



## ISA100 WCI Webinar

Webinar date: June 5<sup>th</sup>, 2024.

The presentation will begin at 11:00 New York Time (UTC-4)

# How to Develop an ISA100 Wireless Instrument that Meets End User Requirements

Presenter: Robert Assimiti  
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# Agenda

1. About the speaker
2. End User Requirements
3. Benefits of ISA100 Wireless Instruments
4. Market Segments and Use Cases
5. How to Develop an ISA100 Wireless Instrument
6. How to Certify an ISA100 Wireless Instrument
7. Q&A



# About the Speaker



## Robert Assimiti

WCI Governing Board Member

Member of the WCI Technical Steering and Committee

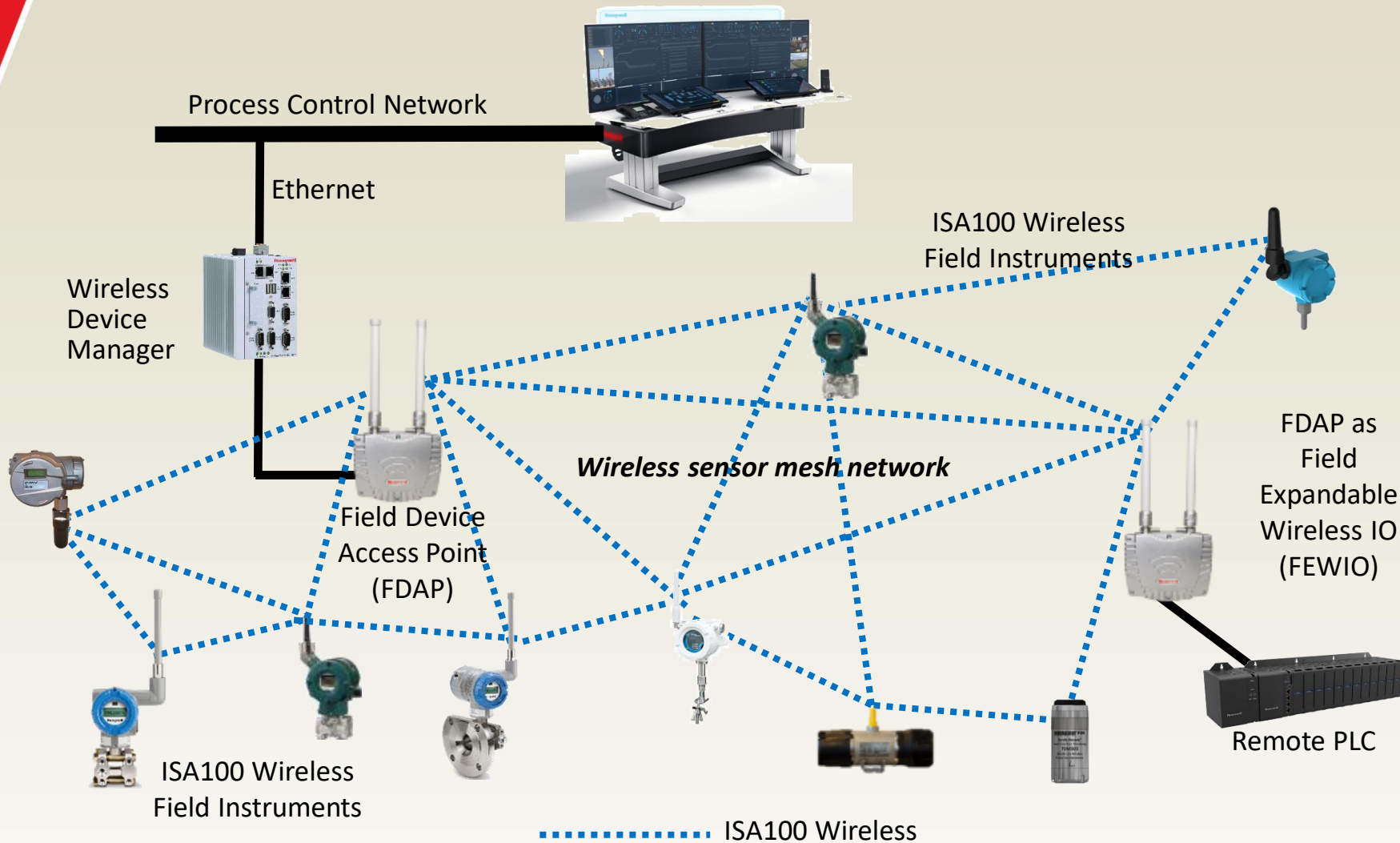
Co-Founder and CEO

Centero



Robert Assimiti has over 20 years of technical leadership in the wireless arena. He has architected and developed several highly-scalable, mesh based wireless product lines for both commercial and industrial wireless applications. He manages a team of technologists focused on the creation of new technologies, standardization and generation of novel intellectual property. He has also authored and co-authored several patents. Robert defines Centero's current and future technical strategic market position. He also oversees strategic partnerships, the integration of new business models, the incubation of new technologies and the cultivation of world-class talent. Robert is also an active member of the WCI Governing Board and the Technical Steering committee. He holds a Bachelor Degree in Computer Engineering from the Georgia Institute of Technology.

# Introduction to Industrial Wireless



## Applications examples

- Machine health monitoring
- Basic process control
- Monitoring of well heads
- Remote process monitoring
- Leak detection monitoring
- Diagnosis of field devices
- Condition monitoring of equipment
- Environmental monitoring
- Tank level monitoring
- Gas detection
- Fuel tank gauging
- Steam trap monitoring
- Open loop control
- Stranded data capture
- And more

# ISA100 Wireless Fast Facts


- International standard IEC 62734 since 2014
- Complies with ETSI EN 300 320 v1.8.1 (LBT)
- End-User Driven Standard - meeting all current and future industrial needs
- Sensor routing or field routers for best performance – Freedom of choice
- Broad Multi-Vendor Portfolio of ISA100 Wireless Devices
- ISA100 Wireless enables SIL-2 Certification
- Ensured Interoperability - best-in-class solutions from best-in-class suppliers
- Readily available ISA100 Wireless Modules and Stacks
- Enable fast-track development and go to market

# ISA100 Wireless Product Portfolio

## Infrastructure



**Independent Gateway**

- Honeywell, Centro, Yokogawa





**Access Point (AP)**

- Honeywell, Centro, Yokogawa


**Integrated Gateway/AP**

- Honeywell, Centro, Yokogawa, CDS





**GW/AP + Recorder**

- Yokogawa



**Adapter (HART, etc.)**


- Honeywell, Yokogawa

## Measurement & Control


**Temperature**

- Honeywell, Yokogawa




**Pressure / Flow**

- Honeywell, Yokogawa





**Level**

- Honeywell, Yokogawa



**DI/DO, AI**

- Honeywell, Yokogawa

**Valve Position**



- Eltav, Flowserve, Honeywell




## HSE + Life cycle



**Corrosion**

- RCS , Honeywell


**Steam Trap**

Spirax Sarco, TLV, Armstrong, Bitherm


**Vibration**

- GE's Bently Nevada, Divigraph




**Gas**

- GasSecure, Scott Safety, New Cosmos, Riken Keiki



**pH**

- Honeywell, Yokogawa



# Online Resources

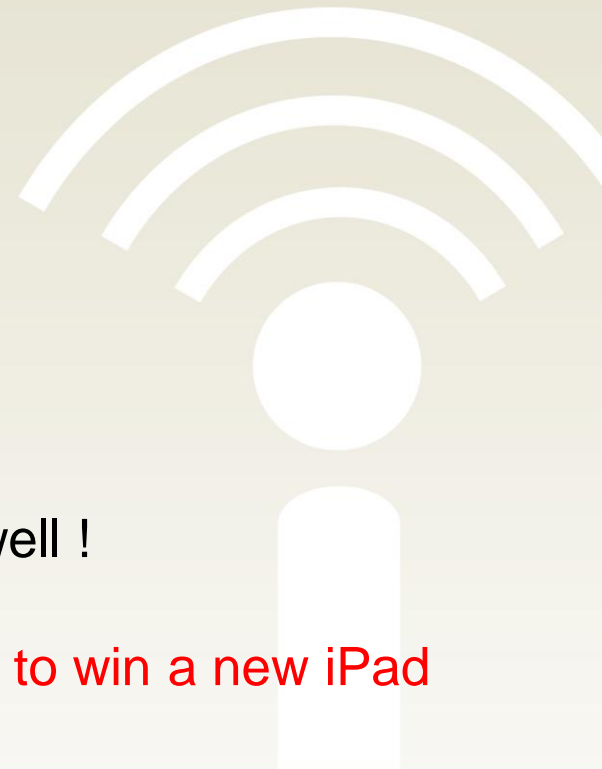


[www.isa100wci.org](http://www.isa100wci.org)

- Learning Center with White Papers
- Articles, End-user stories, Forum
- Receiving over 20,000 web views per month
- Full list of certified/registered ISA100 Wireless devices
- And more useful content for you and your business

**LinkedIn** [ISA100 Wireless Interest Group](#)

- Latest news, end-user and expert discussions, insights
- 1200 members and growing; please join and invite your peers to join as well !
- Receiving over 5,000 web views per month
- **Limited Time Offer: Join the group and you will be entered in a prize draw to win a new iPad**





# ISA100 Wireless Interest Group

## Limited Time Promotion



Scan the QR code and join the ISA100 Wireless LinkedIn group. If you join during our limited time offer, you will be entered in a prize draw to win a new iPad!





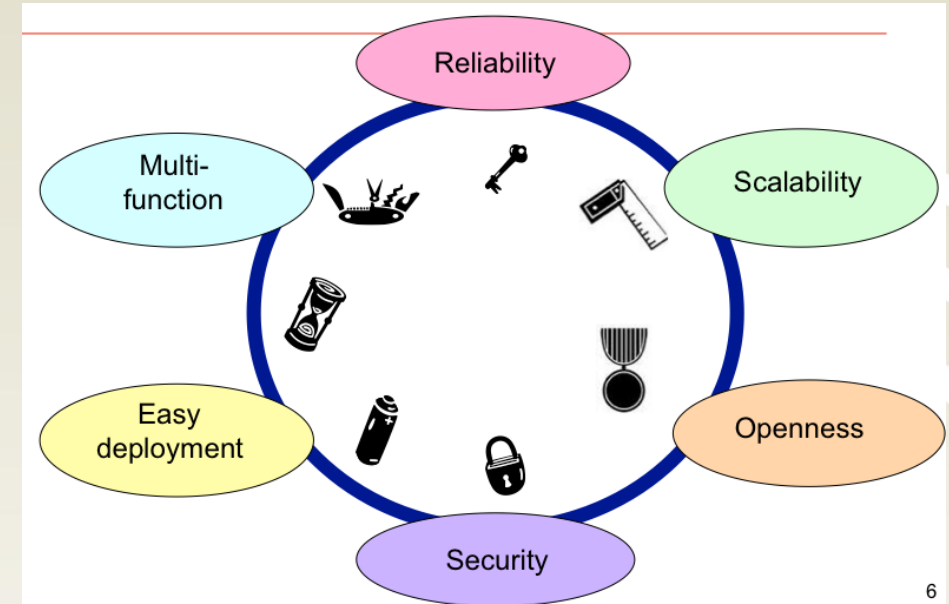
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# ISA100 Wireless – User Driven Technology

- The ISA100.11a standard was architected based on end user's requirements and feedback
- ISA100 Wireless certified devices and systems meet end user requirements



# End User Requirements

- For end users to deploy wireless sensor networks in industrial applications the wireless network must be characterized by
  - Highly reliable data communications
  - Ease of deployment and utilization
  - Extensible in the future
  - Vendor interoperability - standards based
  - Sound security
  - Prolonged battery life
  - IP addressability
  - Solution needs to operate in a single plant network



# The Problem



**Lack of data due to high cost of wired installations**



**Reduced visibility into process  
Decreased efficiency  
Costly downtimes and lack of safety**

**Outdated non-digital technologies**



**Limited data  
No diagnostics**

**Inefficient processes**



**High energy consumption  
High losses – increased emissions**

# Benefits of Deploying ISA100 Wireless Instruments

## Cost Savings CAPEX and OPEX



- Up to 90% of installed cost of conventional wired measurement technology can be for cable conduit and related construction
- Wireless is typically: 1/5 the installation time, 1/2 the cost

## Improved Process Monitoring and Control



- Additional data improves productivity and reduces downtime
- Condition and health monitoring (equipment)
- Add wireless to existing processes for optimal control

## Increased Operational Efficiency



- Reduce energy consumption and losses
- Minimize polluting emissions
- Increased sustainability of processes

## Improved Safety



- Safety related alarms and alerts – gas, fire and smoke detection

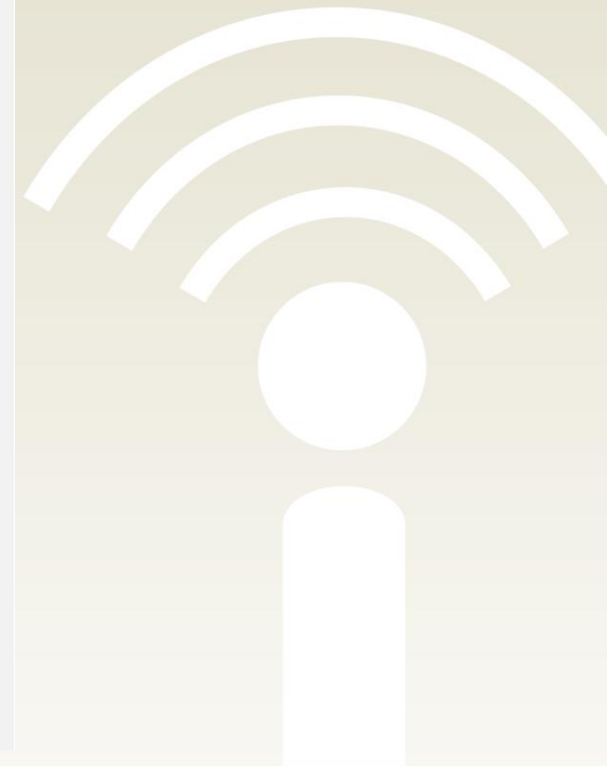
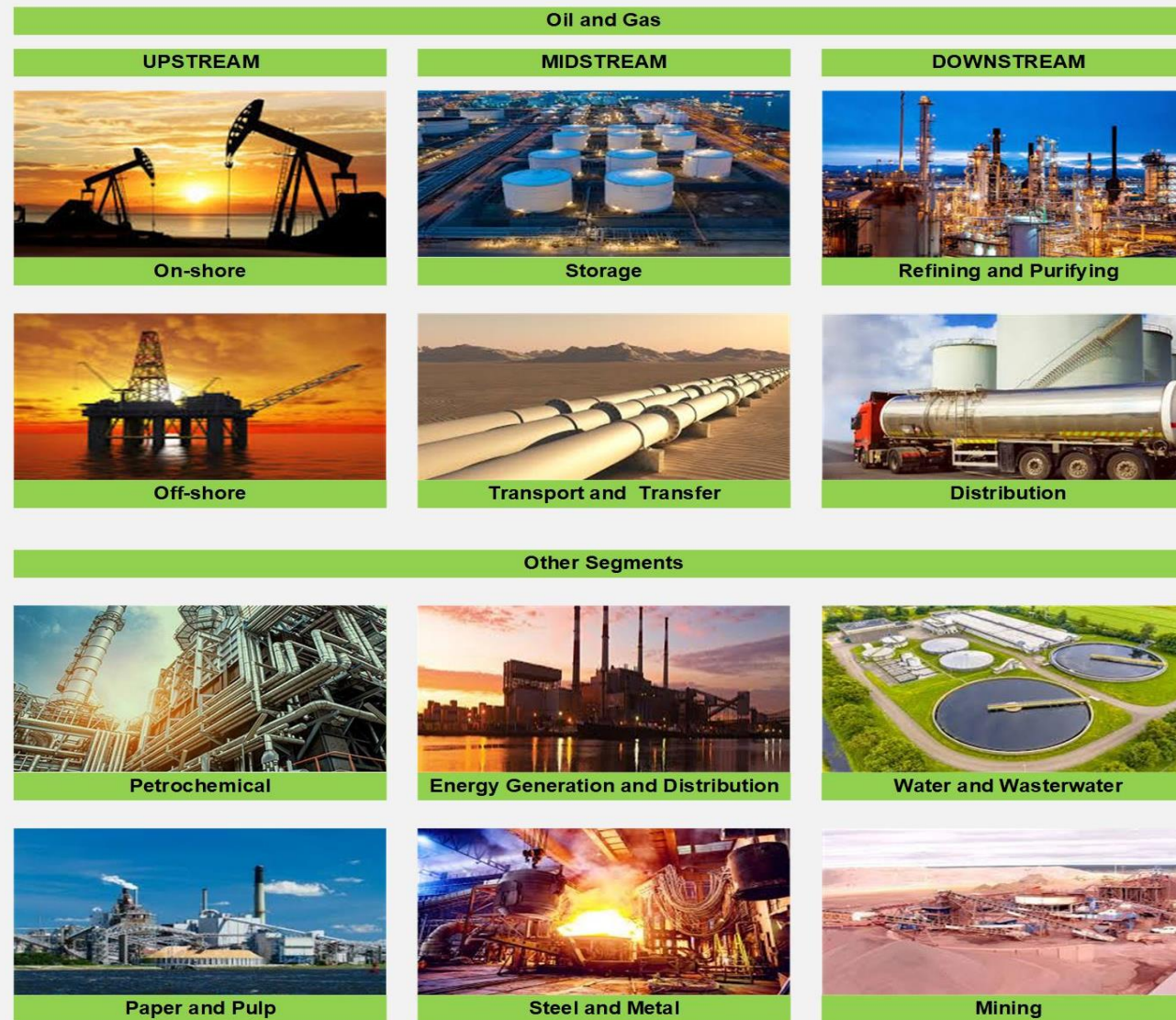
## Increased Reliability



- Wired sensors are prone to failure in difficult environments
- Quickly and easily add redundancy with wireless solutions
- Reduce data latency and increase reaction time



# Process Automation Market Segments





# Sustainability Use Cases



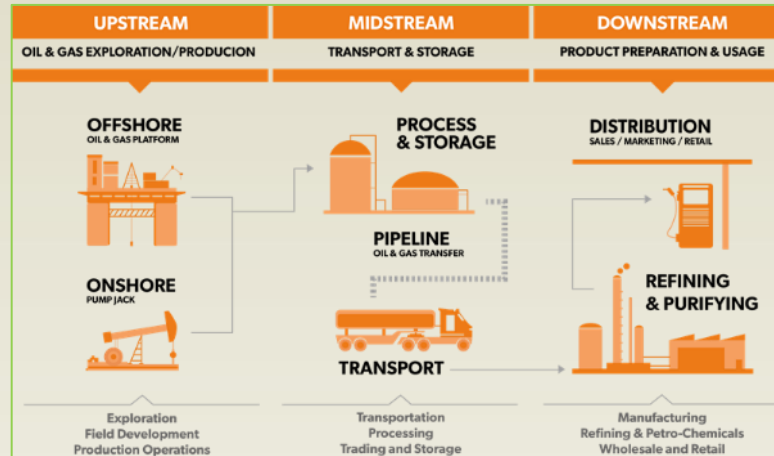
**Gas Detection**  
 Reduce fugitive emissions  
 Protect personnel and assets  
 Compliance with regulations



**Safety Relief Valve Monitoring**  
 Detect Leaks  
 Avoid environmental compliance issues  
 Eliminate fines



**Predictive Maintenance**  
 Equipment health  
 Eliminate critical failures  
 Minimize energy consumption



**Steam Trap Monitoring**  
 Reduce CO2 emissions  
 Minimize energy losses  
 Improve efficiency



**Corrosion Monitoring**  
 Reduce transport emissions  
 Extend the lifetime of assets  
 Eliminate critical failures



**Pressure/Temperature Monitoring**  
 Equipment Integrity  
 Operational efficiency  
 Safety



# Developing an ISA100 Wireless Instrument

- Developing an ISA100 Wireless compliant and certified field instrument used to be a complex undertaking that requires
  - In-depth knowledge of ISA100 application layer concepts and constructs – steep learning curve
  - Significant effort for developing the instrument specific code that resides on the application processor
- This results in slow market adoption and hinders the growth of ISA100 Wireless compliant/certified ecosystem of field instruments

# Technical Primer – Logical Roles



## Field Network

<b>I/O Device</b>	Sources or consumes data. Does not route.
<b>Router</b>	Routes messages for other devices operating in the wireless subnet.



## Infrastructure

<b>Backbone Router</b>	Routes data over the backbone infrastructure.
<b>System Manager</b>	Provides policy-controlled management for all network devices.
<b>Security Manager</b>	Enables, controls and supervises the secure operation of all devices.
<b>Gateway</b>	Provides an application interface between the wireless and the plant network.



## Operational

<b>Provisioning</b>	Provisions devices with configurations required for network operation.
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*Note: Devices typically incorporate multiple logical roles.*

# Development and Certification Process



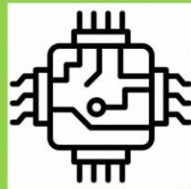
## Product Definition, Architecture and Project Planning

- Formulate product requirements and create field device architecture
- Estimate product battery life
- Identify project requirements and costs



## Develop Functional Prototype

- Purchase WCI ISA100 Wireless RDK (Rapid Development) KSet up development environment
- Tailor application processor source code provided to burst dynamic variables of interest
- See field instrument specific data being reported in the Gateway

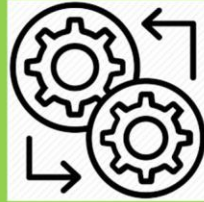


## Hardware and Firmware Development

- Select hardware components and design hardware
- Firmware integration of Centero's WISA module with the application processor



# Development and Certification Process



## Software System Integration

- Develop and generate Device Descriptor and Configuration files (DD/CFF)
- End-to-end system integration tests with ISA100 Wireless Gateways and DCS/PCS of your choice



## WCI Field Device Certification

- Join the Wireless Compliance Institute (WCI) as member and purchase Device Test Kit (DTK)
- Run internal certification tests using the Device Test Kit (DTK)
- Go through WCI certification process and obtain certificate



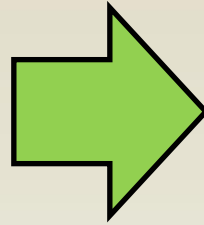
## Regulatory Compliance and Certification

- Compliance and certifications for operation in hazardous areas
- Wireless compliance and certification tests and other EMC, Emissions/RFI, ESD and safety testing



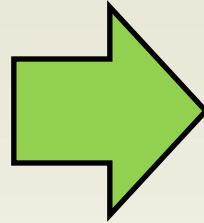
# WCI ISA100 Wireless RDK - Benefits

Includes all Components Needed to Develop an ISA100 Wireless Instrument



Simplified, user friendly field instrument development – minimal ISA100 knowledge needed

Includes WCI Compliant Application Processor Code



Significantly reduce time-to-market, just add sensor/actuator specific functionality. Application processor source code is license free.

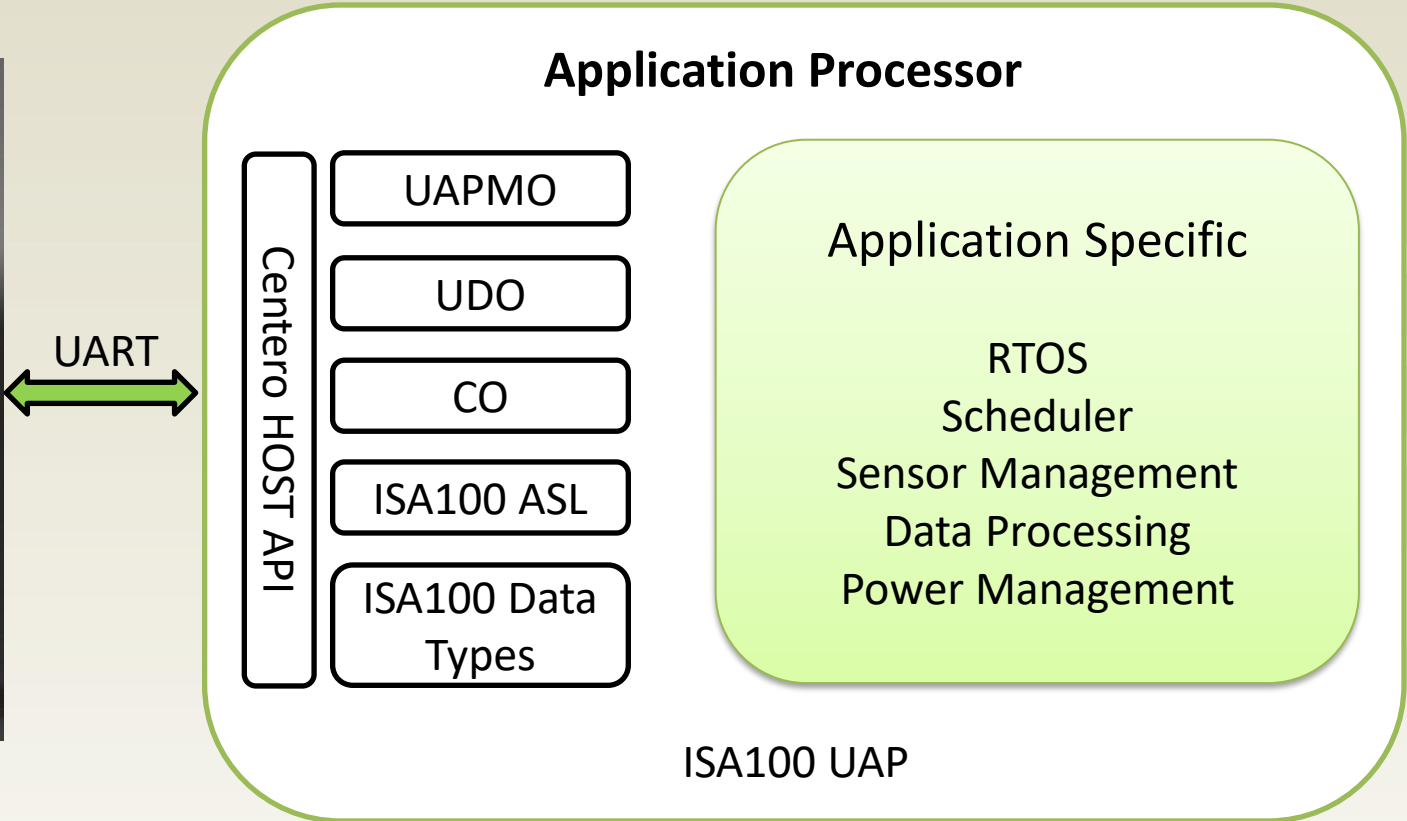
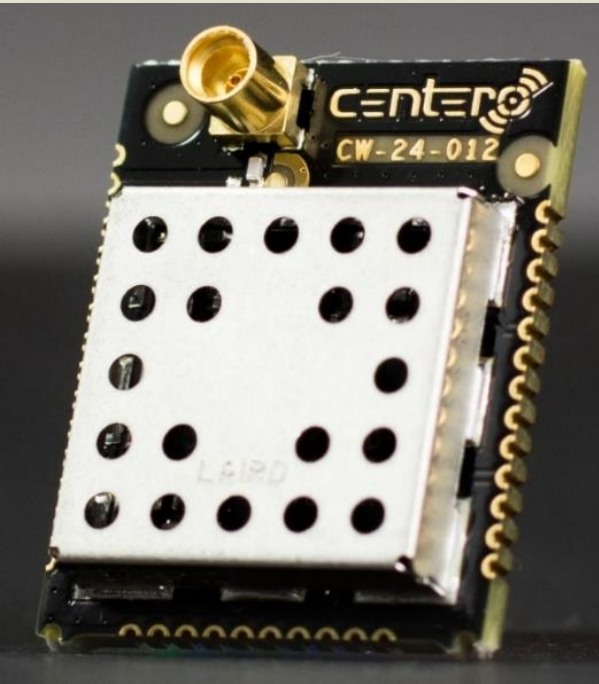
ISA100 Wireless Certified Wireless Module and Application Processor Code



Minimize WCI ISA100 Wireless Certification Effort

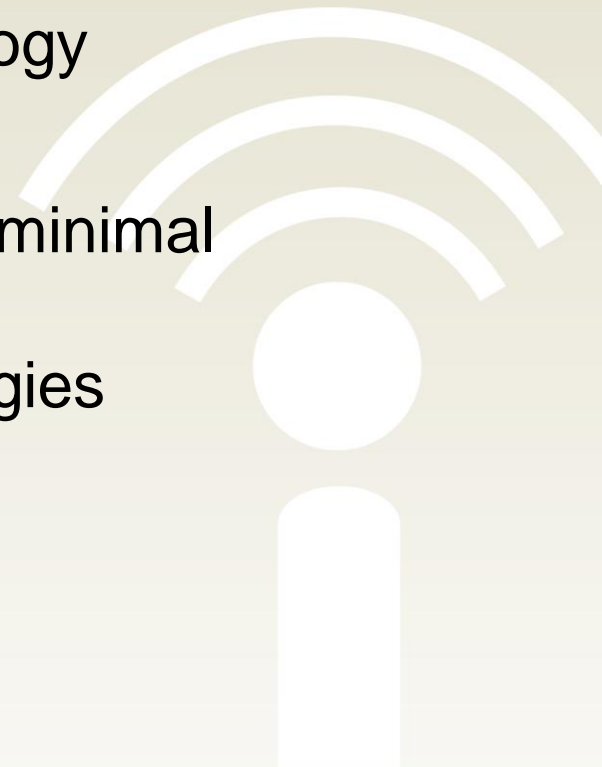


# ISA100 Wireless Field Device Architecture



# Benefits of Rapid Development Kit

- Streamline development process and reduce time-to-market
- User friendly – intuitive interfaces and great out-of-box experience
- Reduce learning curve associated with novel ISA100 technology
- KEY: Minimize application processor development effort
- Offer certifiable field instrument implementation that requires minimal tailoring to the customer's specific needs
- Competitively priced with other kits for industrial IoT technologies (WirelessHART, LoRa, Bluetooth Mesh etc)



# ISA100 Wireless RDK Highlights

- Develop ISA100 Wireless (IEC 62734) compliant and certifiable field instruments with minimal effort using application layer code provided
- WISA wireless modules included run ISA100 Wireless communication stack
- Gateway boasts feature rich web-based Network Operation and Management System
- User friendly SPiN development board includes OLED display and a large variety of sensors
- Connect external processors, sensors or actuators via Arduino and Freedom form factor connector



<https://centerotech.com/product/wci-isa100-rapid-development-kit/>

# Rapid Development Kit (RDK) Components



ISA100 Wireless Gateway (Quantity: 1)



SPiN Field Development Board (Quantity: 2)



Engineering Utility Software (Quantity: 1)

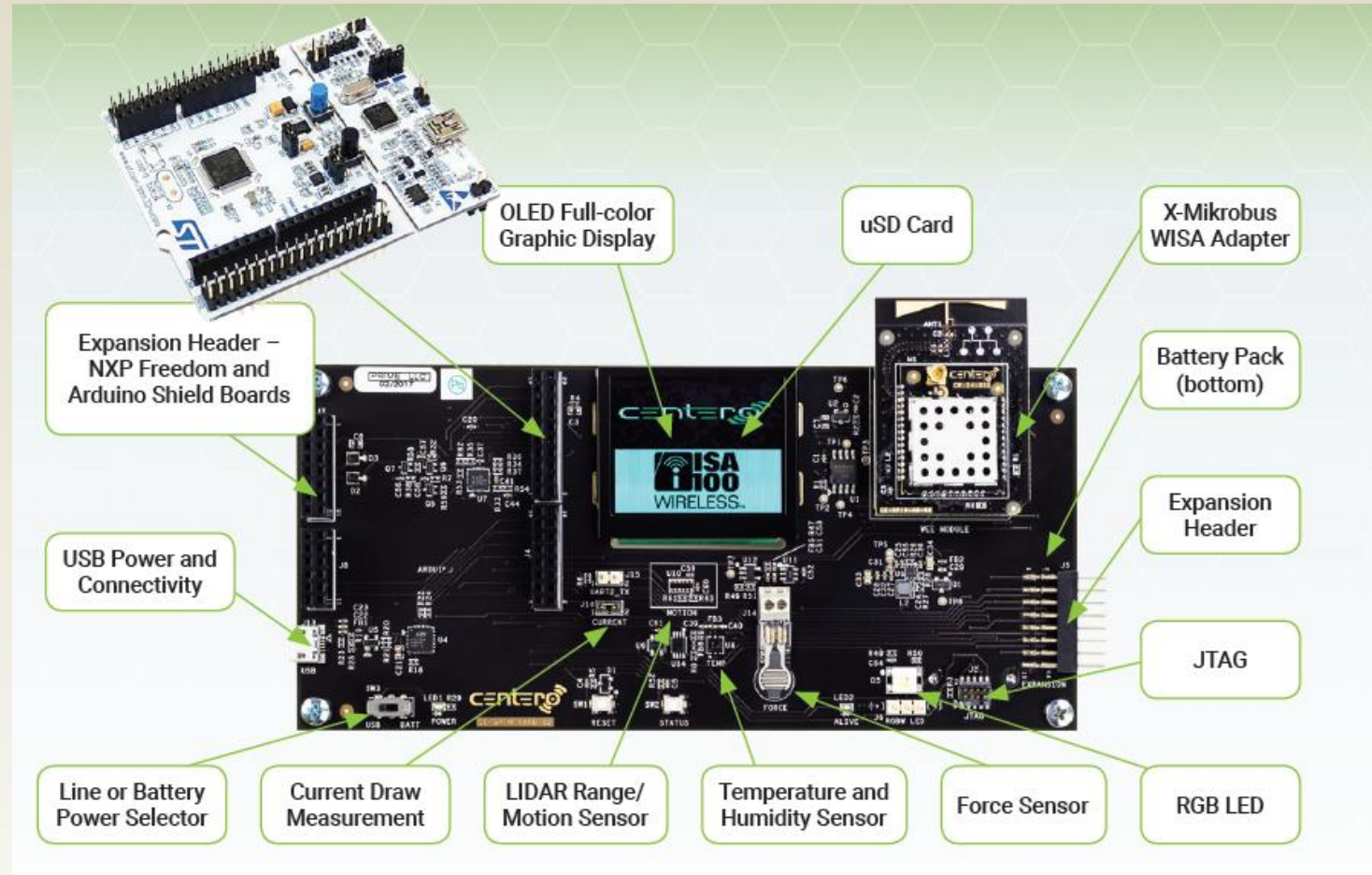


Documentation Package (Quantity: 1)



# SPiN Field Development Board

- Great out-of-box experience
- Hosts a wide gamut of sensors allowing out-of-box monitoring and control
- OLED sensor displays locally ISA100 parameters (role, join status, EUI-64, sensor data etc)
- Connects to Utility Software via USB – on-board USB bridge
- Expandable – hosts Arduino shield connector – user can stack own sensors or controls



# WISA ISA100 Wireless Module



- Runs an ISA100 Wireless certified communication stack
- Designed for integration in intrinsically safe instruments
- Adjustable output power of up to +16 dBm
- Market leading sensitivity of -104 dBm and link budget of 120 dB
- Suitable for real estate constrained products
- Multiprotocol support for ISA100 Wireless and Bluetooth LE
- State-of-the-art security – includes Silicon Labs' Secure Vault – with PSA Level 3 certification
- Over-the-air upgrades via secured, authenticated mechanism
- Tested for interoperability with third-party Gateways
- AI/ML capable through dedicated hardware accelerator



# Application Processor Implementation



- ST Micro NUCLEO-L073RZ Arduino development board
- Centered on the STM32L0 ARM Cortex-M0+ MCU 32-Bit
- Low-power application processor suitable for battery powered field instruments with extended battery life
- Firmware includes a full ISA100 Wireless application layer implementation
  - Mandatory structures and objects needed to obtain WCI's Field Instrument certification
  - Data models and mechanisms needed to periodically publish data, establish contracts as well as manage various aspects of the communication stack residing on the wireless module
  - ISA100 Wireless data types and application payload encoding



# Application Processor Implementation



- Develop your own field instrument firmware using free Eclipse IDE
- Source code implemented in C++
- Source code offered under permissive, free licensing model
  - No license fees
  - User can create derivatives of work and commercialize field instruments
  - User does not have to make modified code available to the community
- WCI ISA100 Wireless certifiable implementation
  - Was tested with the WCI's Device Test Kit (used for field instrument certification)
  - Full instrument is certifiable assuming you use a WCI certified ISA100 Wireless communication stack



# Centero's UNISON ISA100 Wireless Gateways

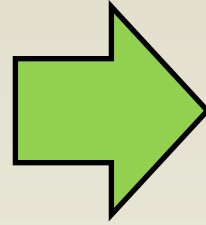


unison

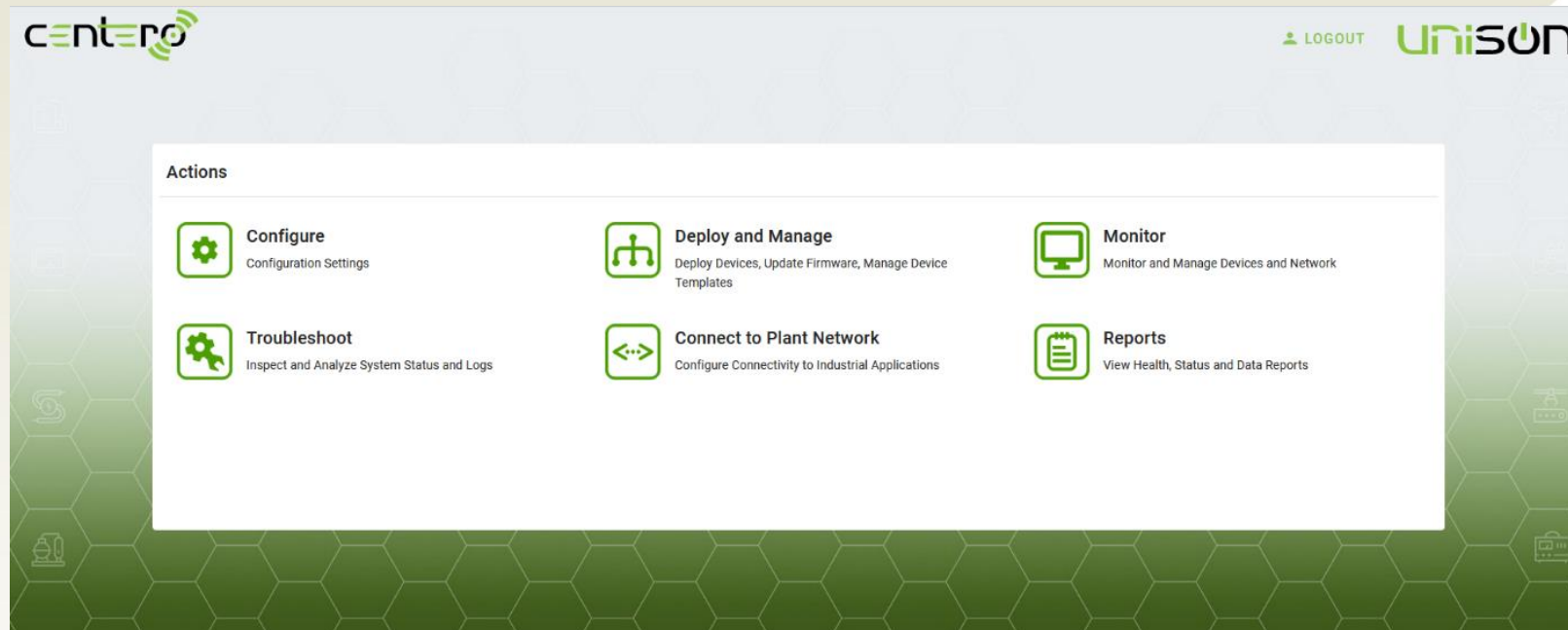
- ISA100 Wireless and WiFi Mesh+ high throughput backbone connectivity
- Supports highly scalable deployments in multiple topologies
- Monitoring and advanced control features
- Over-the-air provisioning with advanced security features
- Advanced diagnostics – NAMUR, wireless health and battery life
- Native support for DD/CF files
- Long-range ISA100 Wireless connectivity - 1.2 miles (2 km) LoS
- Multiple plant connectivity interfaces: MODBUS, OPC UA, GCI
- Multiple models for deployments in hazardous as well as non-hazardous areas

# UNISON Monitoring and Control Application

Suite of “Apps” modeled after field device life-cycle



Clear functional segregation  
User friendly and intuitive  
Minimum training for plant personnel





# UNISON Monitoring and Control Application

centero **ISA 100** WIRELESS **Unison** Powered by

CONNECT CONFIGURE INTERACT MANAGE

**Network Status**

- 10 Active Device(s)
- No device rejoins
- No New Alarms
- OTA Provisioning Disabled
- No Firmware Updates in Progress

**System Status**

- Version: 2.8.5
- No Errors
- Low

Version: 2.8.5 | NIC200-1AG

T022FF000002CF89 [0022:FF00:0002:CF89]

**Device**

- STATUS
- REGISTRATION LOG
- DEVICE HEALTH
- NEIGHBORS HEALTH
- SCHEDULE&CHANNELS
- BATTERY
- RADIO

**Application**

- INFORMATION
- DIAGNOSTICS
- VENDOR PARAMETERS
- PROCESS VALUES

**Device Identification**

Device Tag: T022FF-000002CF89  
 MAC ID: 0022:FF00:0002:CF89  
 IPv6 Address: FC00:0000:0022:FF00:0002:CF89:0005:0021  
 Subnet ID: 5

Manufacturer: 0ARM  
 Model: ST6700  
 Software Revision: V3\_04.11.04\_15  
 Serial Number: 6703537

**Device Status**

Join Status: Joined & Configured & All info available  
 Device Role: IO Router Device  
 Last comm: 2022/02/09 08:09:24

Power Supply: ▶  
 Energy left: 365 days  
 Rejoins count: 10

**Restart Device**

Warm Restart  Restart as provisioned  Reset to factory defaults

RESTART

centero **ISA 100** WIRELESS **Unison** Powered by

LOGOUT

**Actions**

- Configure**  
Configuration Settings
- Deploy and Manage**  
Deploy Devices, Update Firmware, Manage Device Templates
- Monitor**  
Monitor and Manage Devices and Network
- Troubleshoot**  
Inspect and Analyze System Status and Logs
- Connect to Plant Network**  
Configure Connectivity to Industrial Applications
- Reports**  
View Health, Status and Data Reports

10 Active Device(s) No device rejoins No New Alarms OTA Provisioning No Firmware Updates No Errors Low

Version: 2.8.5 | NIC200-1AG Powered by FMBAJX6

centero **ISA 100** WIRELESS **Unison** Powered by

LOGOUT

← Topology LIST

Map

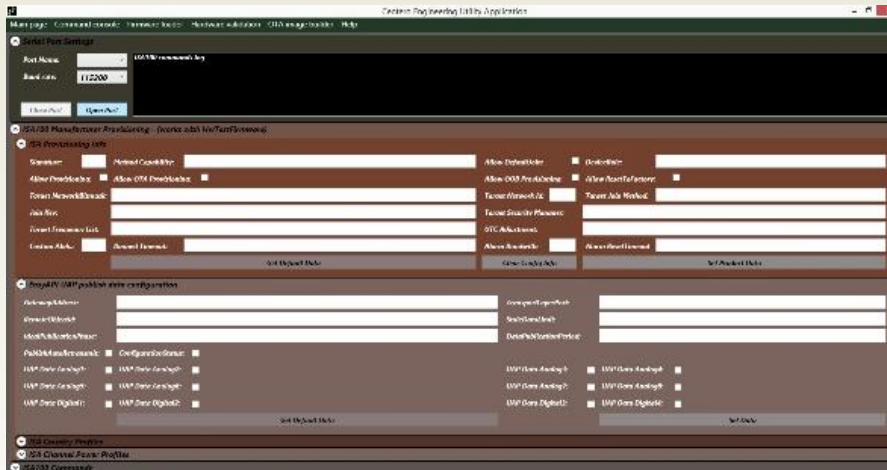
Chemical Factory

EDIT DEVICE POSITIONS

View Settings

Unmapped devices

# Engineering Utility Software



- Feature rich Engineering Utility Software can be installed on any PC
- Communicates with the SPiN board via USB/serial
- Allows user to provision and configure the ISA100 communication stack
  - Provisioning parameters
  - Country codes and RF profiles
- Full set of ISA100 Wireless commands
- Full configuration of the process values published
- Serial upgrades of the communication stack



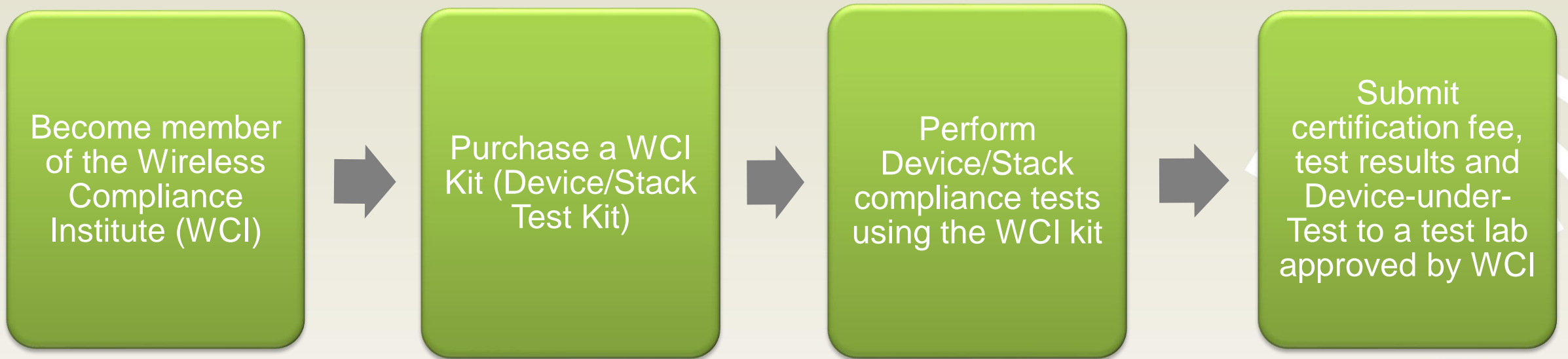
# Documentation Package – Training Materials

Document or File Title	Description
<b>ISA100 Wireless Nine - Part Training Course</b>	A comprehensive training course provided by the WCI (Wireless Compliance Institute) which covers everything from ISA100 technical basics as well as the process to obtain ISA100 Wireless certification.
<b>The Technology Behind ISA100 Wireless</b>	A presentation that provides the compressed foundation of ISA100 compliant technologies.
<b>White Paper - ISA100 Applications Technology and Systems</b>	White paper that provides a technical foundation as well as industry practices related to ISA100 systems
<b>ISA100 - Spectrum Management and Co-Existence</b>	Presentation that explains ISA100 RF spectrum management features and also provides test results for co-existence with WiFi products.

# Documentation Package – Engineering Materials

Document or File Title	Description
<b>RDK User Guide</b>	User guide that describes the functionality of the RDK. It includes initial setup of an ISA100 compliant network as well as the steps needed to create an ISA100 field instrument demo.
<b>Developing ISA100 Compliant Products - Training Course</b>	Training course that provides a step-by-step approach on how to develop ISA100 Wireless compliant field instruments and products.
<b>HOST API Manual</b>	Firmware integration document that details the API.
<b>WISA Radio Module - Hardware Integration Manual</b>	Document contains all the information needed to integrate the WISA wireless module into a product – including reference design.
<b>Hardware Engineering Package</b>	Schematic symbol, layout footprint, mechanical drawings.
<b>Engineering Utility Software - User Guide</b>	Details the functionality and capabilities of the Engineering Utility software.
<b>ISA100 Provisioning and Firmware Upgrade</b>	Document describes the process of provisioning and upgrading the WISA ISA100 wireless module via various methods.
<b>And much more.....</b>	WISA Radio Module - Intrinsic Safety Analysis WISA Wireless Module Performance Evaluation - Application Note

# WCI ISA100 Wireless Compliance Steps



# ISA100 Wireless Field Instrument Certification Requirements

## Test Requirements

**Base Requirement: Field instrument includes an ISA100.11a-2011 WCI certified communication stack. Centero's ISA100 WISA communication stack is WCI certified.**

Test	Description	Comments
<b>WISA module wireless- PHY compliance</b>	IEEE 802.15.4 compliance tests Wireless compliance test results (FCC, ETSI etc) Antenna radiation patterns	Provided by wireless module manufacturer (Centero) – except antenna radiation pattern
<b>Device Test Kit</b>	Full suite of ISA100.11-2011 compliance tests. Compliance tests mainly focused on the application layer and functionality of the field instrument. Tests also include a checkpoints that test connectivity and other features of the ISA100 communication stack running on the WISA wireless module.	Requires active WCI DTK GEN (Device Test Kit) license

# WCI Device Test Kit



- Mandatory for obtaining WCI ISA100 Wireless® field instrument certification
- Certifies conformance to the ISA100.11a-2011 standard revision (IEC 62734)
- Excellent tool for troubleshooting, debugging, and regression testing of ISA100 Wireless® field instruments
- Includes the following components:
  - GEN 2 Script Server and software
  - Test script source code and technical documentation
  - Diagnostic Backbone Routers
  - Reference Device Under Test



**To purchase the kit please visit:**

[www.centerotech.com/product/wci-isa100-rapid-development-kit](http://www.centerotech.com/product/wci-isa100-rapid-development-kit)

**THANK  
YOU**

**For Your Attention!**



# Questions?



**Robert Assimiti**

[robert.assimiti@centerotech.com](mailto:robert.assimiti@centerotech.com)

To purchase the kit please visit

[www.centerotech.com/product/wci-isa100-rapid-development-kit](http://www.centerotech.com/product/wci-isa100-rapid-development-kit)



[www.isa100wci.org](http://www.isa100wci.org)



[ISA100 Wireless Interest Group](#) **LinkedIn**

1200+ members and growing; please join and invite your peers to join as well !