		05/26/10 12:38:31	29.522 DegC	24.748 DegC	-0.739 DegC	-0.588 DegC	4

Figure 7. Trial #2 1420 Gateway Explorer web page Screenshot

Similar to trial #1, both figures shown above indicated that all devices are live and are communicating with each other which validated this second trial as feasible installation.

Comparing with Trial #1 results, there was a significant RSSI signal strength increase from -69 db to -61 db between the THUM unit located at the lube oil and the Rosemount 702 repeater at the East power station which validated that this position as a valid location for one of the Rosemount 702 repeater.

The second screenshot shows the defective demo unit (THUM_2_2051) which was not considered for the remaining part of the study.

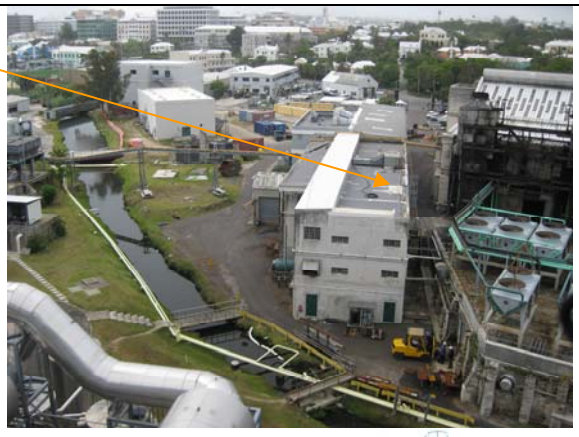
3.3 Trial #3

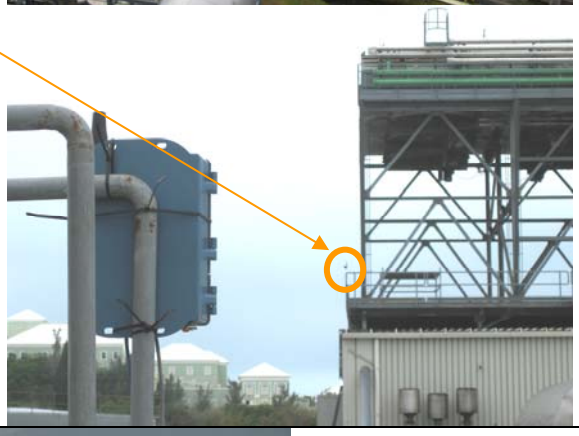
3.3.1 Trial #3 Wireless Equipment Location

Below is the overview map of the wireless equipment locations used for the third (3rd) and last trial. The 1420 Gateway was relocated on the roof of the office building located south of the East Power Station and the Rosemount 3051S DP Wireless Transmitter was relocated at the Lube Oil Tanks in replacement of the defective demo unit to be able to complete the tests.

The Rosemount 1420 Wireless Gateway *(hg1420)* was installed on top of the roof of the office building located south of the East Power Station building. This location was preferred by Cahill/BELCO as it had direct access to UPS power and to the plant Ethernet server rack room.

At this location, the Gateway had direct line of sight with the Rosemount 702 repeater located at the East Power station building.





Rosemount 3051S DP Wireless Transmitter was relocated at the Lube Oil Tanks in replacement for the defective demo unit to be able to complete the wireless trials.

At this location, the 3051S DP Wireless Transmitter had direct line of sight with the Rosemount 702 repeater located at the East Power Station Building.

3.3.2 Trial #3 results

The transmitters were left powered on and the Rosemount 1420 Gateway was powered off and relocated on top of the roof of the office building located south of the East Power Station building. Once powered up, the gateway automatically started communicating back to the remote transmitters. No resets were required at the remote field wireless to re-initiate the communication back to the gateway.

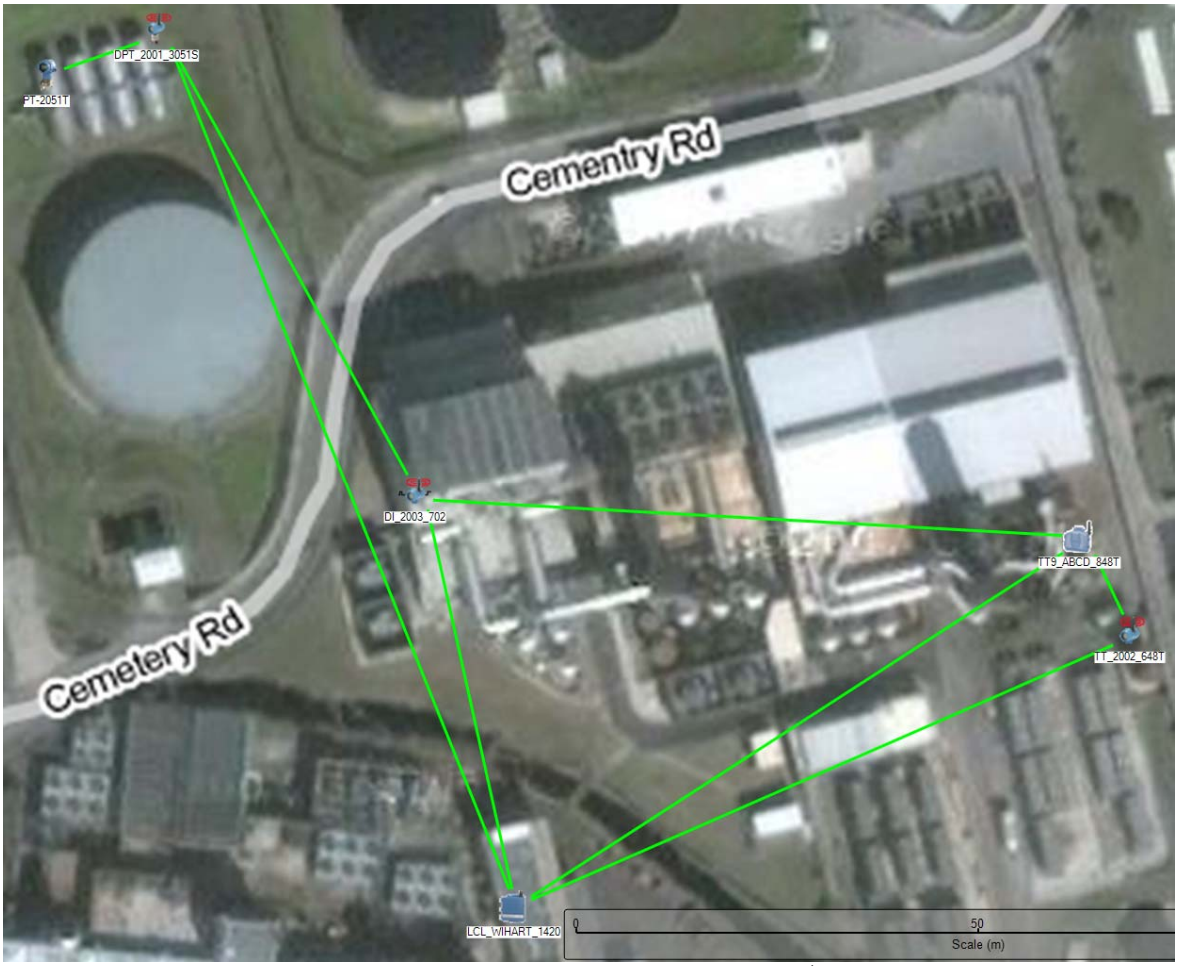


Figure 8. Trial #3 AMS Wireless Snap-on LIVE mode May 26th at 3h45 PM

In this trial, the Rosemount 1420 Wireless Gateway had direct communications with the 3051S DP Wireless Transmitter (DPT-2001) located at the Lube Oil tanks without the need of going through the Rosemount 702 repeater.(DI-2003)

The Gateway had direct line of sight with the Rosemount 648T Wireless Temperature transmitter (TT-2002) located between fuel & sludge tanks #2 & #3 and had obstructed line of sight with the Rosemount 848T Wireless Multiplexer Temperature Transmitter (tx_Multipoint_TT-2009ABCD) installed on top of the sludge & heavy fuel day tank #4.

During this trial, the Rosemount 702 repeater located on top of the East Power Station building was able to communicate directly to the Rosemount 848T Wireless Multiplexer Temperature Transmitter on top of tank#4.

Smart Wireless Gateway

Network Device Status admin

HART Tag	Node state	Active neighbors	Neighbors	Service denied	Reliability	Missed updates	Path stability	RSSI	Joins	Join Time
DI-2003	●	hg1420 DPT-2001 Tx Multipoint TT-2009ABCD	3	●	100.0 %	0	73.3 %	-72 db	1	05/26/10 14:35:11
DPT-2001	●	hg1420 DI-2003 THUM_2051	3	●	90.0 %	3		-72 db	2	05/26/10 15:09:07
THUM_2051	●	DPT-2001	1	●	79.3 %	6			1	05/26/10 15:21:02
TT-2002	●	hg1420 Tx Multipoint TT-2009ABCD	2	●	96.8 %	5	95.0 %	-68 db	1	05/26/10 14:34:56
Tx Multipoint TT-2009ABCD	●	hg1420 DI-2003 TT-2002	3	●	99.4 %	2	84.2 %	-68 db	1	05/26/10 14:35:24

Figure 9. Trial #3 1420 Gateway Network Status web page Screenshot

Smart Wireless Gateway

Explorer

HART Tag	HART status	Last update	PV	SV	TV	QV	Burst rate
2051T	●	05/26/10 15:58:50	0.242 PSI ●	29.387 DegC ●			00:01:00
DI-2003	●	05/26/10 15:58:52	1.000 ●	0.000 ●	26.000 DegC ●	9.111 V ●	8
DPT-2001	●	05/26/10 15:58:51	0.017 InH2O 68F ●	29.184 DegC ●	29.250 DegC ●	9.003 V ●	4
THUM_2051	●	05/26/10 15:58:50	28.000 DegC ●				00:01:00
TT-2002	●	05/26/10 15:58:57	29.221 DegC ●	NaN DegC ⚠	31.000 DegC ●	9.136 V ●	8
Tx Multipoint TT-2009ABCD	●	05/26/10 15:59:01	28.308 DegC ●	24.736 DegC ●	-0.718 DegC ●	-0.604 DegC ●	4

Figure 10. Trial #3 1420 Gateway Explorer web page Screenshot

Similar to trials #1 & #2, both figures above shows that all devices are live and are communicating with each other which validated this third (3rd) trial as feasible installation.

3.4 Stability & reliability of the proposed Tank Gauging Wireless Network

Using the results obtained from Trials #1, #2 & #3, we were able to create the path stability drawing below to be able to draw our conclusions on the feasibility of the proposed Tank Gauging Wireless Project installation.

Path stability is defined as the *"Percentage of transmitted packets that have successfully reached their destination over a given path"*. The actual measured path stability percentages are indicated below while some others were conservatively estimated indicated by "Exx%"

Each location indicated by a "T" below indicates a Wireless Transmitter, "R" for a Wireless Repeater and "G" the Wireless Gateway of the proposed tank gauging project

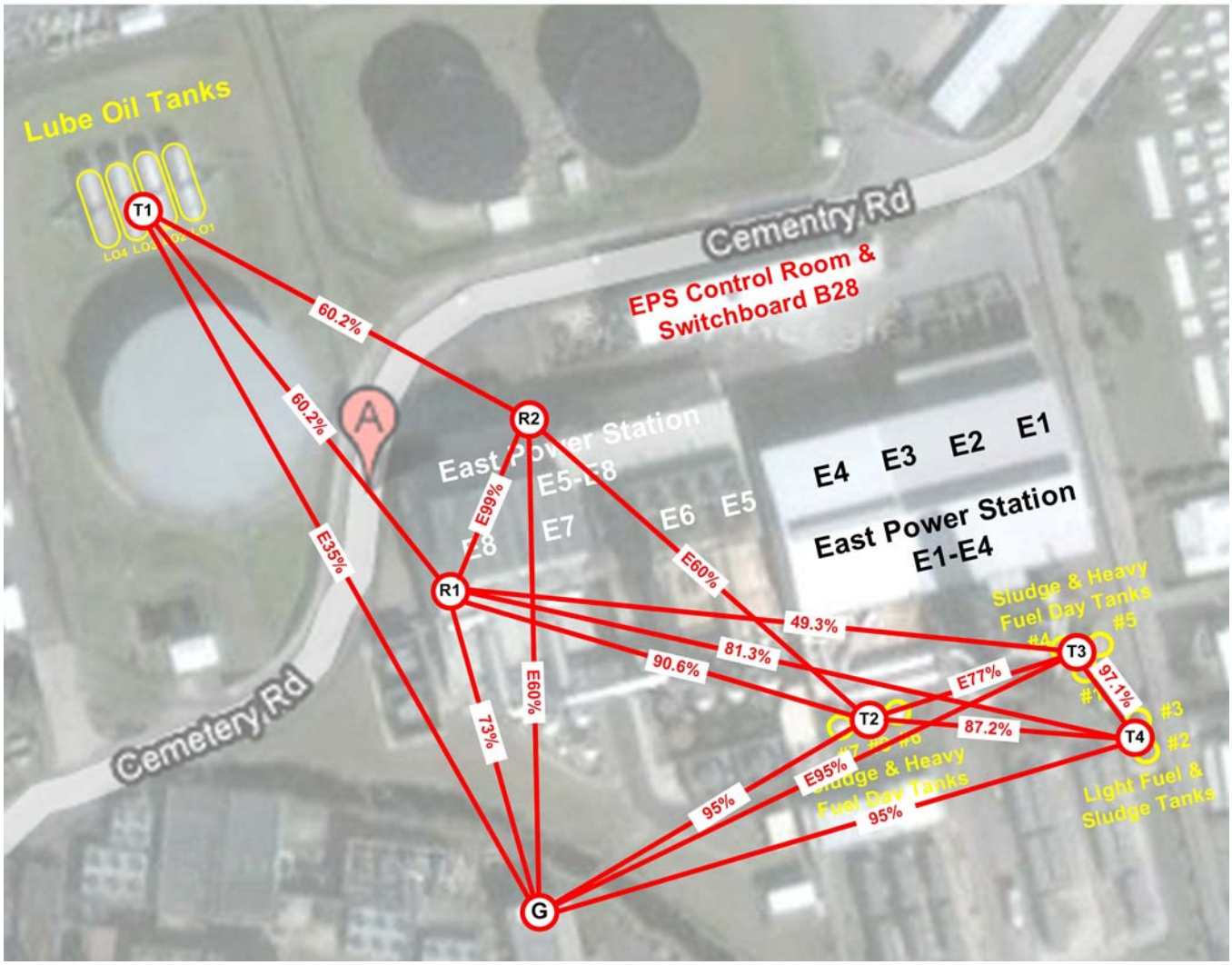


Figure 11. Path Stability of the proposed Tank Gauging Wireless Project

Once the path stability has been established for every node of the wireless network, the next step is to estimate the overall reliability of the wireless network.

The reliability of the wireless network is defined as the percentage of expected data packets that have been received by the Gateway. For example, 100% reliability means that every expected data packet was received.

4 Recommendations

4.1 Wireless Installation Best practices

Our recommendations are based on the Emerson Process Management Wireless Installation Best Practices. In order to meet the recommended best practices, a wireless network must meet the following criteria's:

1) The gateway must be able to communicate directly with 25% of the wireless
2) Each wireless device must be able to communicate directly with three (3) neighbors
3) Each wireless device must have two (2) distinct pathways to the gateway

4.2 Wireless Repeater Location

To properly address the issue of the Lube Oil wireless transmitters being blocked by the East Power Station building, It is recommended to install a Rosemount 702 long range repeater at location identified by R1 – located on the south west corner floor underneath the East Power Station building roof (E8) and another Rosemount 702 long range repeater at the location identified by R2 – located north east corner underneath of the East Power Station building roof (E7).

By using a second repeater (R2), we meet the 3rd best practice criterion "*Each wireless device must have two (2) distinct pathways to the gateway*"

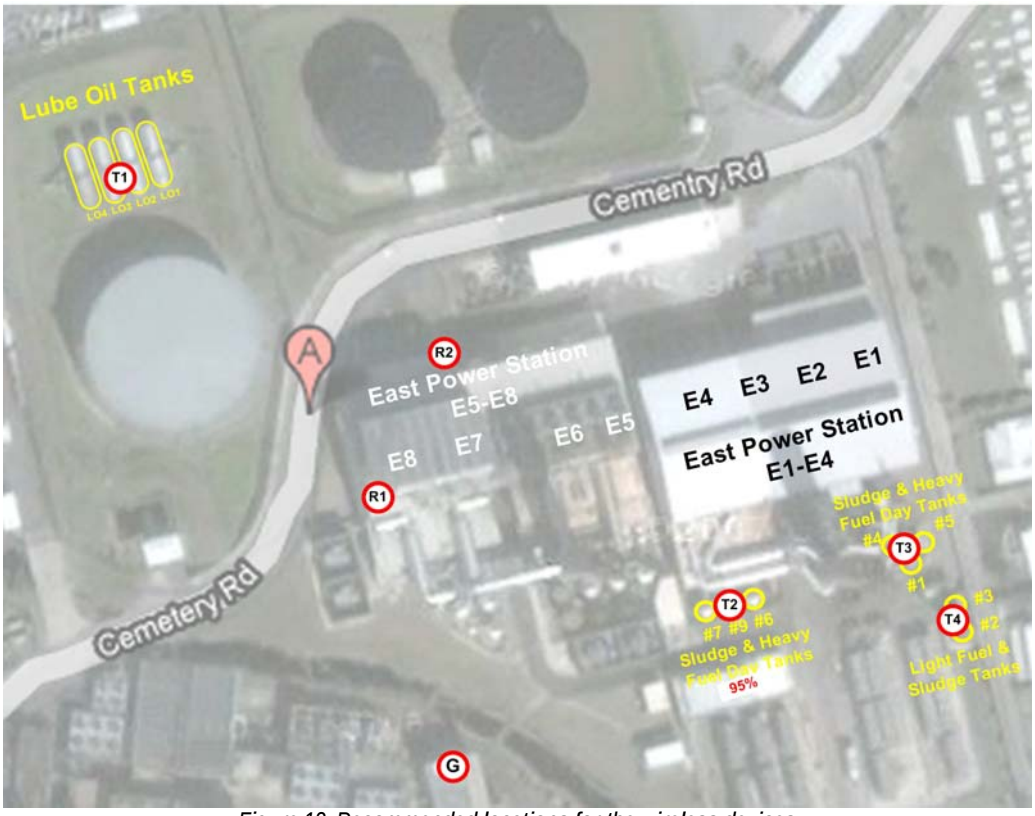


Figure 12. Recommended locations for the wireless devices

4.3 THUM remote junction boxes at Lube Oil Tanks

Additionally, it is recommended to elevate all four (4) THUM devices located at the Lube Oil Tanks by using a remote JB box mounted on a pole for each wireless level measurement (approx 3-4 feet high) as represented in the picture below. This will improve the overall wireless communications to the repeater stations located at R1 and R2 as there is partial obstruction caused by TANK #7 located in front of the Lube Oil Tanks.

Figure 13. THUM Remote junction box

5 Conclusion

Following our wireless test audits that were done during the week of May 24th at the BELCO facilities, we can validate that the proposed wireless network will meet recommended the following best practices for a wireless network installation.

1) The gateway will be able to communicate directly with 25% of the wireless devices
2) Each wireless device will be able to communicate directly with three (3) neighbors
3) Each wireless device will have two (2) distinct pathways to the gateway

The tests results compiled in this report were taken during episodes of rain, fog & drizzle on May 25th & 26th which are great testing conditions to fully validate the wireless functionality in not so optimal climate conditions. We would therefore expect even better result during optimal weather conditions.

In conclusion, based on the fact that:

1) Trial #3 combined with an additional repeater meets all 3 best practices.
2) We have validated path stability using actual measured data from our tests while estimating others as shown in Figure 11 section 3.4

We believe that the network will work properly and meet 99 % reliability under normal conditions.

I have included in both Sections 6 & 7 of this report additional product information on our Emerson Smart Wireless™ product lines along with some information on the AMS Intelligent Device Manager software package that was actively used during the wireless audits.

We thank you in giving us this opportunity in validating our Rosemount Wireless offering at BELCO facilities, and are appreciative of the overall experience and generous collaboration that we have received from CAHILL during our stay in Bermuda.

Do not hesitate contacting me if you have any questions and/or require any additional clarification to this report.

Best Regards,

Francis Paul

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6 Emerson Smart Wireless ™

By allowing information to be collected in previously inaccessible areas, Emerson's Smart Wireless technology allows you to optimize your assets and implement predictive maintenance in a whole new way. Process control plants gain a valuable tool to avoid costly down time, to optimize production and asset lifespan, and to maximize throughput. These new tools also allow users to improve response time to safety incidents, and to reduce environmental emissions.

Increasing the reach of the digital PlantWeb architecture, Emerson provides solutions to process plants with self-organizing wireless networks of intelligent field devices. Smart Wireless technology allows you to reliably access information from previously stranded assets where it's too expensive or too complex to connect wires to the equipment. Field installations across North America and Europe over the past three years have shown data reliability of greater than 99% and total installed costs showing more than 90% cost savings compared to traditional wired methods.

Emerson's Smart Wireless process automation technology combines self-organizing wireless devices, innovative gateway products, best-in-class Rosemount measurement devices and the AMS predictive maintenance Suite of applications. This technologies can be transparently integrated with the DeltaV digital control system or other traditional hosts.

Why Wireless ?

Imagine yourself driving a car without rear-view mirrors. It's certainly possible, but can you see yourself actually doing it? Not really! You wouldn't even be able to see what's beside and behind you.

In a similar way, wireless solutions can extend your visibility into "blind spots" in the plant, allowing you to view and optimize equipment that was previously out of reach with wired technology. As many of these inaccessible areas are typically critical to performance of the plant, they need to play an integral role in your operations.

With Emerson Smart Wireless technology, these blind spots disappear. You'll gain valuable insight to information that you don't have today. Also take a moment to consider the dozens of intelligent field devices already in your plant whose diagnostics and configuration capabilities are inaccessible since a suitable host system is not available. And what about the time wasted doing clip board rounds to manually record device readings since there is no other way to collect this critical date? Start today, the opportunities to benefit from wireless technology are all over your existing facility. From process monitoring, plant security, health and safety and environmental emissions control. Existing installations have already found excellent applications for wireless technology. But surely you know your plant better than anyone else and can see new applications from which you can benefit!

Straight-Forward Integration with Existing Systems

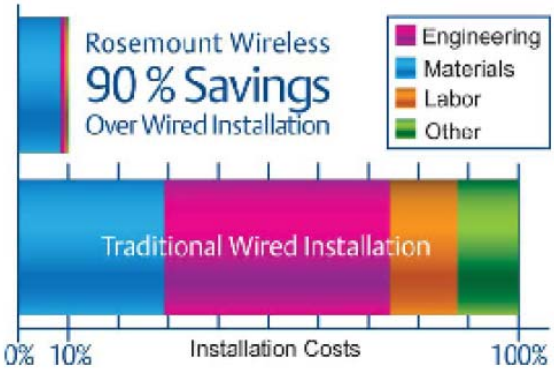
Emerson Smart Wireless solutions for process automation do not require complicated site surveys, nor do they use any special tools. These solutions are designed to integrate with control and monitoring applications conformant to SP100 classes 1 through 5 on the same network, and have been proven in actual operation for classes 3 through 5.

Autonomous Instruments Thanks to SmartPower™

Emerson's SmartPower™ technology is available in the form of a lithium battery pack with an autonomous power life of 5 to 15 years depending on the application. Certified intrinsically safe for hazardous environments, SmartPower™ goes wherever your pocess does. Even change the battery in a hazardous environment!

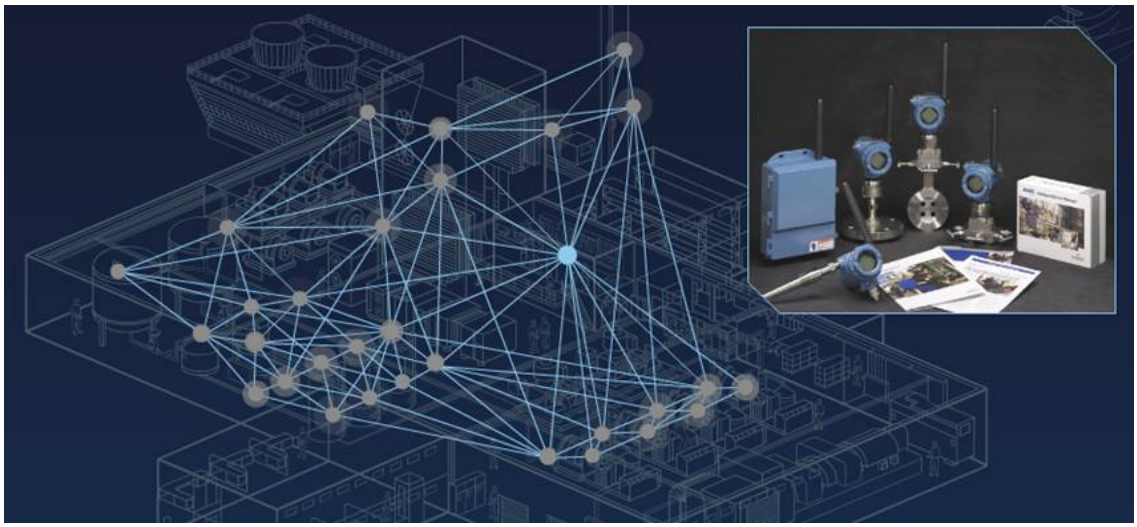
Cost Savings

Save upwards of 90% of your total installed cost! Cabling, wire conduits and cable trays as well as man power for installation quickly add up irrespective of the size of your project. Wireless technology allows you to add measurement points for less than you ever through possible.



Not surprisingly, one of the main hurdles to new technology adoption and addition of incremental measurement points in a plant is cost. For every dollar you spend on instrumentation, you also pay 8 to 10 dollars in man power, material, engineering and other associated activities. Using Emerson's Smart Wireless approach, you can save upwards of 90% or more compared to traditional wired methods. Imagine getting 10 times the number of wireless measurements for the cost of a single wired device. You can start to see your plant in a whole new way.

Self-Organizing Wireless Networks

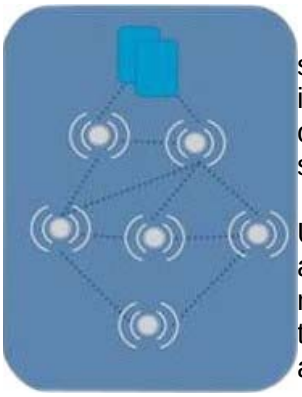


At the heart of Emerson Smart Wireless solutions is a self-organizing mesh network. This technology automatically adapts to changing conditions, allows data reliability of greater than 99%, and is flexible enough to navigate the “canyons of metal” in a typical process plant.

In contrast to existing wireless technologies requiring line of sight between devices and gateways, the Emerson Smart Wireless approach allows a robust network to self-organize between all devices. Each device is a measurement and a communications router. This means that no single point of failure exists and devices can choose the optimal communication path based on actual conditions.

Point to point communication or self-organizing netoworks?

In traditional wireless technologies using point to point or line of sight concepts, network reliability can be as low as 40% due to changed in the plant landscape and physical layout of the plant. Users rightfully demand higher reliability in their wireless networks.



In contrast, Emerson Smart Wireless has consistently proven at numerous client sites that 99% data reliability is achievable. This unprecedented degree of reliability is only possible using self-organizing networks. In the case where temporary obstacles hinder communication paths, the network automatically redirects the signal through a different path to insure availability of device information.

Using the Time Synchronized Mesh Protocol (TSMP), which supports both 900Mhz and 2.4GHz (IEEE 802.15.4), Emerson offers a robust network that cannot be matched …resistant to all types of obstacles – permanent or temporary. Moreover, these networks can transparently co-exist with current wireless networks without any concern.

Applications

Smart Wireless allows you to consider new applications and work practices that were previously impossible. Additionally, it allows you to extend the benefits of the PlantWeb digital architecture to new locations where you previously had to surrender to the « too expensive to solve » mentality.

Process Monitoring

Wireless process monitoring allows you to better understand your process and opens the door to implement process optimization.

- Find cold spots on a steam line
- Prevent reservoir overfills by using alarms
- Eliminate manual reporting and clip board rounds
- Gain better visibility to your process

Security, health & safety and environment

The implementation of wireless solutions can improve your response time to health & safety incidents and environmental emissions accidents throughout the plant.

- Monitor you cooling tours
- Safety and vent valve monitoring
- Accurate measurement of fugitive emissions
- Conformance with environmental standards

Equipment Monitoring

Intelligent wireless technology can contribute to the extending the life of plant assets and to better understand their performance. This additional information allows you to move from a reactive maintenance approach to a proactive one.

- Oil and bearing temperature
- Differential pressure across filters
- Implement planned maintenance when it is needed
- Real time equipment performance evaluation
- Reduce unplanned shutdowns due to equipment failure

Smart Wireless Products™

1420 Wireless Gateway

- Network Management
  - Advanced security with easy configuration
  - Scalable network creation and expansion
  - Communication is self-organizing and self-optimizing
- Data Management
  - Data Reliability >99%
  - Local trending available
  - Seamles integration with DeltaV™, Ovation™ and AMS™ Suite
  - Alerting functionality for users
- Instrument diagsnotics
  - Low battery, and communication alerts are conveniently accessible

CSI9420 Wireless Vibration Transmitter

- Can connect with up to two accelerometers
- Can alternately connect with one accelerometer and one temperature sensor
- View velocity, acceleration and Peakvue™
- Sensor health monitoring
- Nema 4X enclosure
- Large local LCD display
- SmartPower™ lithium battery pack

3051S Scalable Wireless Pressure Transmitter

- Built on the 3051S SuperModule® platform
- Integrated solutions available for pressure, differential preesure, level and flow
- Four customizable alarms
- Large local LCD display
- SmartPower™ lithium battery pack for 5 years+ of battery life

648 Wireless Temperature Transmitter

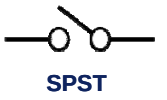
- Integrated transmitter/sensor solutions to meet your temperature needs
- Supports all types of temperature sensors :
  - Thermocouples, RTD's (mV, Ohms)
  - Sensor Matching (Callendar Van Dussen)
  - Can also accept 4-20mA signals
- Double compartment housing
- Eight customizable alarms
- Large local LCD display
- SmartPower™ lithium battery pack for 8 years+ of battery life

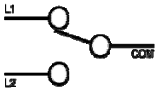
848T Wireless Temperature Transmitter (High Density)

- Offres up to four (4) inputs with a single wireless transmitter!
- Supports all types of temperature sensors :
  - Thermocouples, RTD's (mV, Ohms)
  - Sensor Matching (Callendar Van Dussen)
  - Can also accept 4-20mA signals
- Eight customizable alarms
- SmartPower™ lithium battery pack for 5 years+ of battery life

702 Wireless Discrete Input Switch

- Discrete switch input : 1 SPDT or 2 SPST
- Nema 4X enclosure
- Large local LCD display
- SmartPower™ lithium battery pack





6081 Wireless pH or Copnductivity

- Measure liquid pH or conductivity wirelessly
- Combine with traditional pH or conductivity sensors
- Nema 4X enclosure
- Large local LCD display
- SmartPower™ lithium battery pack for 4 years+ of battery life

Get ahead. Stay ahead.

Your competitors are right on your heels! Emerson's Smart Wireless solutions put new tools in your hands to realize projects that were previously commercially or technically impossible. We invite you to work with Laurentide Controls and Emerson Process Management to discover the advantages that wireless instrumentation can offer to the process control industry. You are limited only by your imagination.

- Discover the power and value of PlantWeb
- Reduce no-value maintenance activities
- Improve plant throughput and availability
- Prolong the life of your plant equipment
- Improve the profitability of your operations
- Improve the effectiveness and efficiency of your personnel

For additional information on new products and to view the entire Emerson Smart Wireless portfolio, we encourage you to visit **www.emersonprocess.com/SmartWireless**.

Emerson also offers free on-line training at PlantWeb University. This service includes 19 new courses of 15 minutes each for convenient and self-paced learning. These can be used to introduce your operators, engineers and technicians to wireless technology. Simply visit **www.PlantWebUniversity.com**.

7 AMS Intelligent Device Manager

7.1 AMS Wireless Configurator

AMS Intelligent Device Manager is a plant asset management system which allows you to configure, calibrate, diagnose and document all activities in your plant relating to intelligent field instruments. AMS Device Manager supports HART and FOUNDATION Fieldbus (FF) devices, as well as new Wireless HART field devices. Refer to section 6.2 for additional details regarding the AMS Device Manager system.

With every new wireless gateway, Emerson includes a free copy of the AMS Wireless Configurator. This is a limited version of the full AMS Device Manager system, and allows configuration only of Wireless HART devices. The purpose of this system is to allow you to set the network id and join key of new Wireless HART devices to provision them into your wireless network. This can alternately be done using Emerson's 475 Field Communicator, or can be pre-set at factory.

The AMS Wireless Configurator allows you to communicate with Wireless HART instruments using a HART modem, and also in an on-line fashion through the 1420 wireless gateway once the device has been provisioned into the network.

7.2 AMS Device Manager as an Integral Part of the Smart Wireless Solution

To fully leverage the intelligence of you intelligent field devices, the AMS Device Manager system is needed. A licensed copy of the AMS Device Manager system will allow you to benefit from the following functionalities which are not possible with the AMS Wireless Configurator alone:

1. Communicate with wired devices (HART and FF) via a host of different interfaces (modem, multiplexer, PLC pass-through, DCS pass-through, HART over Profibus network, etc).
2. Perform calibration management for HART, FF and Wireless HART devices.
3. Access device diagnostics for HART, FF and Wireless HART devices.
4. Proactively scan HART and Wireless HART devices for active alerts on a pre-determined interval in order to move from a reactive maintenance approach to a predictive one.
5. Save configuration files in the AMS database and perform back-ups as necessary.
6. Auto-capture events and changes in the AMS Audit Trail historian.
7. Leverage the power of advanced devices with SNAP-ON applications, such as Fisher Valve Link and Rosemount Engineering Assistant (note: the only SNAP-ON that can be added to the AMS Wireless Configurator is the Wireless SNAP-ON (refer to section 6.3 for additional details)).
8. Add additional Client stations to the AMS network for access to the system from multiple locations.
9. Print configurations, calibration certificates, etc
10. Compare configuration revisions

7.3 AMS Wireless SNAP-ON

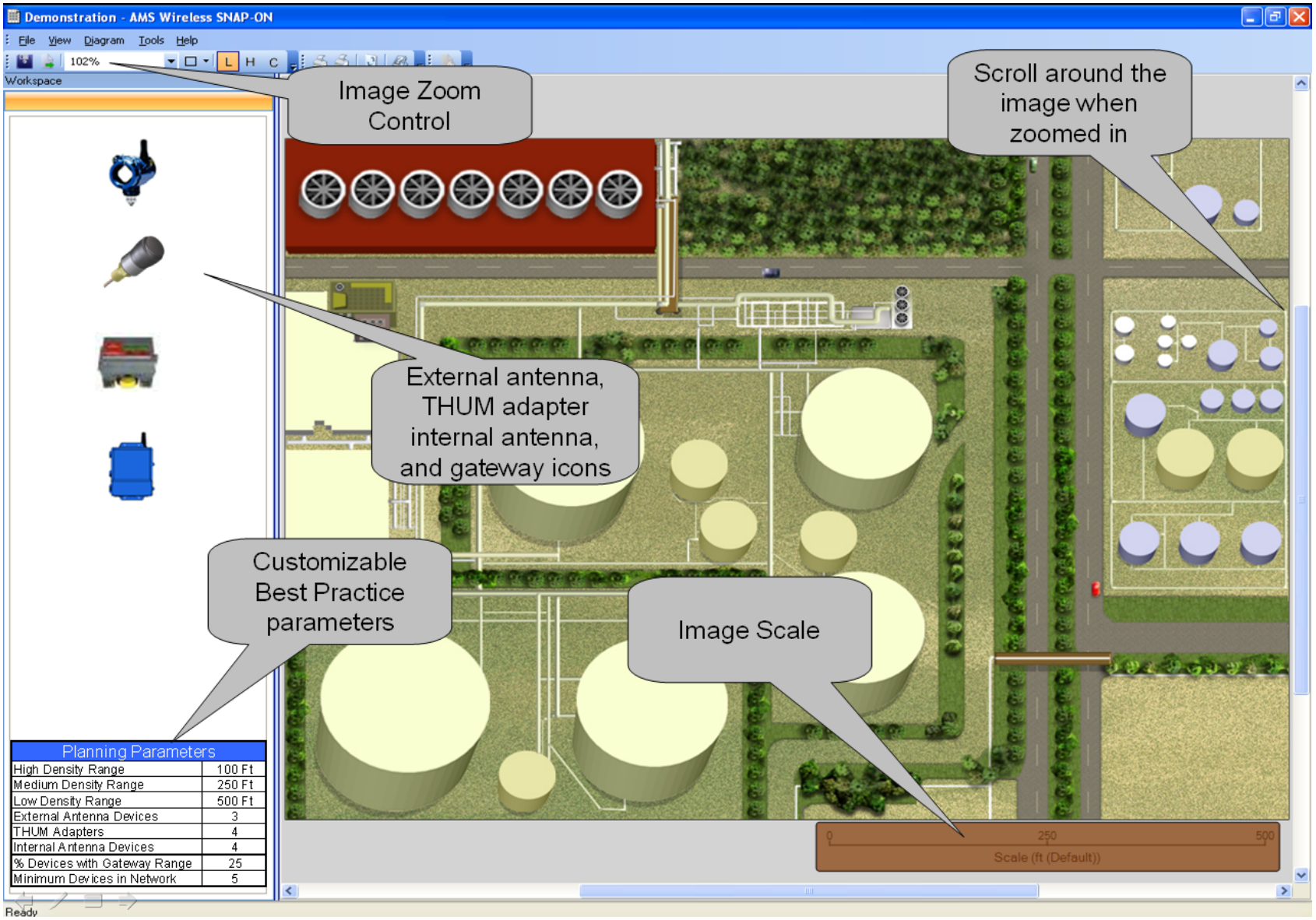
The following pages contain screenshots highlighting the advanced functionalities available using the AMS Wireless SNAP-ON application.

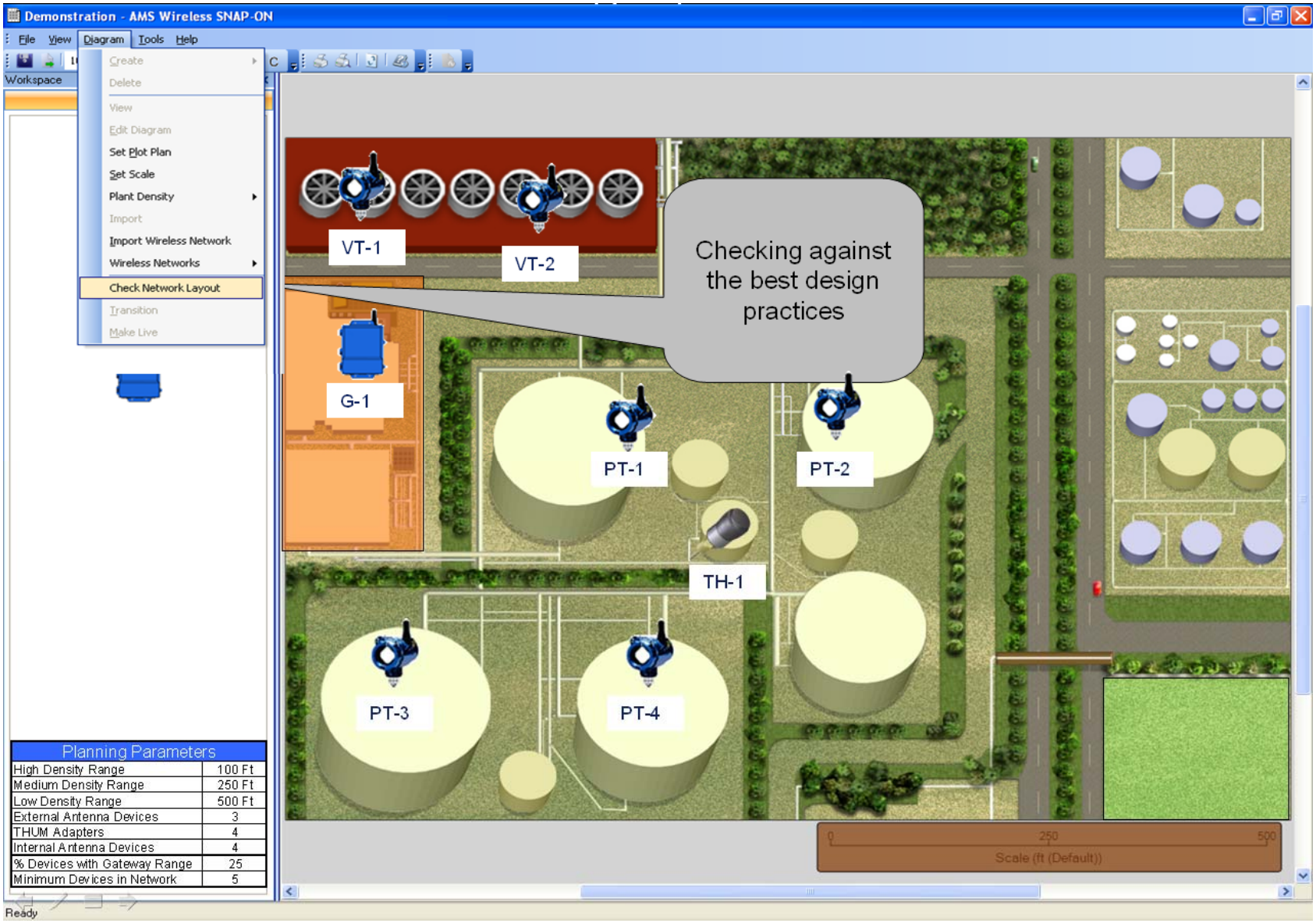
The Wireless SNAP-ON is an optional feature that can be added to the AMS Device Manager system in order to plan, manage and diagnose your Wireless HART networks. Below we have summarized the three main functionalities that the Wireless SNAP-ON offers:

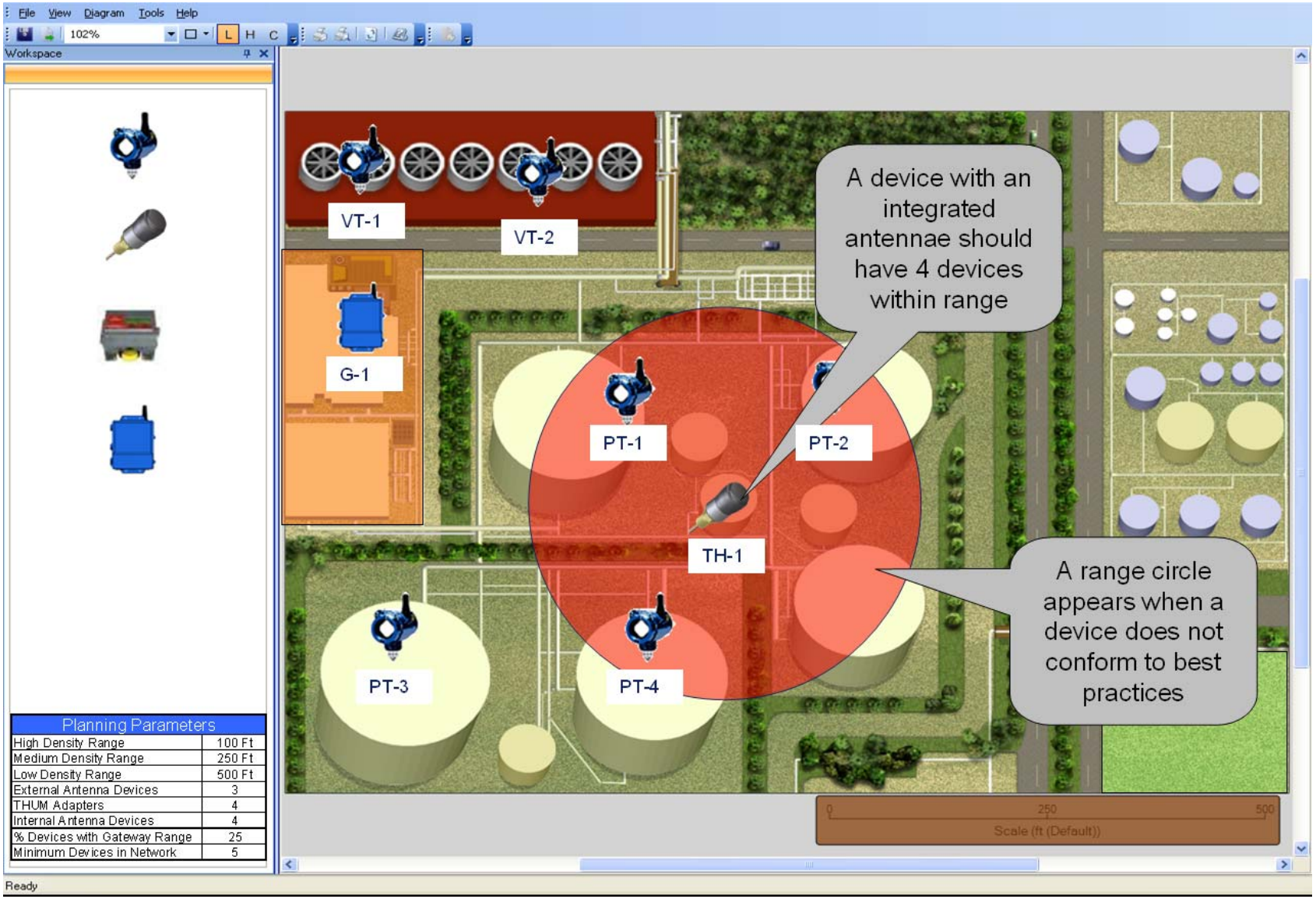
1. Planning Mode:
Starting from a graphical representation of your plant, import the file to the Wireless SNAP-ON and design your wireless network. The Wireless SNAP-ON will validate that your proposed design meets recommended best practices to insure 99.9% data reliability of your network. Also provides a very convenient way to share your design work with the experts at Laurentide Controls and Emerson Process Management to optimize your network.

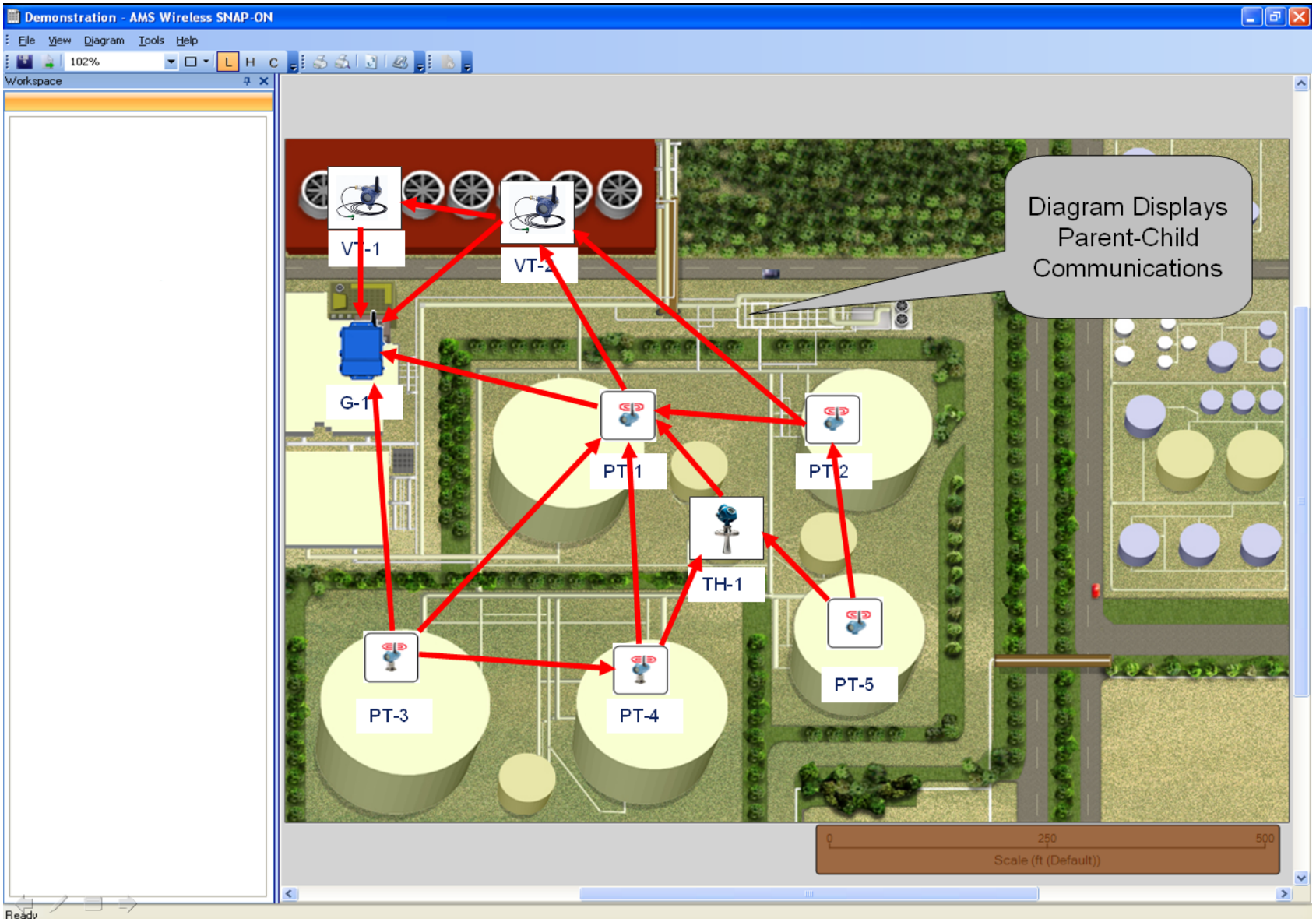
2. Live Mode:
Using the design work performed in the Planning Mode, your graphical representation of the plant is instantly converted into a live information screen for your Wireless HART devices. Find devices based on their location instead of their tag number! The Wireless SNAP-ON allows you to view measured process variables, remaining battery voltage, data reliability and more! Additionally, it allows you to view parent/child communication paths between wireless nodes to identify potential strangle points in your network.

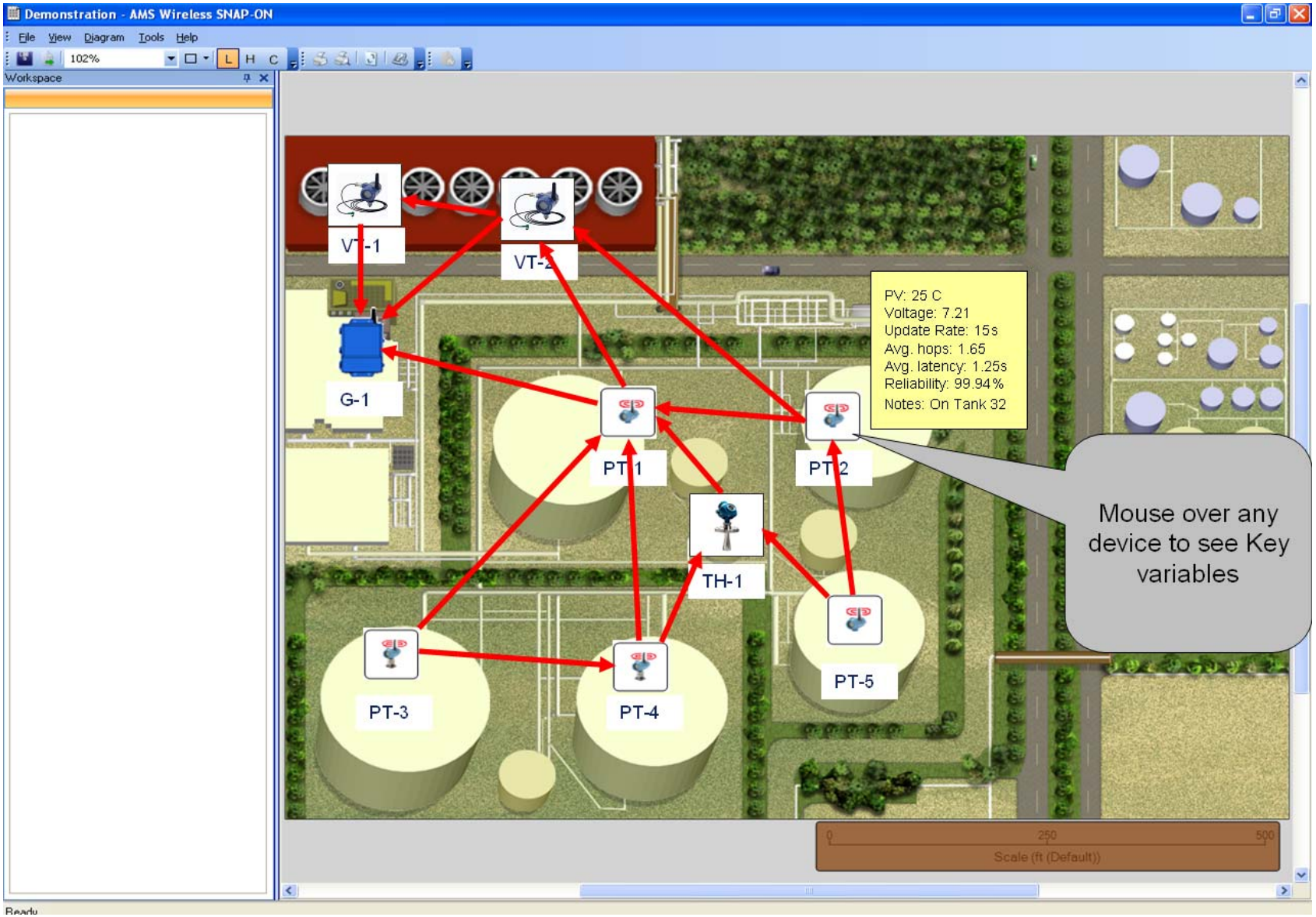
3. Reporting Mode:
In a 100% customizable spreadsheet reporting screen, determine the health of your wireless network at a glance. Allows easy viewing of all data, including many parameters that are beyond what is displayed in the 1420's web browser alone. View all devices or only the devices you currently want to see!

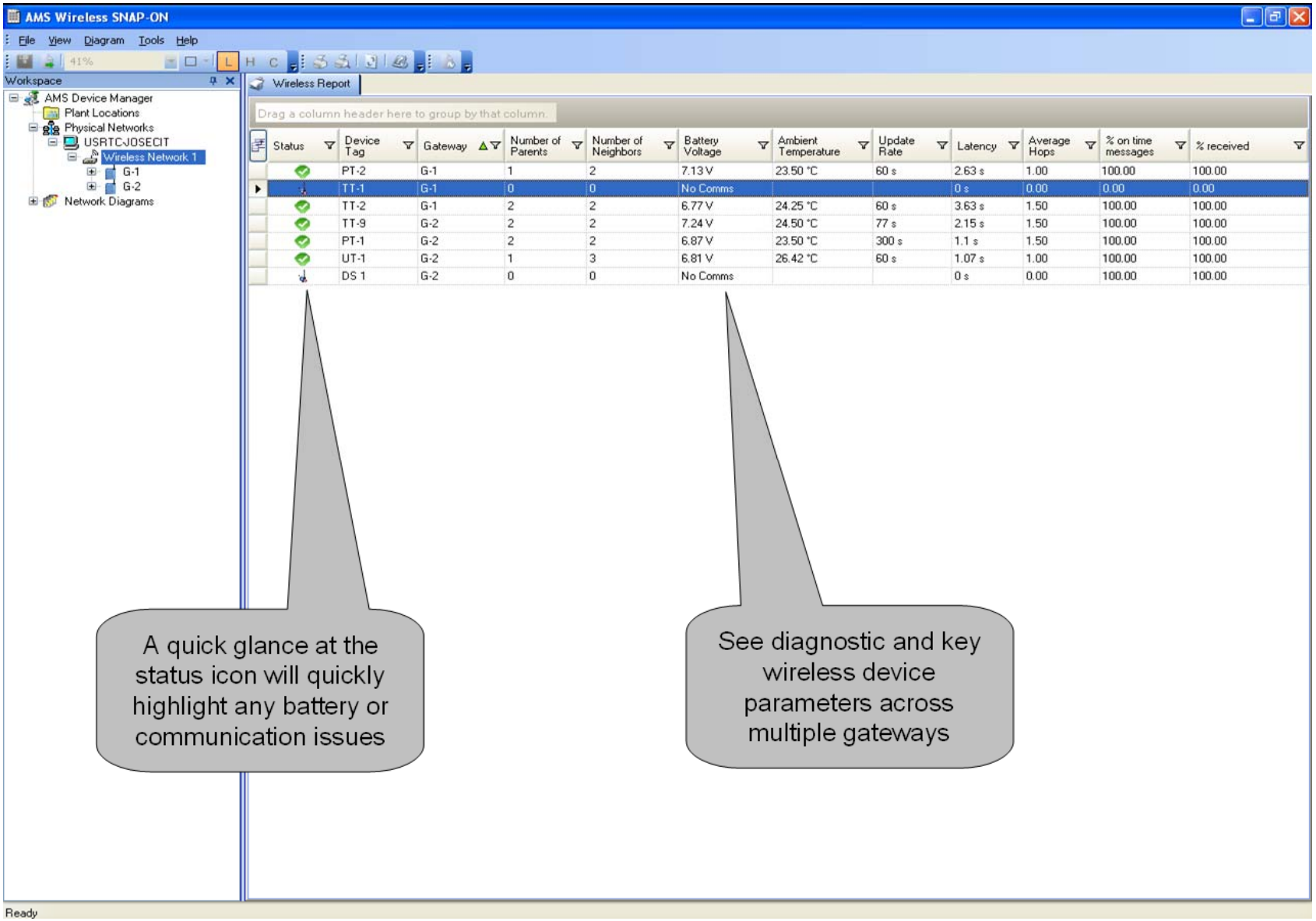

Demonstration - AMS Wireless SNAP-ON
File View Diagram Tools Help
102%
Workspace
Image Zoom Control
Scroll around the image when zoomed in
External antenna, THUM adapter internal antenna, and gateway icons
Customizable Best Practice parameters
Image Scale
Planning Parameters
High Density Range 100 Ft
Medium Density Range 250 Ft
Low Density Range 500 Ft
External Antenna Devices 3
THUM Adapters 4
Internal Antenna Devices 4
% Devices with Gateway Range 25
Minimum Devices in Network 5
0 250 500
Scale (ft (Default))
Ready


Demonstration - AMS Wireless SNAP-ON
File View Diagram Tools Help
Create
Delete
View
Edit Diagram
Set Plot Plan
Set Scale
Plant Density
Import
Import Wireless Network
Wireless Networks
Check Network Layout
Transition
Make Live
Workspace
VT-1
VT-2
Checking against the best design practices
G-1
PT-1
PT-2
TH-1
PT-3
PT-4
Planning Parameters
High Density Range 100 Ft
Medium Density Range 250 Ft
Low Density Range 500 Ft
External Antenna Devices 3
THUM Adapters 4
Internal Antenna Devices 4
% Devices with Gateway Range 25
Minimum Devices in Network 5
0 250 500
Scale (ft (Default))
Ready


File View Diagram Tools Help
102%
Workspace
VT-1
VT-2
G-1
PT-1
PT-2
TH-1
PT-3
PT-4
A device with an integrated antennae should have 4 devices within range
A range circle appears when a device does not conform to best practices
0
250
500
Scale (ft (Default))
Planning Parameters
High Density Range 100 Ft
Medium Density Range 250 Ft
Low Density Range 500 Ft
External Antenna Devices 3
THUM Adapters 4
Internal Antenna Devices 4
% Devices with Gateway Range 25
Minimum Devices in Network 5
Ready


Demonstration - AMS Wireless SNAP-ON
File View Diagram Tools Help
Workspace
VT-1
VT-2
G-1
PT-1
PT-2
TH-1
PT-3
PT-4
PT-5
Diagram Displays Parent-Child Communications
0
250
500
Scale (ft (Default))
Ready


Demonstration - AMS Wireless SNAP-ON
File View Diagram Tools Help
102%
Workspace
VT-1
VT-2
G-1
PT-1
PT-2
TH-1
PT-3
PT-4
PT-5
PV: 25 C
Voltage: 7.21
Update Rate: 15s
Avg. hops: 1.65
Avg. latency: 1.25s
Reliability: 99.94%
Notes: On Tank 32
Mouse over any device to see Key variables
0
250
500
Scale (ft (Default))
Ready


AMS Wireless SNAP-ON
File View Diagram Tools Help
Workspace
AMS Device Manager
Plant Locations
Physical Networks
USRTCJOSECIT
Wireless Network 1
G-1
G-2
Network Diagrams
Wireless Report
Drag a column header here to group by that column.
Status | Device Tag | Gateway | Number of Parents | Number of Neighbors | Battery Voltage | Ambient Temperature | Update Rate | Latency | Average Hops | % on time messages | % received
PT-2 | G-1 | 1 | 2 | 7.13 V | 23.50 °C | 60 s | 2.63 s | 1.00 | 100.00 | 100.00
TT-1 | G-1 | 0 | 0 | No Comms | | | 0 s | 0.00 | 0.00 | 0.00
TT-2 | G-1 | 2 | 2 | 6.77 V | 24.25 °C | 60 s | 3.63 s | 1.50 | 100.00 | 100.00
TT-9 | G-2 | 2 | 2 | 7.24 V | 24.50 °C | 77 s | 2.15 s | 1.50 | 100.00 | 100.00
PT-1 | G-2 | 2 | 2 | 6.87 V | 23.50 °C | 300 s | 1.1 s | 1.50 | 100.00 | 100.00
UT-1 | G-2 | 1 | 3 | 6.81 V | 26.42 °C | 60 s | 1.07 s | 1.00 | 100.00 | 100.00
DS 1 | G-2 | 0 | 0 | No Comms | | | 0 s | 0.00 | 100.00 | 100.00
A quick glance at the status icon will quickly highlight any battery or communication issues
See diagnostic and key wireless device parameters across multiple gateways
Ready

8 Additional Information

Should you require additional information, please don't hesitate to contact us at (514) 697-9230.

Please note that there is a wealth of information available online at the following link:

www.emersonprocess.com/SmartWireless