



Workshop on Performance Assessment of Industrial Wireless Systems

Plus: Standards Meeting: P1451.5p

May 31, 2022

Organizing Committee

Workshop Chairs:

- Zhibo Pang (ABB, Sweden):
- Rick Candell (NIST, USA):

Committee members

- Kang Lee (NIST, USA)
- Kim Fung Tsang (CityU, HK)
- Allen Chen (IES, USA)
- Victor Huang (IES, USA)

Sponsored by:

IEEE Industrial Electronics Society (IES) Standards Committee

Technical Co-sponsors:

National Institute of Standards and Technology (NIST)

IMS Technical Committee on Sensor Technology, TC-9

IES Technical Committee on Cloud & Wireless Systems for Industrial Applications

IES Technical Committee on Industrial Cyber-Physical Systems

IES Technical Committee on Industrial Informatics

IES Technical Committee on Industrial Agents

Registration

- Workshop Only (1 day registration): US\$100.00
- Full ISIE Conference (includes Workshop): Full Conference Fee

The Workshop

The workshop and standards meeting will address user and manufacturer needs and requirements for the development of an environment model and respective specifications for the evaluation of wireless systems in specific RF environments. This is in support of the development of the IEEE P1451.5p - Standard for Radio Frequency Channel Specifications for Performance Assessment of Industrial Wireless Systems. This standard is applicable for wireless mechatronics systems consisting of sensors, actuators, and control systems. This workshop would like to invite and welcome participants to address relevant issues in formulating the environment model and specifications for the standard.

Program

Workshop and Standards Meeting on Performance Assessment of Industrial Wireless Systems, to be held at the 2022 IEEE International Symposium on Industrial Electronics (ISIE) on May 31, 2022 at the Dena'ina and Egan Centers in downtown Anchorage, Alaska.

Morning 8:30 am to 12:00 pm

8:30-8:45am - Introduction - **Kang Lee, NIST**

8:45-9:15am - Keynote: "IEEE P1451.5p Standard and Future of

Interferences in Wireless factories" - **Dr. Richard Candell, NIST**

9:15-9:45am - "Interference Experience in Different Industrial Environments"

- **Scott McNeil, GPA, Industrial Automation**

9:45-10:15am - "Impulse Noise and Interference in Industrial Wireless Systems"

- **Dr. Zhibo Pang, ABB Corp. Research Sweden/Royal Inst.Tech (KTH)**

10:15-10:30 am Coffee break

10:30-11:00am - "Wireless Channel Impacts on Safety Systems"- **Dr. Iñaki Val, IKERLAN**

11:00-11:30am - "Evaluation and Tuning of Wireless Time Sensitive Networks using P1451.5p Model"- **Dr. Javier Perez-ramirez, Intel**

11:30-12:00pm - "Dependability, the Enabler for Industrial Wireless Communications"

- **Dr. Hans-Peter Bernhard, Silicon Austria Labs**

LUNCH BREAK - Noon to 1:30 pm

Afternoon 1:30 to 5 pm

- IEEE P1451.5p working group meeting addressing various technical issues - modeling, testing, data fitting, verification, etc.

- Meeting adjourned at 5 pm

- Group Dinner - 6:30 pm

(List of talks, abstracts, bios, photos of speakers - next page)

List of talks, abstracts, bios, and photos of the speakers.

“IEEE P1451.5p Standard and Future of Interferences in Wireless Factories” – Dr. Richard Candell, NIST

Abstract:

Deploying wireless in factories is an interesting and yet challenging topic for factory communications. Wireless brings a high degree of flexibility and lower installation costs but comes with valid concerns related to reliability and latency determinism for the factory network. The history of using wireless in factories is not new. Since the advent of IEEE 802.11 (Wi-Fi) and later low-rate wireless personal area networks (LR-WPAN) and Bluetooth, people have been experimenting with and deploying wireless networks to factories with varying degrees of success. The wireless environment can be harsh and demanding, and the applications requirements are quite different from those of traditional home and office where retransmissions and delays can be tolerated. To make wireless a reality in factories, performance expectations must be managed and quantified according to standardized processes. In his talk, Rick Candell will present the ongoing challenges of wireless in the factory, what use cases are important, the need for improved testing methods, and a call for more data to support that in terms of spectral activity and use case visibility.

Biography:



Dr. Richard Candell has over twenty years of experience in wireless systems engineering with extensive experience in the design and evaluation of wireless communications systems. Dr. Candell spent twelve years developing, testing, and deploying secure wireless technologies for commercial and defense applications. He served as the lead systems engineer in developing spread spectrum interference cancellation and performance evaluation strategies for satellite ground stations and mobile phased array beam steering transceivers. He holds patents in successive interference cancellation and transmission burst detection applied to spread-spectrum satellite communications signals. He holds a Ph.D. in Computer Science from the University of Burgundy, Dijon, France. He also holds a BS and MS degree in Electrical Engineering from The University of Memphis. Dr. Candell joined the National

Institute of Standards and Technology (NIST) in the US in 2014 where he leads the Industrial Wireless Systems research laboratory. He is a member of the IEEE Industrial Electronics Society and the Robotics and Automation Society. His current research interests include the performance of mobile robotic, manufacturing, and safety applications when deployed with wireless networks as the primary mode of communications. Dr. Candell was the primary contributing author of the Guide to Industrial Wireless Systems Deployments (NIST AMS 300-4) and he serves as the Chair of the IEEE P1451.5p Wireless Performance Assessment and Measurement Working Group and the NIST Industrial Wireless System technical interest group.

“Interference Experience in Different Industrial Environments” - Scott McNeil, GPA, Industrial Automation

Abstract:

Wireless communication is hard! Once all of the protocols are sorted out, syns have been acked, timing has been figured out, authentication has happened and packets sent and received, it is amazing any of it works at all.

But is that all you have to worry about? Nope! Then comes interference from sources that have nothing to do with the organized communication of 802.11 (or other protocols). The ambient noise of the raw radio frequency spectrum. Add to that the wild west conditions of an industrial environment and if wireless works at all, it's total magic!

This presentation will share several very real examples of raw RF interference that can be present in different industrial environments.

Biography:



Scott McNeil is Industrial Network & Security Architect for automation integrators GPA with Assoc. and BS in Information Systems and Industrial Technology from East Carolina University

Scott has been a member of the wireless community for over sixteen years. He has experience ranging from metro-area WiFi to private enterprise and higher education wireless deployments. For the past six years he has specialized in all manner of wireless communications in industrial and manufacturing environments.

Scott maintains multiple wireless certifications from CWNP and Aruba Networks and is an avid supporter of Autism Awareness.

“Impulse Noise and Interference in Industrial Wireless Systems” – Dr. Zhibo Pang, ABB Corporate Research Sweden/ Royal Institute of Technology (KTH)

Abstract:

Impulse noise and interference is one of the major domain specific challenges when the wireless communication is introduced to factories. In this presentation, we will share the work we have done related to the impulse noise model, including some experimental measurement, the existing model defined in an IEEE standard, a commonly applied model in telecom research, and a simplified model in our previous works. At the end, we will share some use cases in practice where the new impulse noise model will be used and expected to make some changes.

Biography:



Zhibo Pang, PhD & MBA, is currently a Senior Principal Scientist at ABB Corporate Research Sweden, and Adjunct Professor at the University of Sydney and the Royal Institute of Technology (KTH). He is a Senior Member of IEEE and Co-Chair of the Technical Committee on Industrial Informatics. He is Associate Editor of IEEE TII, IEEE JBHI, and IEEE JESTIE. He was General Chair of IEEE ES2017 and General Co-Chair of IEEE WFCS2021 and Invited Speaker at the Gordon Research Conference AHI2018. He was awarded the “Inventor of the Year Award” by ABB Corporate Research Sweden, three times in 2016, 2018, and 2021 respectively. He works on enabling technologies in communication, computing, and intelligence for Industry4.0 and Healthcare4.0.

“Wireless Channel Impacts on Safety Systems” – Dr. Iñaki Val, IKERLAN

Abstract:

In recent years, the idea of replacing wired industrial fieldbuses with wireless counterparts has gained interest. It is a slow but inexorable process, and its deployment will eventually cover different industrial sectors (Factory Automation, Process Automation, Power Electronics Control). Wireless technologies offer well-known advantages: greater flexibility, scalability, lower operational costs, and ease of integration. Although there is a research activity in the field of wireless safety, there is currently no industry-accepted wireless system that guarantees safety function requirements imposed by safety standards, such as IEC 61508. In such a scenario, integrity is compromised by

wireless channel propagation imperfections, where the transmitted signal suffers from a deep fading that varies over time, depending on the environment. Having all this into account, it can be identified the need for a methodology to evaluate the feasibility of using wireless links as part of functional safety systems.

Biography:



Iñaki Val received B.S. and M.S. degrees from the Department of Electronics Engineering at Mondragon University (Spain) in 1998 and 2001, respectively, and a Ph.D. degree from the Department of Signals, Systems and Radiocommunication at Polytechnic University of Madrid (Spain) in 2011. Since 2001 he is a researcher in the Communications Dpt. of Ikerlan and in the past he has been working in the Fraunhofer IIS of Erlangen (Germany) as invited researcher for two years (2005-2006). His research activities include the design and implementation of digital wireless communications systems, SDR, cognitive radio, wireless channel measurement & emulation and digital signal processing in general. He is currently focused on wireless communications applied to industrial and safety applications.

“Evaluation and Tuning of Wireless Time Sensitive Networks using P1451.5p Model” – Dr. Javier Perez-Ramirez, EMBA, PhD, Intel Corporation

Abstract:

Wi-Fi has become ubiquitous in our lives, enabling services such as internet browsing, video streaming, and on-line gaming to name a few. From its early inception, Wi-Fi has evolved to offer higher throughput and capacity in every new generation. Recently, the emergence of new use cases in industrial IoT, extended reality and gaming have triggered a clear change in how Wi-Fi is conceived. Upcoming generations will have a much larger focus on achieving latency bounded and deterministic communications. To evaluate the performance of these new Wi-Fi networks, a novel channel interference model is required. In this presentation, we will discuss what type of signals P1451.5p needs to accurately model to evaluate Wi-Fi networks. We will also discuss how to leverage P1451.5p to efficiently tune network parameters and achieve high reliable, low latency and deterministic communications.

Biography:



Javier Perez-Ramirez was born in Malaga, Spain, in 1981. He received the M.S. and Ph.D. degrees in electrical engineering from New Mexico State University, Las Cruces, NM, USA, in 2010 and 2014, respectively, and the Telecommunications Engineering degree in sound and image from the Universidad de Malaga, Malaga, in 2006. From 2005 to 2008, he was a Lecturer with the Escenica Technical Studies Center, Malaga. He is currently with Intel Labs, Hillsboro, OR, USA. His current research interests include wireless time-sensitive networks, channel coding, estimation and detection theory, navigation and positioning, and optical wireless communications.

“Dependability, the Enabler for Industrial Wireless Communications”, Dr. Hans-Peter Bernhard, Silicon Austria Labs

Abstract:

Why doesn't industry use wireless OT widely, even though there is a need? In industry, there is often a need for reliable, time-critical communication to cover all aspects of data exchange on the factory floor. We have had this

experience for many years, with wired communications being very successful. As we move towards Industry 4.0 or 5.0, the need for reliable wireless communication is inevitable. However, if it is not possible to achieve the reliability required for specific use cases, we will not succeed with wireless communication and therefore with the next step in the industry. In this talk, we will derive an approach to what is needed and how we can achieve reliability in specific dynamic industrial environments. We will look at current technologies and issues that need to be evaluated and further researched for the sake of reliable communications.

Biography:



Hans-Peter Bernhard is Principal Scientist, Head of Research Unit Wireless Communications at Silicon Austria Labs and Senior Scientist at the Institute of Communications and RF Systems at the Johannes Kepler University Linz, Austria. Hans-Peter Bernhard holds a Master's degree in electrical engineering in 1991 and a PhD in Technical Sciences from the Technical University Vienna in 1997. He was Assistant Professor at TU-Vienna until 1998 and joined the JKU as Lecturer in 1999. In 2014 he started as Senior Scientist at Johannes Kepler University and at Silicon Austria Labs in 2018. He was Guest Researcher at Prague Academy of Science and at University of Cambridge. His research interests include the design and analysis of time sensitive

communication systems with a focus on dependable solutions. He has given several invited talks on various aspects of wireless factory and sensor communications. He has organized/co-organized several special sessions at ETFA2019, WFCS2020, NOMS2020, IEEE-IM 2021, WF-IoT 2021 and serves as conference General Chair WFCS2021 and Organizing Chair of EWSN2022. He is an active member of the IEEE P1451 standard technical committee, IES TC-II, IES TC-FA, IEEE Senior Member, and guest editor of IEEE Transactions on Industrial Informatics.