

## CONFIGURATION OF SMART DEVICES IN WIRELESSHART NETWORKS

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### ABSTRACT

*This paper presents the SMART network devices that are used in planning the implementation of WirelessHART network. Then are explained used software tools for planning and management of wireless networks such as: AMS Wireless Configurator and AMS Wireless SNAP ON. At the end of the paper are shown several experimental implemented Mesh Wireless Networks.*

**Keywords:** WirelessHART Networks, AMS Wireless SNAP ON, Mesh Wireless Networks

### 1. INTRODUCTION

Devices that support WirelessHART protocol are backwards compatible with existing HART devices and applications. They are financially profitable and have reasonable access to the wireless communication since support the industrial demands for simple, reliable and secure wireless communication technology. They meet necessary communication requirements that must be supported by compatible equipment and ensure interoperability. So, all types of wireless devices from other manufacturers may be replaced without compromising network or system performances.

### 2. CONFIGURATION OF SMART WIRELESS GATEWAY

In the world of wireless devices a gateway is interface between the wireless field devices, i.e. transmitter and the host system. It provides easy integration of data from the wireless network into the system that uses such data, including control systems and other hosts. When a gateway insure that, then can be used existing tools for measuring, collecting data and information management, without need to distinguish between data coming from wireless or wired networks. Before a gateway is permanently installed, and connects to the active network, it is necessary to form a private network between the gateway and the PC/laptop and have to be configured following items:

- Security keys,
- Time settings,
- TCP/IP network settings.

To check the connection of transmitters in the network can be used interface of gateway such that navigate it to the **Explorer> Status page**, as in Fig. 1.

The green status indicator in Fig. 1 indicates that the device works correctly. If the indicator is red then there is a problem with the device or communication way and an additional device is added to bridge connection on the network.

Network Device Status admin

HART Tag	State	Parents	Neighbors	Late updates	Path stability	RSSI	Joins	Join Time	Battery
PT-101	●	hg1420 PT-102	3	0	88.5 %	-47 db	0	02/09/10 20:22:37	8.753 V
PT-102	●	hg1420	4	0	84.5 %	-75 db	0	02/09/10 20:19:01	8.794 V
TT-101	●	PT-102	1	2	35.4 %	-56 db	0	02/09/10 20:28:39	8.165 V
TT-102	●	PT-101 PT-102	2	0	94.1 %	-45 db	0	02/09/10 20:28:04	8.985 V

Figure 1. Status of device in network

For any additional device can be obtained more details when is clicked on his name which is located in HART tag column. Good connections should show the following characteristics:

- Reliability of data is greater than 99%,
- Time of data access is three times less than the speed of updates,
- Battery life time is greater than the desired time at the maximum speed of updates,
- Primary net connections,
- Stability of the line.

Radio Signal Strength Indication (RSSI) in the diagnostics of gateway is very important, because the weak signals may pass if the line is stable. However, it can also help in identifying of problems when they arise.

### 3. CONFIGURATION OF TRANSMITTERS TT 648 AND PT 3051

Industrial transmitters TT 648 and PT 3051 perform digital signal processing using the HART protocol and have two parts:

- sensor for data collection, and
- radio to send and receive data.

Some wireless devices are using cables for power supply and these are "true wireless" devices that use batteries as power supply source. Transmitters must be configured to communicate with other devices in a wireless network (Fig.2. and Fig.3). Using the AMS Wireless Configurator it is entered Network ID and Join Key of transmitter, so that they match the Network ID and Join Key of gateways and other devices in the network. If they are not identical transmitter will not be able to communicate with the network.

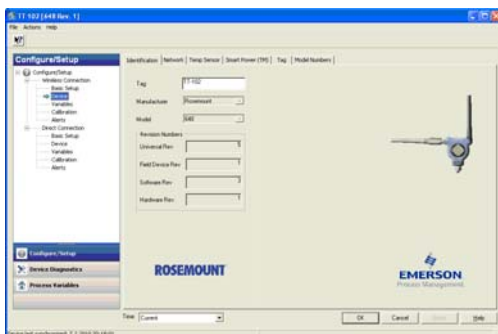


Figure 2. Configuration of transmitter TT 648

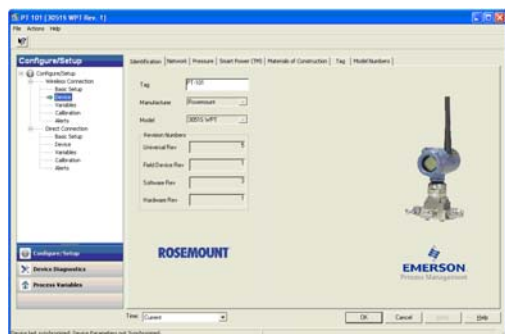


Figure 3. Configuration of transmitter PT 3051

Last part of the configuration of the device in a wireless network is the speed of updates. It can be changed during their putting into operation or at any time using the AMS Wireless Configurator as

well as the Smart Wireless Getaway Web server. The update rate by the standards should be between 15 and 60 seconds. For networks with up to 100 wireless devices maximum speed of updates is 60 seconds and for up to 50 or less devices top speed of updates is 15 seconds. Once the sensor and network are configured, it is necessary to remove the power supply module that is a battery that is inserted only when the device is ready for putting into operation.

#### 4. PLANNING AND MANAGEMENT OF WIRELESSHART NETWORK

When wireless devices are configured, AMS Wireless SNAP-ON application communicates with the network through the AMS Device Manager that using AMS Wireless Configurator supports Smart Wireless Gateway and all devices that are attached to it.

##### 4.1. Planning of wireless network

AMS Wireless SNAP-ON application allows the entry of prepared drawn plans, i.e. maps of station facilities or process units in order to improve the planning of wireless networks. Images that are the mostly used require jpg or bmp format. After defining of the image follows scale setting by identifying the known distance between two points. The next step in planning of a wireless network is set up on locations of gateway and the transmitters on the background image, where for each device is entered height on which it will be installed in the plant, and so until the end of complete network planning.

When the planning of the network is completed, then the AMS Wireless SNAP-ON application checks the network of the plant and graphically displays deviations from the defined parameters. Red circle around the wireless device indicates that it does not meet the defined parameters that are shown on the right side of Fig. 4., so they are marked in red.

In order to obtain correct network it is needed to set up, i.e. to install wireless devices within its range to meet the planned parameters that also dictate the number of redundant paths in case that the signal between devices is lost. AMS Wireless SNAP-ON application gives in written form notice on the screen when is finished design of the network, i.e. that the network is correct and graphically shows the communication links between devices, as shown in Fig. 5.

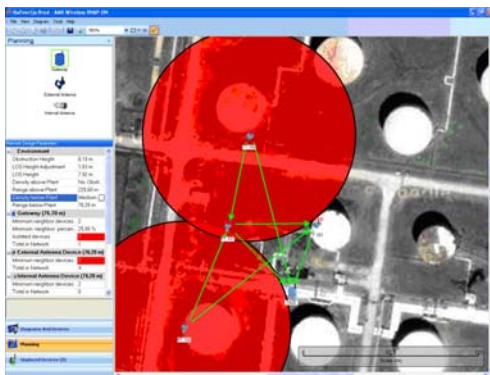


Figure 4. Correction of network.

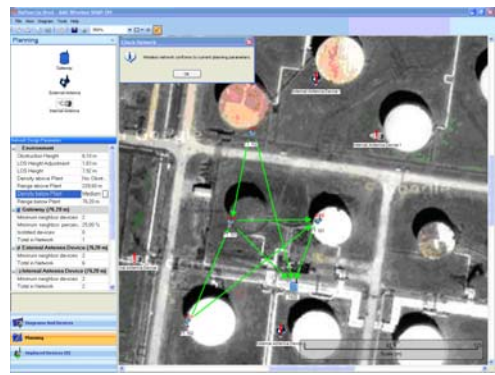


Figure 5. Correctly planned network

##### 4.2. Managing of wireless network

Existing self-organizing wireless network functions as a large antenna for any new device added to the periphery of the network, and a multiple of connections is available for devices that are added inside the network. In self-organizing networks, the more wireless devices in the network, the easier is to expand network because there are more lines available for additional communication. The network easily notices that the new device is connected into the network and routing algorithm in the device and the gateway automatically finds the best path to the destination. This feature not only allows easy addition of new devices, but also temporarily install of the device in order to test whether its permanent installation will contribute to improvement or to carry out short-term monitoring for diagnostic purposes.

Using the AMS Wireless SNAP-ON application it is obtained a comprehensive view of self-organizing network and helps to identify potential problematic sites when are set up barriers between transmitters causing loss of signal (gray arrows), and communication links in that case are made over redundant paths (green arrows), as shown in Fig. 6.

This application also helps to identify potential problematic sites such as the "pinch point", i.e. when messages from several devices in the network pass through the same device on the path to the gateway. One such example is shown in Fig. 7.

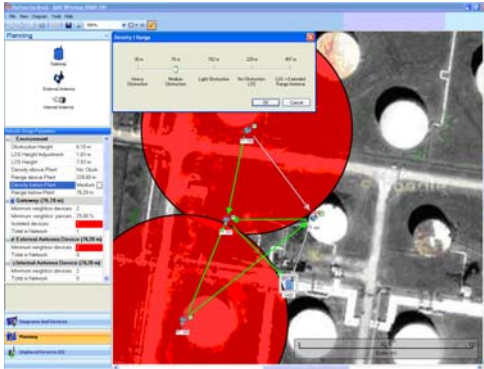


Fig. 6. Network with physical obstacle

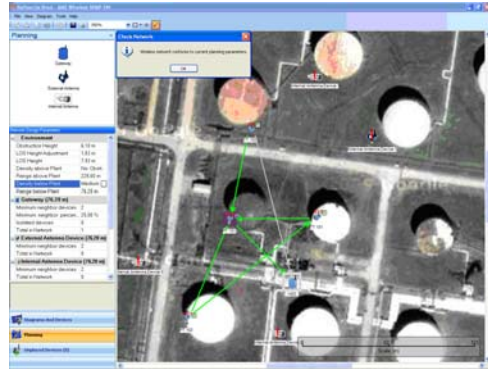


Fig. 7. Network with pinch point

The pinch point does not happen often due to extensive communication lines in most self-organizing networks, and the solution is to add additional device near the pinch point to provide more communication lines.

## 5. CONCLUSION

Based on previous explained experiments it can be concluded that by installation of WirelessHART protocol and industrial wireless standards into Emerson AMS Wireless SNAP-ON application is obtained insight that allows to realize the full potential of industrial plants. Secure, unlimited configurable with data security greater than 99%, SNAP-ON application provides a flexible and adaptive approach to wireless technology that defies to so-called woods of metal barriers characteristic for most plants. Existing self-organizing wireless network is functioning like a large antenna for any new device added to the periphery of the network and multitude of connections are available for devices that are added into the network interior. In self-organizing network, if the more wireless devices are in the network easier is to expand it because there are more lines available for additional communication. The network simply notes that the new device is connected to the network and routing algorithm in the device and in the Gateway automatically find the best path to destination This feature not only allows easier addition of new devices, but also temporary installation of devices to test whether its permanent installation will contribute to the improvement or to be carried out short-term monitoring for diagnostic purposes.

## 6. REFERENCES

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