

## **ESTIMATION OF CONTROL PERFORMANCES OF INTEGRATED WIRELESSHART NETWORK**

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### **ABSTRACT**

*This paper covers research related to estimation of control performances of proposed and practically implemented models of integration into WirelessHART industrial networks in which the main objectives are safety and reliability. Then, for the same models of industrial networks implemented using Emerson Process Management equipment, will be shown results obtained by simulation and experiment in which the use of THUM specialized adapters as integrators is a better choice than use the Smart Wireless Gateway 1420.*

**Keywords:** WirelessHART, THUM adapters, AMS Wireless SNAP ON

### **1. INTRODUCTION**

One way to connect the HART (Highway Addressable Remote Transducer) devices with WirelessHART networks is the use of conventional adapters. However, enlargement of the same may be used as an integrator, i.e. tool for security integration of HART and WirelessHART network [1]. Gateway can also be used as an integrator [2]. But if the safety and reliability are the main goals of integration, the use of special adapter as an integrator is a better choice for the following reasons:

- The adapter is designed to allow connection to a multidrop architecture in which more than one device can be connected to the power loop and then to one adapter, but the point to point architecture can connect only one device to the power loop.
- In contrast to the gateway adapters are portable and changes in physical location do not require additional cabling.
- Adapters can be connected to any HART component, but security will be greater if the adapter is connected directly to one of the devices.
- If the gateway is used for integration its architecture is more complex and expensive.

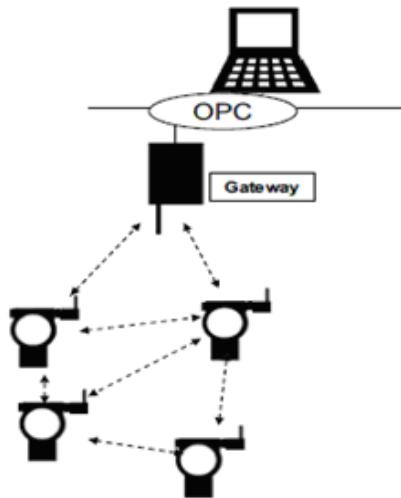
All these reasons justify the use of an adapter as a network integrator and can be used to secure the integration of HART and WirelessHART network.

### **2. WIRELESSHART ADAPTER**

WirelessHART standard defines the type of device known as an adapter that connects to a standard wired HART network as the main unit. All wired HART devices in the network shown in Figure 1 specifically are addressed as subdevice adapter and thanks to that device can communicate over wireless HART networks [1,2]. The result is that the device in a wired HART network is part of WirelessHART network with full access to information such as:

- **Process variables** (each instrument can provide up to four process variables)
- **Diagnostic message** (valve operation and the status of the instrument)

In general, WirelessHART adapter provides full access to digital information of connected instrument by methods that are similar to the methods of connection of handheld configurator.



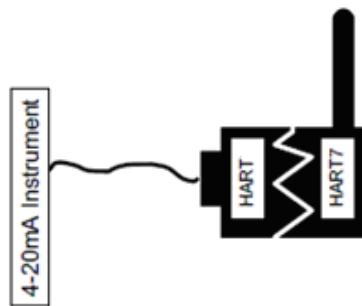
*Figure 1. WirelessHART network with integrated HART devices [1]*

Adapter forwards the information in two-ways of the installed instrument to WirelessHART network acting as the master for instrument in wired HART network, and as a slave for the WirelessHART gateway [1,2].

## 2.1. THUM-specialized adapter

In this chapter briefly will be described THUM as a component of a specialized adapter that plugs into a standard HART device and together they act as WirelessHART device, as in Figure 2. THUM consists of the following components:

- FSK (Frequency Shift Keying) port for connection to a HART device.
- WirelessHART antenna that is used to represent the newly formed Wireless HART devices in a wireless network.
- FSK port for external connection for connecting a wired HART interface of the newly formed Wireless HART devices.



*Figure 2. WirelessHART adapter [1]*

The principle of the adapter operation is as follows:

At the beginning THUM communicates with the HART device to retrieve the necessary information about the device as for example ID, device tag, and then assumes the identity of the device and then waiting to be initiated either through an external FSK port or through wireless network. Adapter

executes all wireless and wired HART commands. When execute the command, the adapter can if necessary to send the command HART device to retrieve additional information.

Commands initiated from wired device will be recognized as of the adapter, and if wired HART device supports version 7, then THUM has the simplest form. THUM can send majority of commands in either direction without a lot of their changes. However, if the HART device is of older version then the adapter must have functions defined in the 7th version and there will not be differences in hardware, but only changes in the software of adapter in several places:

- It recognizes only one slave device on the network.
- Assume the identity of slave device instead of being remembered as a sub device.
- Instead of acting as a router between the host and sub device, THUM is corresponding to host device and treats it as a component that serves as a data source.

Two important features of THUM technology are:

- No changes are made to the HART device by connecting an adapter to it, it simply becomes WirelessHART device.
- The adapter is universal and can be connected to any HART device.

When it would be necessary to develop a complete wireless HART device from one wired, THUM could be part of the solution, so as to remove the FSK port and connect the motherboard devices and adapters in one and retain the most of adapter software.

### **3. ESTIMATION OF CONTROL PERFORMANCES**

Incorporating open WirelessHART protocol and industrial Wi-Fi standards in Emerson AMS Wireless SNAP-ON application, an insight was obtained that allows to achieve control performance assessment of industrial plants. Unlike many approaches to wireless networks in plants that require direct visibility between the instruments and communication devices, Emerson's Smart Wireless approach ensures the highest integrity of the network enabling all devices communicate with each other [3]. That means no single point error for each device used for connecting networks. If an object is temporarily obscuring the visual field device and prevents direct connection, the network will automatically reprogram the signal path to the next device and will allow consistency and data integrity [4].

Typical engineering work phases when using the adapter in WirelessHART SNAP-ON application are:

#### **Connection adapters:**

- Connection option 1: screw in adapter into a free connection instrument port.
- Connection option 2: connect adapter using the terminal box of the appropriate type.
- Connect adapter cables to the instrument or if you use the correct type terminal box, then connect to cable in the terminal box.
- If the adapter is self powered enable power supply.

#### **Setting the parameters of the adapter:**

- Connect to HART configurator or PC configuration program via HART PC modem in the adapter.
- Add WirelessHART Join Key.
- Add WirelessHART Network identification.
- Select of process variables of one of the instruments to be sent.
- Select the updated items.

If the adapter is used to obtain diagnostic information engineering work phases are very similar, but instead of process variables the instrument sends a status. When used WirelessHART adapter and connected instrument is necessary to set some additional parameters with the existing HART configurator or PC configuration program with the updated DD installation.

After completing the planning of the network, AMS Wireless SNAP-ON application checks the network facilities and plots the deviations of the parameters that are set to following values:

- 25% of wireless devices in the range of the gateway.
- Minimum of two wireless devices in the network.
- Any device with an external antenna has two wireless devices in range.
- Any Smart Wireless THUM adapter has two wireless devices in range.

The red circle around the wireless device indicates that it does not meet the planned parameters that are shown on the right side in Figure 3, so they are marked in red.

To have the network correct, within the range of each wireless device should be placed a minimum of two devices in order to meet the planned parameters that also dictate the number of redundant paths in case you lose the signal [4]. AMS Wireless SNAP-ON application gives a written message to the monitor when it is completed network design, i.e. that the network is correct, as shown in Figure 4.

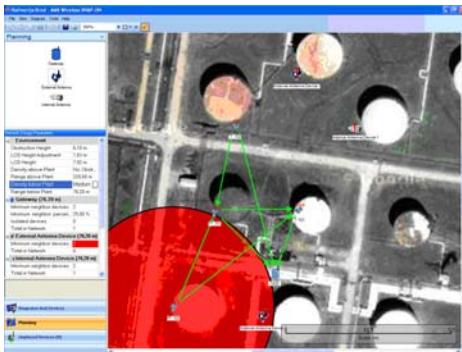


Figure 3. Network Planning



Figure 4. Correctly planned network

Finally, the resulting industrial communication network can be exported and included in project documentation.

#### 4. CONCLUSION

It can be concluded that WirelessHART adapter allows cheap and easy installation, so that becomes a member of WirelessHART network providing access to variables and parameters of the installed wired HART instruments. The main advantages secured by adapter are:

- Remote access to process information (calculated variables, positional feedback, the total flow).
- Read of diagnostic/check information (valve operation, clock counter, the over voltage warning).
- Upload of configuration to help maintain the database.

#### 5. REFERENCES

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