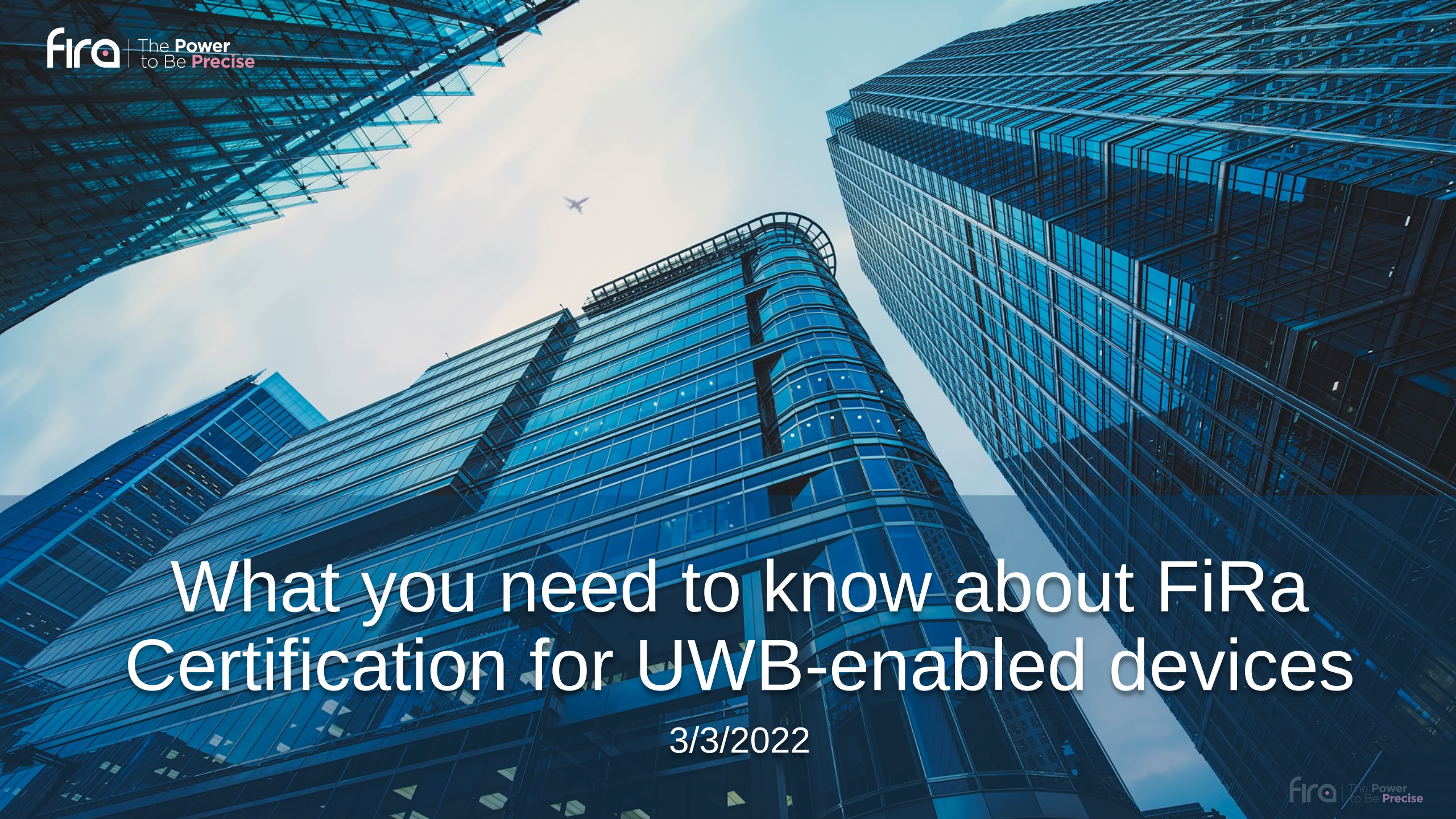


What you need to know about FiRa Certification for UWB-enabled devices

3/3/2022

fira | The Power to Be Precise

• SPEAKERS

• Ardavan Tehrani

- Ardavan is currently representing Meta Reality Labs at FiRa, where he is also serving as co-chair of the Requirements and Marketing Working Groups. He has more than 20 years of experience in the wireless industry, serving in a number of technical leadership and executive roles.

• Eve Danel

- Eve is a Senior Product Marketing Manager at LitePoint responsible for wireless connectivity test systems, she has over 15 years of experience working in test and measurement.

• Krzysztof Wlodarczyk

- Krzysztof is a Senior Software Developer at Comarch. He has been with Comarch for 12 years and for most of that time, he has been involved in development and support of tools for certification testing for several worldwide certification organizations. He is currently responsible for development of certification testing tools for FiRa.

• Mitch Kettrick

- Mitch is the FiRa Certification Program Manager and is responsible for managing all aspects of FiRa's device certification program. He has more than 20 years of product development, testing and certification experience in the wireless telecommunications industry.

• Patryk Stryczek

- Patryk is Department Director at Comarch. Since 2017, he has been directly involved in the management and supervision of service projects for various customers from the automotive, embedded and certifications areas of expertise. He has a strong technical background in quality assurance.

FiRa Introduction

Comarch FiRa Litepoint Webinar

Ardavan Tehrani

Co-Chair, Requirements and Marketing Working Groups @FiRa Consortium

Who We Are

Current Sponsor Members

ALLEGION
PIONEERING SAFETY

BOSCH
Invented for life

CISCO

Google

HID

NXP

qorvo

Qualcomm

SAMSUNG

THALES

See full list of members at www.firaconsortium.org/about/members

Key Stakeholders

- Chip Manufacturers
- Device Manufacturers
- System Integrators
- Service Providers
- Technology Providers
- Test Tool Developers
- Test Labs

UWB TECHNOLOGY

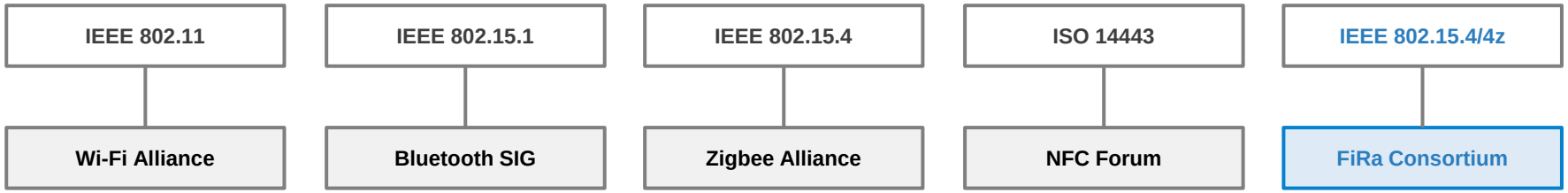
FiRa’s vision is to provide seamless user experiences using secured fine ranging and positioning capabilities of interoperable UWB technologies.

Our Vision

Mission: Develop Use Cases and Guarantee Interoperability

Provide the missing blocks for a broad UWB ecosystem deployment

- Develop use cases based on IEEE 802.15.4 enhanced ranging technologies;
- Develop specifications and a certification program to ensure interoperability among chipsets, devices and solutions;
- Promote UWB ecosystems to enable new business opportunities delivering better user experiences; and
- Establish the FiRa Consortium as the reliable and trusted UWB technology brand that is adopted by the market.



*Detailed goals of the FiRa Consortium are described in the Appendix.

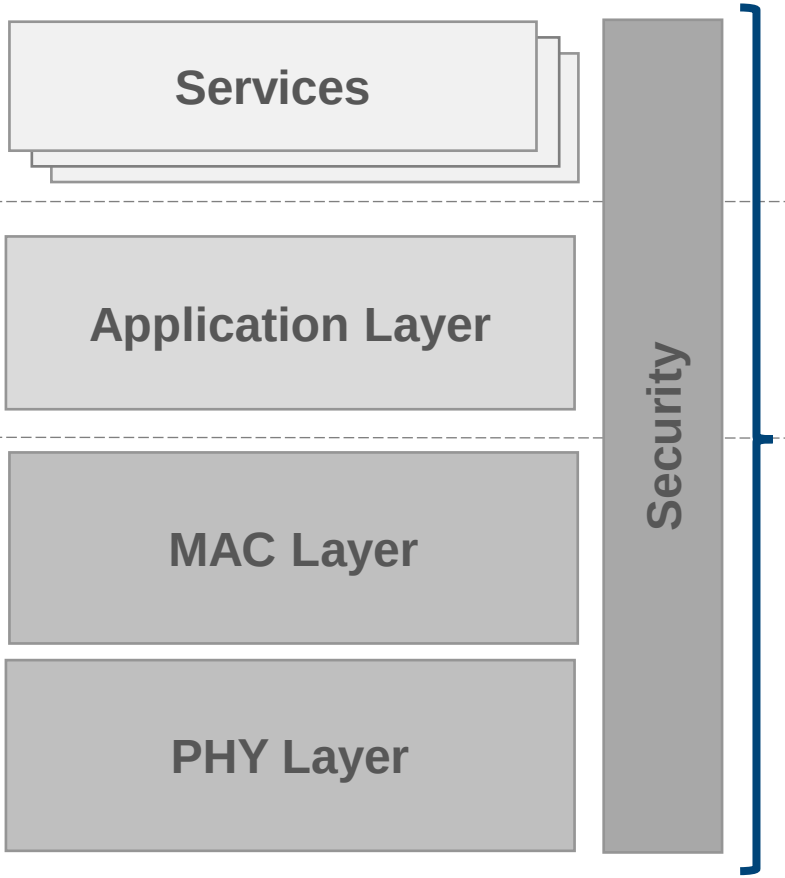
Drive For Interoperability At All Levels

Existing Standards

IEEE 802.15.4/4z

Enhanced UWB PHY & MAC

- Coding and preambles
- Improved integrity and accuracy
- Information elements
- Multiple ranging methods



FiRa Consortium

Service-specific protocols for multiple verticals

- Hands-free access control, location-based services, and device-to-device (peer-to-peer) applications

Mechanisms which are not within IEEE scope

- Discover UWB devices and services
- Configure devices in an interoperable manner
- Specify interoperable security requirements

Interoperability Standard

- Profiled features among 802.15.4/4z PHY/MAC
- Performance requirements
- Test methods and procedures
- Certification program

Drive For Interoperability At All Levels

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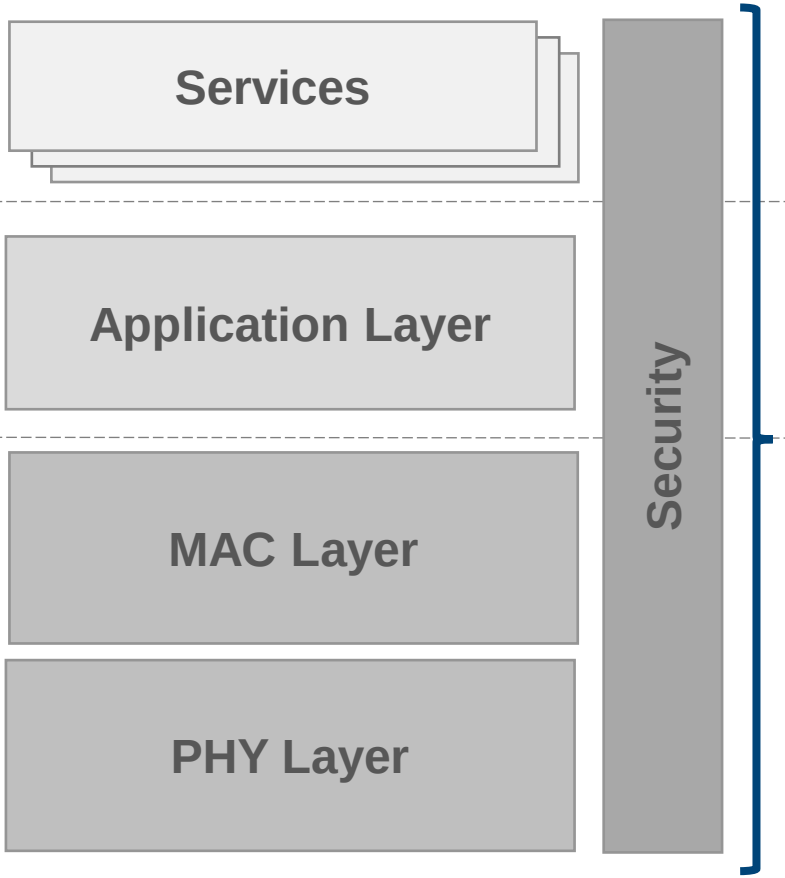

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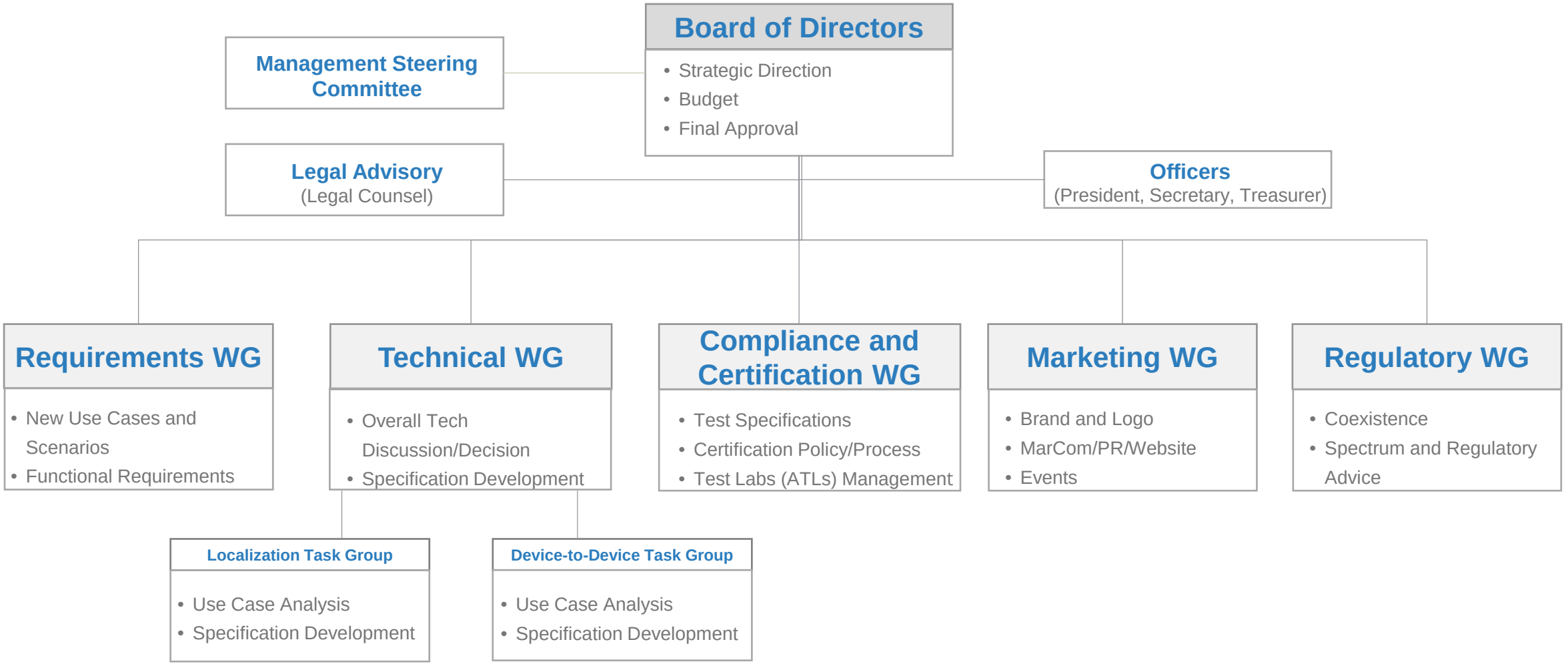
FiRa UWB Use Cases

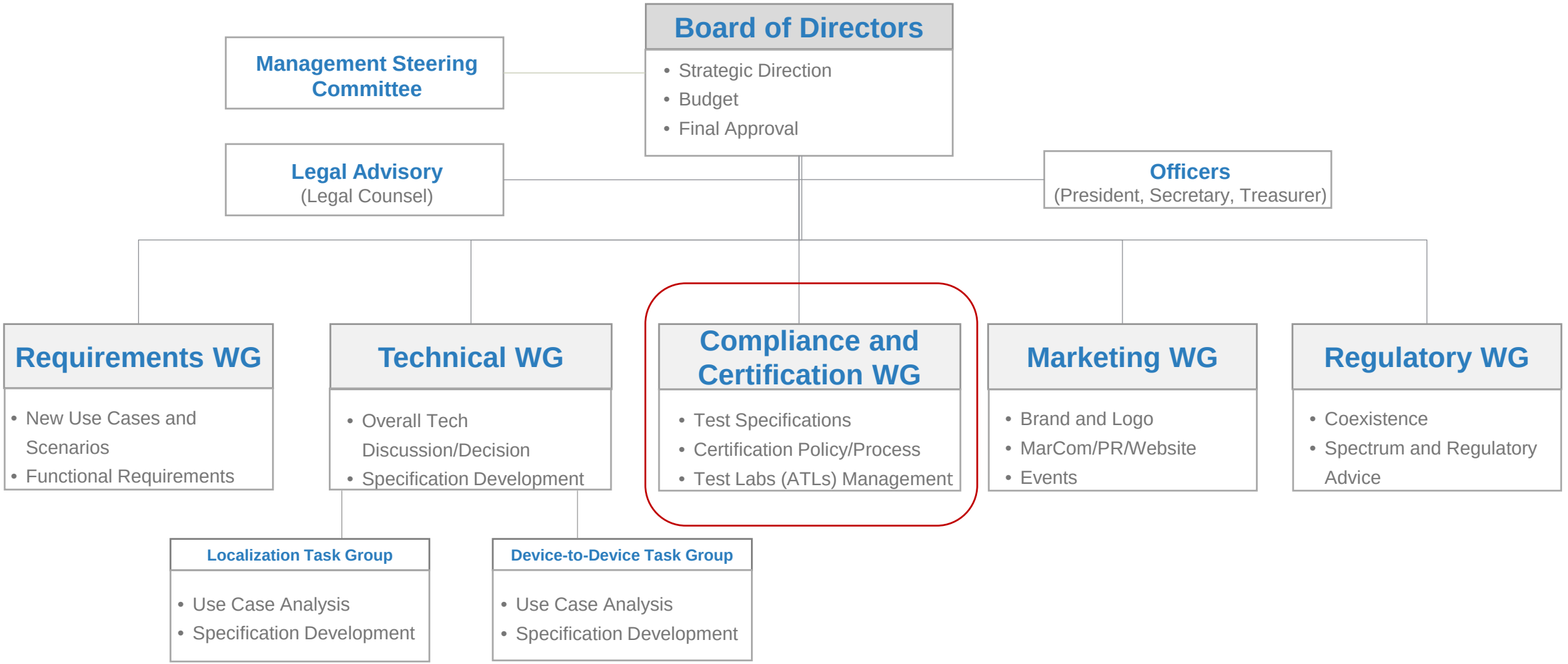
SMART CITIES & MOBILITY		SMART BUILDING & INDUSTRIAL		SMART RETAIL		SMART HOME & CONSUMER	
Indoor Navigation	V2X* and Autonomous Driving	Social Distancing	Asset Tracking	Tap-Free Mobile Payment	Targeted Marketing	Point and Trigger Controller App	Gesture-Based Control
Vehicle Digital Key (Standardized by CCC)	Ticket Validation (Public Transport Services)	Controlled Access	Find Equipment	Unmanned Store Access	Drone-Controlled Delivery	Residential Access Control	VR Gaming and Group Play
Rider Identification (Private Transport Services)	Reserved Seat Validation	Physical Access Control	Patient Tracking	Foot Traffic and Shopping Behavior Analytics	In-Vehicle Payment	Easy (Logical) Access to Personal Devices	Find Someone/ Something Nearby
Transportation Sharing (Find a Bike or Scooter Nearby)	Transportation Fare Payment	Indoor Navigation	Teleconference System	Exhibition Attendee Management		AR Gaming	Presence-Based Device Activation
Ride Sharing (Precise Positioning)	eID Validation in Crowded Environments	Employee Gathering in Emergencies	Proximity-Based Patient Data Sharing				
Driverless Valet Parking and Pick-Up	Parking Garage Access Control						
Learn more >>		Learn more >>		Learn more >>		Learn more >>	

*Connected Vehicle-to-Everything Communication

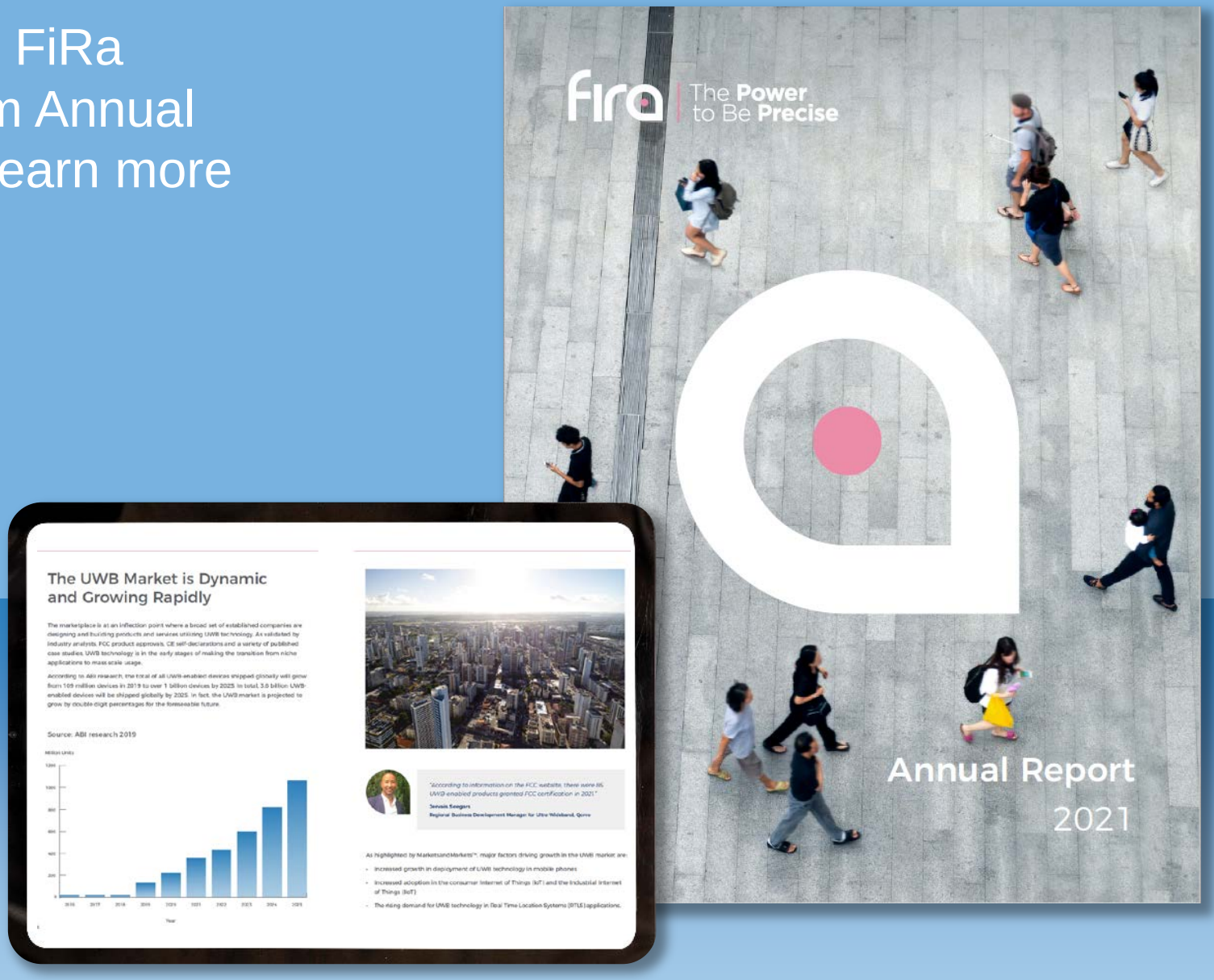
FiRa Organization Structure



FiRa Organization Structure



Read New FiRa Consortium Annual Report to learn more



LITEPOINT

A Teradyne Company

FiRa PHY Conformance Test Tool

Eve Danel

Senior Product Marketing Manager

LitePoint At-A-Glance

Founded:
May 2000

> 30
wireless standards supported out-of-box

Hundreds
of chipset-ready solutions

Global offices supporting
10,000s
of systems

Focus:
System-Level
RF Performance

Expertise:
Design Validation
Characterization
Manufacturing

Over
10 billion
devices tested

Acquired by Teradyne:
October 2011

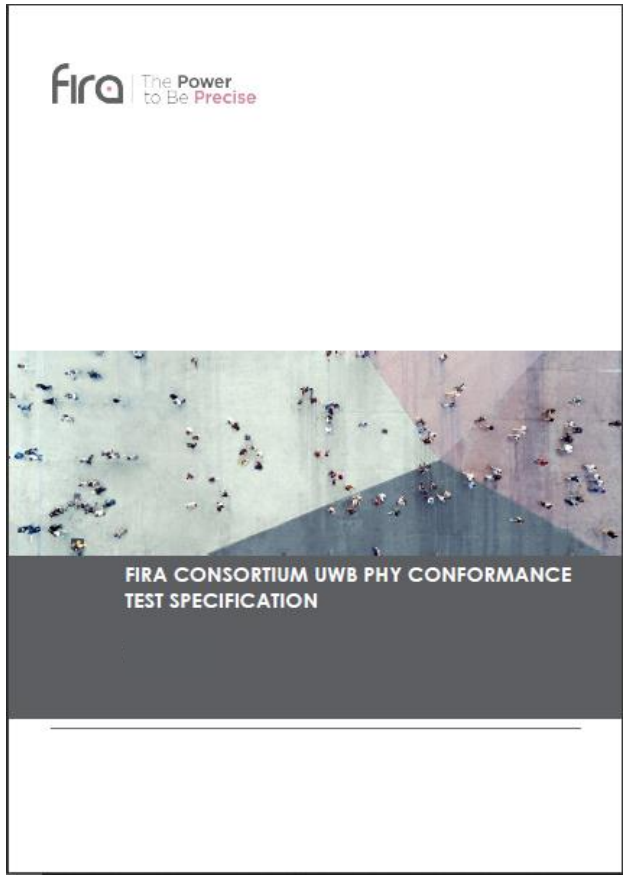
LITEPOINT

LITEPOINT

fira | The Power to Be Precise

Validated Test Tool

FiRa Consortium UWB PHY Conformance Test Specifications

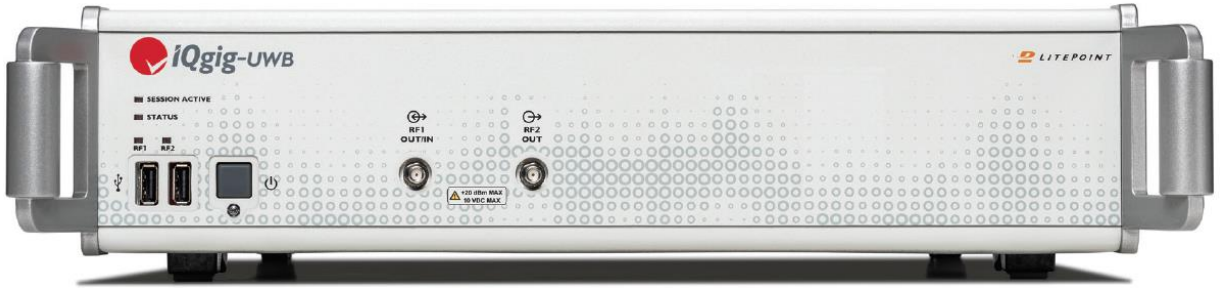


- Transmitter Tests
  - Test cases validate that the packet properly-formatted packets for the mandatory PHY Parameter Sets
  - Transmitter Power Spectral Density Mask verification, Carrier frequency tolerance and Pulse timing verification
  - Baseband impulse response
  - Transmitter Signal Quality (NRMSE metric)
- Receiver Tests
  - Test cases validate the receiver's packet sensitivity for various packet formats
  - Dirty packet tests verify the receiver's capability to detect malformed packets
  - First path dynamic range

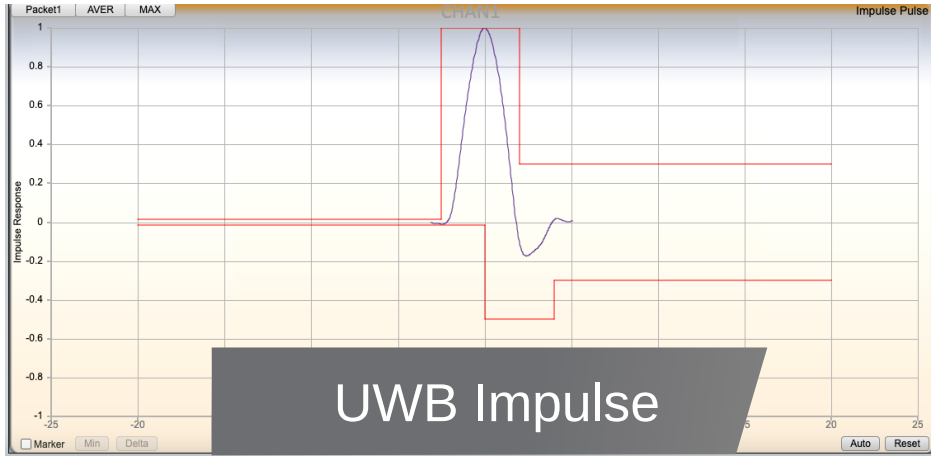
Ensure conformance to FiRa's PHY Technical Requirements

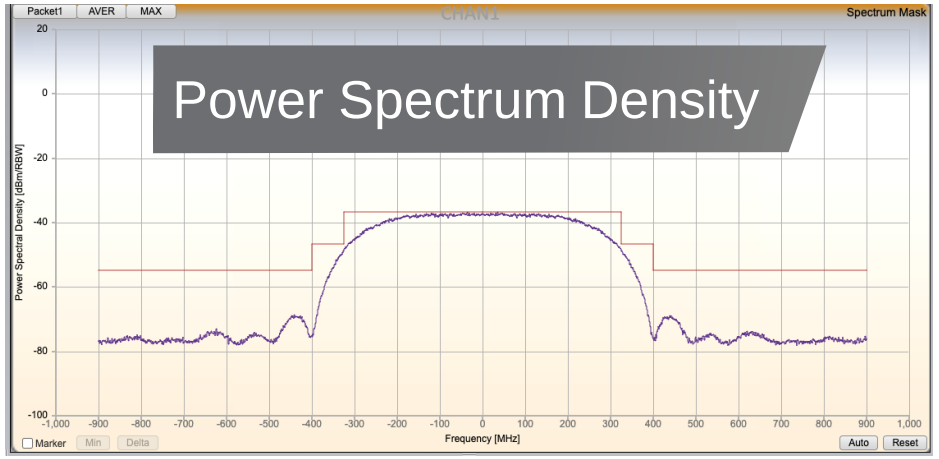
LITEPOINT

Integrated PHY UWB Test Solution: IQgig-UWB



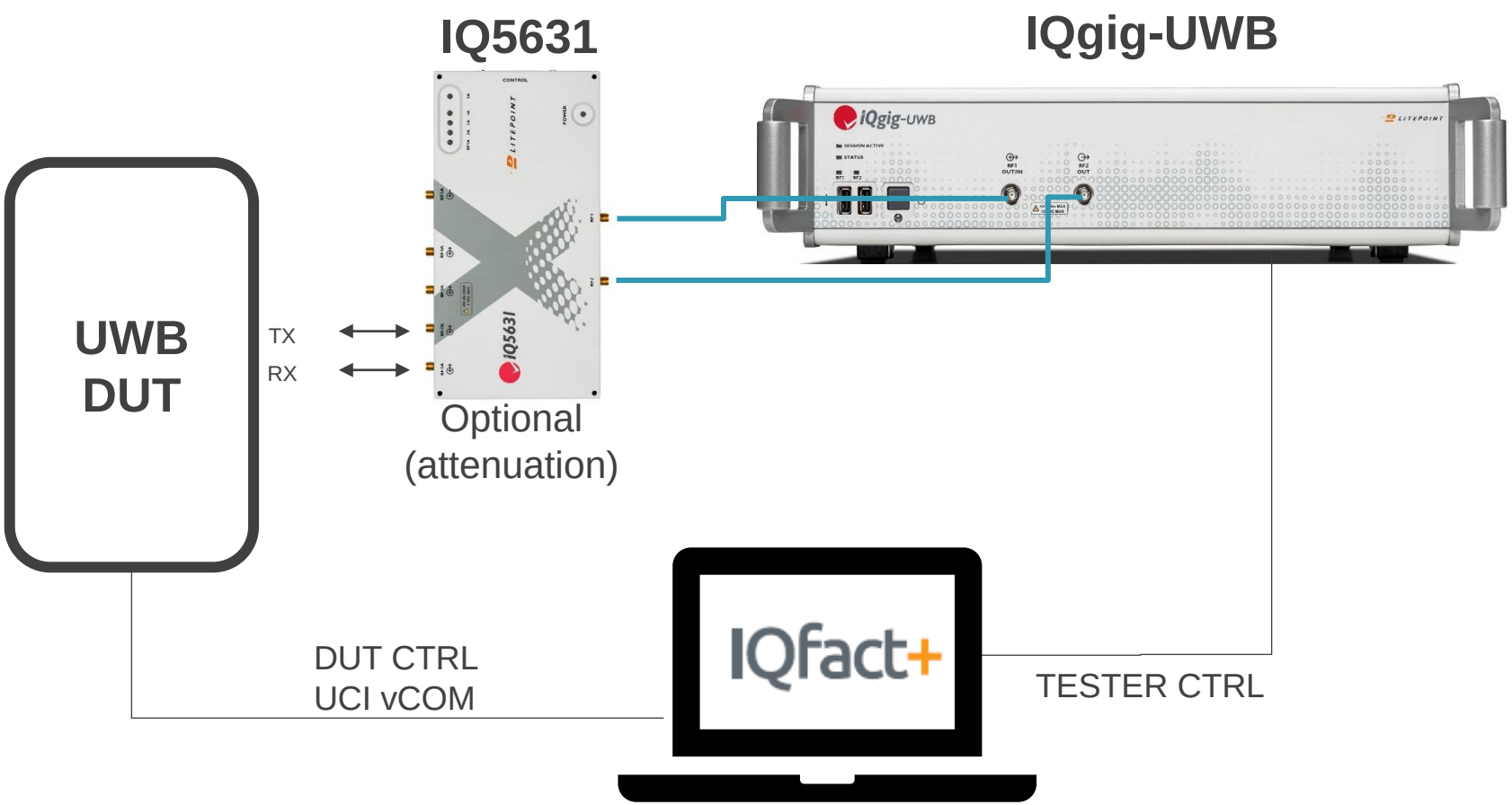
- Integrated Signal Generator and Signal Analyzer for high-performance Receiver and Transmitter testing of UWB devices
  - Frequency range covers core Band Group 2 UWB channels and bandwidths
  - Wide analysis bandwidth (> 1GHz)
  - Supports 802.15.4/802.15.4z standard (HRP, BPRF, HPRF)
  - IEEE and FiRa PHY layer measurements, Time of Flight (ToF) & Angle of Arrival (AoA)





LITEPOINT

PHY Conformance Test Tool (PCTT)



IQfact+

File Edit Tools Window Options Help

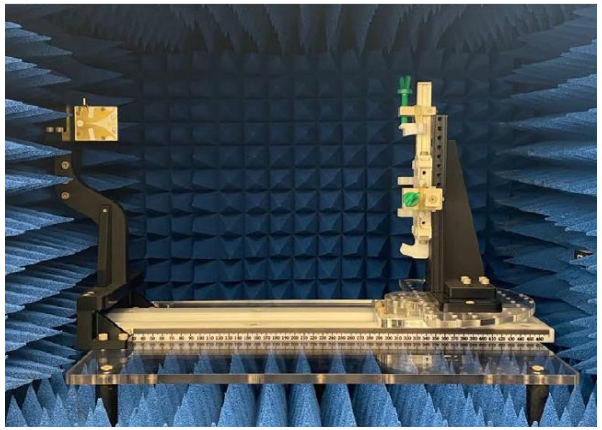
Execution Mod

C:\LitePoint\IQfact_plus\IQfact+_FIRA_PCTS_UCI_UART_3.3.5.0_L

- FIRA_PCTS_UWB
  - 1.GLOBAL_SETTINGS
  - 2.INSERT_DUT
  - 3.INITIALIZE_DUT
  - 4.CONNECT_IQ_TESTER
  - 5.LOAD_PATH_LOSS_TABLE
  - 6.LOAD_PICS
  - 7.PCT1.1.1_TX_BPRF_PACKET_FORMAT
  - 8.PCT1.1.2_TX_HPRF_PACKET_FORMAT
  - 9.PCT1.2.1_TX_BPRF_PSD_MASK
  - 10.PCT1.2.2_TX_HPRF_PSD_MASK
  - 11.PCT1.3.1_TX_BPRF_CFR_OFFSET_PULSE_TIMING
  - 12.PCT1.3.2_TX_HPRF_CFR_OFFSET_PULSE_TIMING
  - 13.PCT1.4.1_TX_BPRF_BB_IMPULSE_RESPONSE
  - 14.PCT1.4.2_TX_HPRF_BB_IMPULSE_RESPONSE
  - 15.PCT1.5.1_TX_BPRF_SIGNAL_QUALITY
  - 16.PCT1.5.2_TX_HPRF_SIGNAL_QUALITY
  - 17.PCT2.1.1_RX_BPRF_SP0_SP1_SENSITIVITY
  - 18.PCT2.1.2_RX_HPRF_SP0_SP1_SENSITIVITY
  - 19.PCT2.2.1_RX_BPRF_SP3_SENSITIVITY
  - 20.PCT2.2.2_RX_HPRF_SP3_SENSITIVITY
  - 21.PCT2.3.1_RX_BPRF_SP0_SP1_DIRTY_PKT
  - 22.PCT2.3.2_RX_HPRF_SP0_SP1_DIRTY_PKT
  - 23.PCT2.4.1_RX_BPRF_SP3_DIRTY_PKT
  - 24.PCT2.4.2_RX_HPRF_SP3_DIRTY_PKT
  - 25.PCT2.5.1_RX_BPRF_SP3_1ST_PATH_DYNAMIC_RANGE
  - 26.PCT2.5.2_RX_HPRF_SP3_1ST_PATH_DYNAMIC_RANGE
  - 27.PCT2.6.1_RX_BPRF_PACKET_FORMAT
  - 28.PCT2.6.2_RX_HPRF_PACKET_FORMAT
  - 29.REMOVE_DUT
  - 30.DISCONNECT_IQ_TESTER

LITEPOINT

LitePoint's Complete UWB Test Coverage



R&D

- Integrated signal generation and analyzer for high-performance TX / RX testing of UWB devices
- Chipset specific test automation software
- OTA solutions for UWB: shielded chambers, antenna

Certification

- FiRa validated PHY conformance Test Tool
- Complete automated test solution available for pre-certification and certification

Manufacturing

- Chipset optimized solutions for multi-DUT high volume testing
- Calibration and Validation for ToF, AoA xtal and power

LITEPOINT

Contact us: sales@litepoint.com

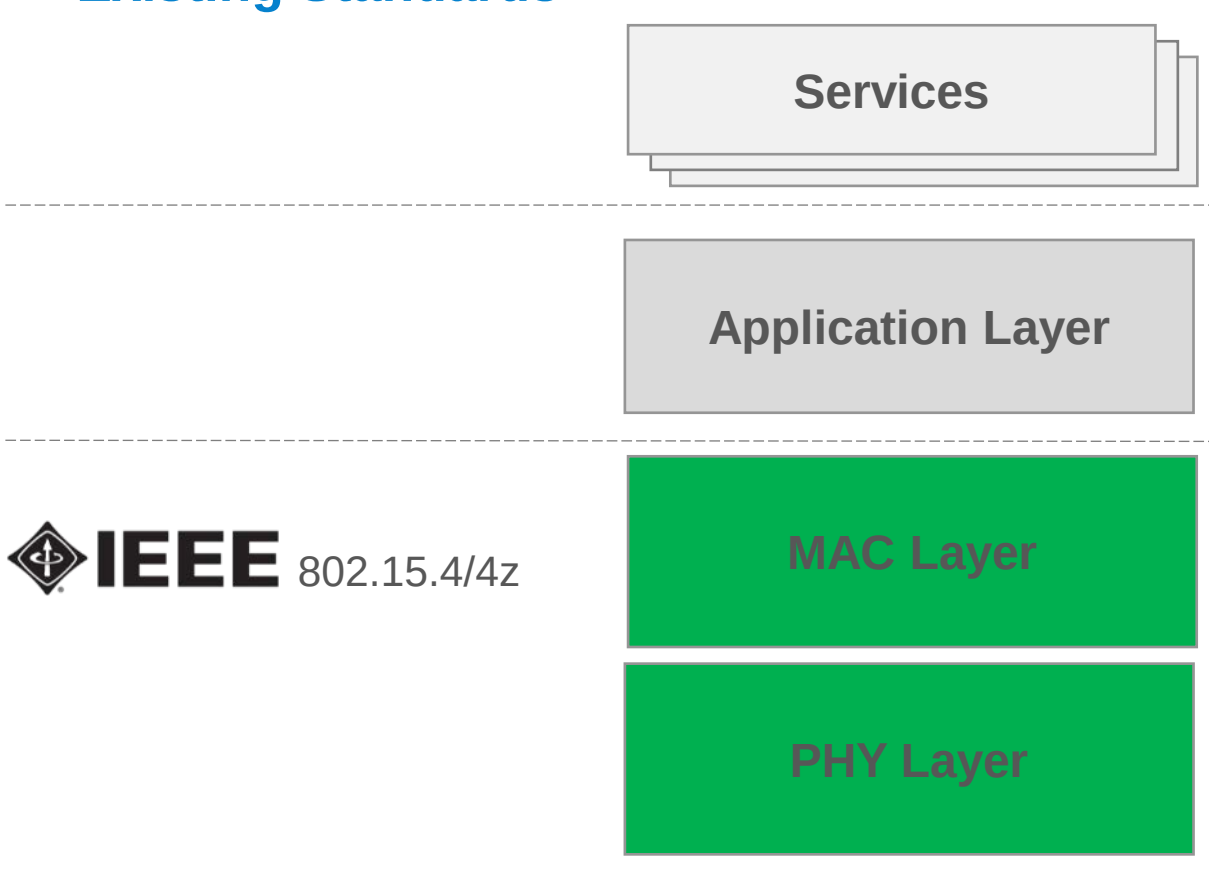
For more information visit us at: www.litepoint.com
Follow us on:

LITEPOINT


fira | The Power to Be Precise
FiRa Certification
Mitch Kettrick
Certification Program Manager
fira | The Power to Be Precise

• FiRa‘s Scope of Certification

Existing Standards



FiRa Consortium

Service-specific requirements for multiple verticals

Mechanisms which are not within IEEE scope

- Discovery and configuration
- Security requirements

Conformance Standards

- Profiled features among 802.15.4/4z PHY/MAC
  - Signaling conformance
  - Minimum performance
  - Interoperability
- Test methods/procedures
- Certification program

• Validated Test Platforms

- Test platforms go through a rigorous validation process to ensure that they meet the requirements defined by FiRa
- The latest list of validated test platforms can be found here: https://www.firaconsortium.org/certifications/fira-validated-test-tools

Validated Test Scope	Test Tool Vendor	Model	Contact
PHY Conformance	LitePoint	IQgig-UWB	sales@litepoint.com
MAC Conformance	Comarch	Comarch MCTT	technologies@comarch.com
MAC/PHY Interoperability	Comarch	Comarch ITT	technologies@comarch.com

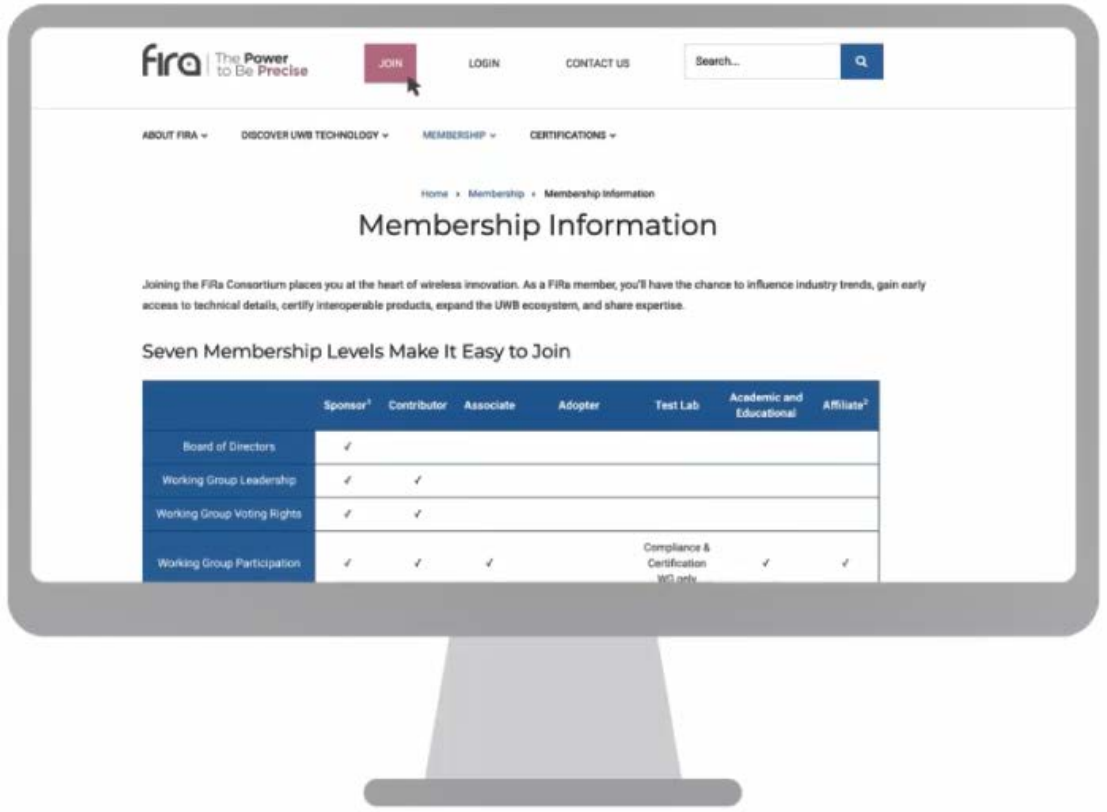
• Authorized Test Labs

- Test labs must meet FiRa's requirements and pass an on-site audit to become authorized to perform FiRa certification testing
- The latest list of Authorized Test Labs can be found here: https://www.firaconsortium.org/certifications/authorized-test-labs

Authorized Test Laboratory	Authorized Test Scope	Location	Contact
DT&C	MAC, PHY	South Korea	compliance@dtnc.net
HCT	MAC, PHY	South Korea	iopt-sales@hct.co.kr
SGS	MAC, PHY	South Korea	KR.FIRA@sgs.com
TTA	MAC, PHY	South Korea	iot@tta.or.kr

• Certification Process

1. JOIN

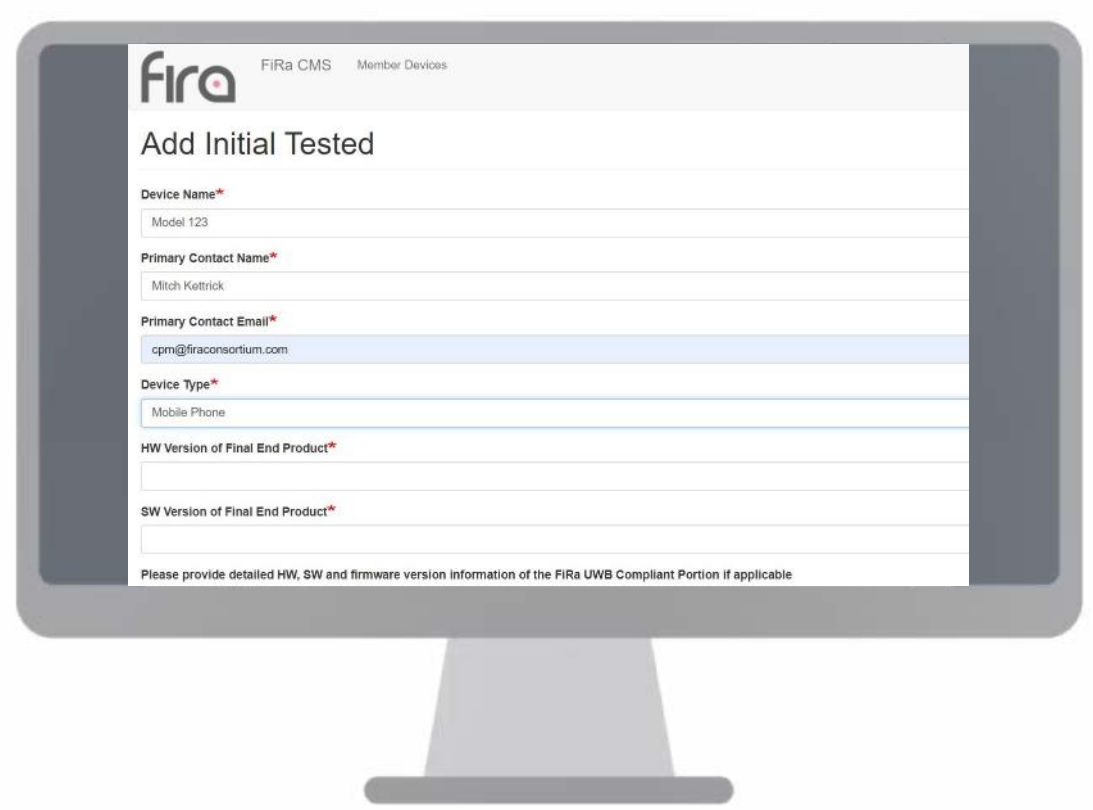


- Certification is open to FiRa members only
- Learn more and apply for FiRa membership at https://www.firaconsortium.org/membership/information

• Certification Process

2. PREPARE

- Review the device certification requirements
- Enter your device in the Certification Management System

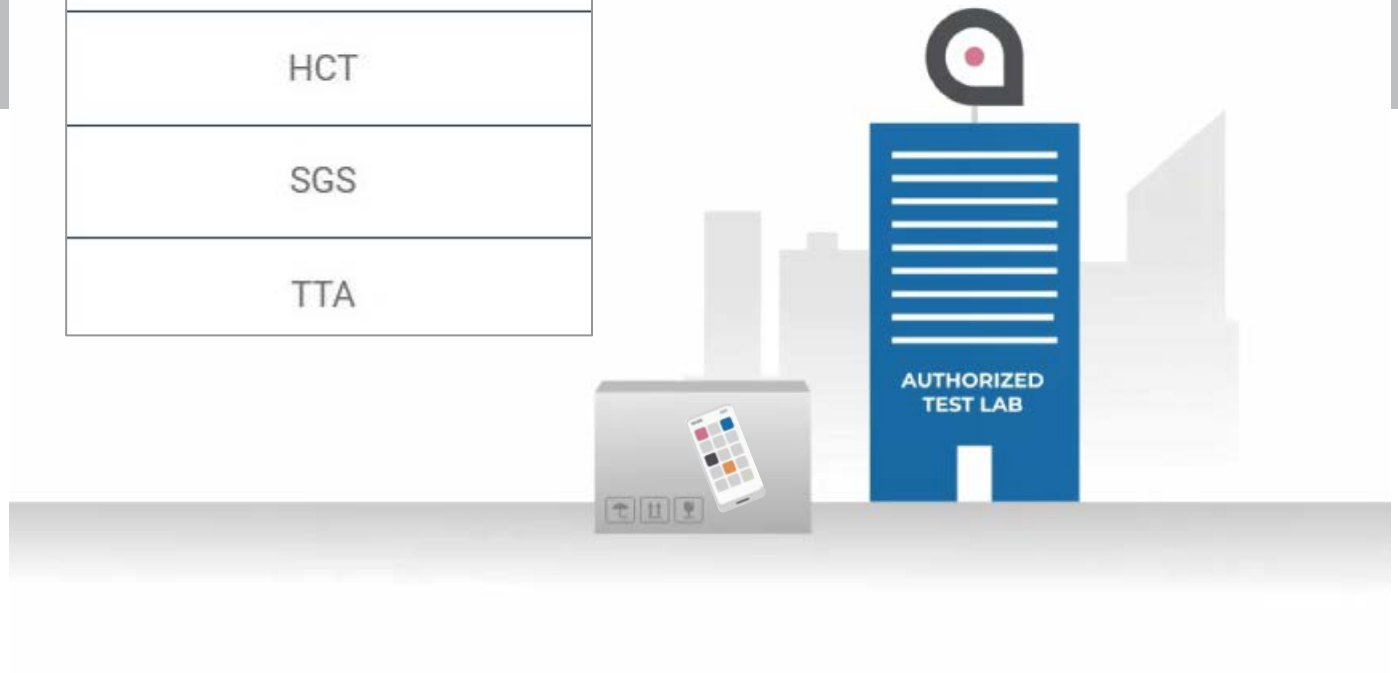


• Certification Process

3. TEST

- Submit your device to an Authorized Test Lab
- Certification testing is conducted using test platforms validated by FiRa

Authorized Test Laboratory
DT&C
HCT
SGS
TTA



• Certification Process

- Resolve any issues found during testing
- Pay the certification listing fee

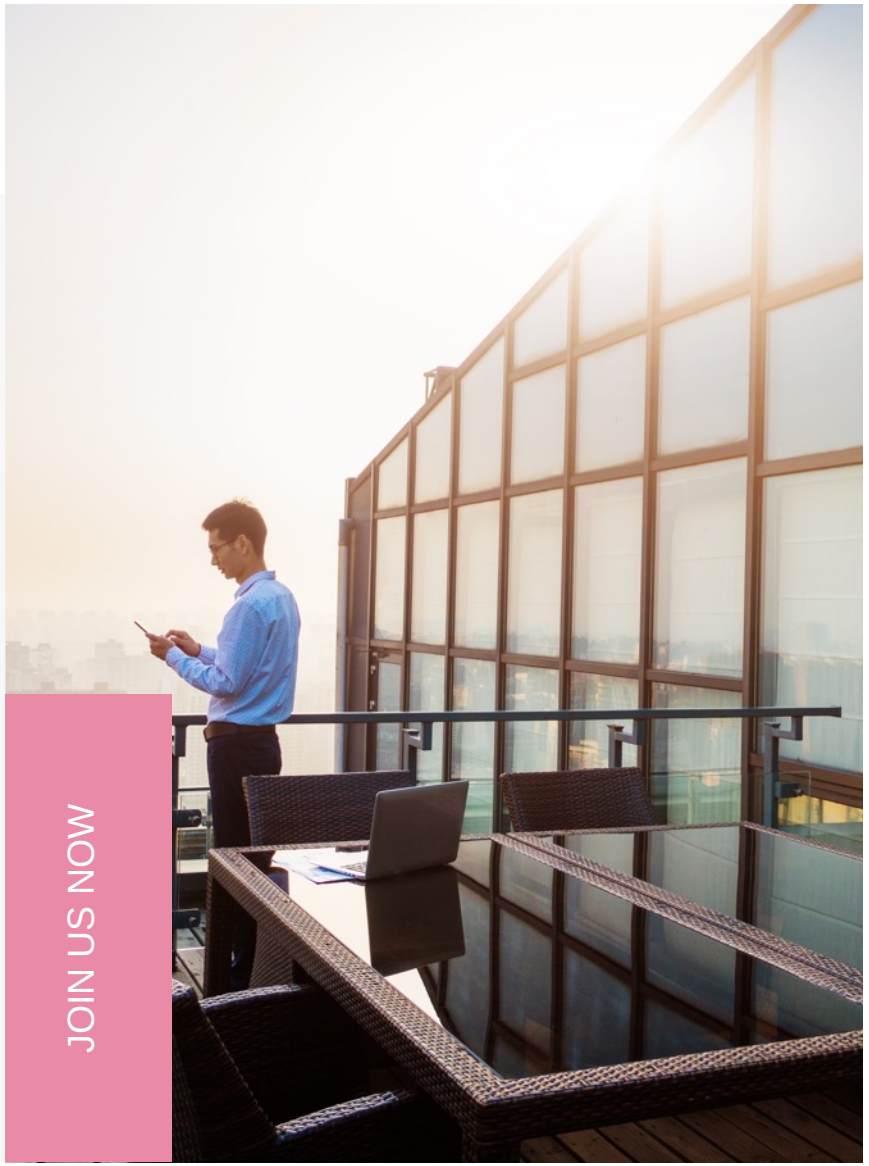
• Certification Process

- Receive a Certificate of Conformance
- Your device is listed on the certified device list on the FiRa website

Learn more

www.firaconsortium.org

- Explore the FiRa Certification Program on the FiRa website at: https://www.firaconsortium.org/certifications
- For assistance with the Certification Program, contact Mitch Kettrick at cpm@firaconsortium.com



COMARCH

Comarch
MAC Conformance Test Tool

SPEAKERS:

- **Patryk Stryczek** - Department Director – Certification &Automotive at Comarch Professional Services Business Unit
- **Krzysztof Wlodarczyk** - Senior software developer at Certification Department of Comarch Professional Services Business Unit

Comarch at a Glance

1991 Comarch onset

Founding year **1993**

1999 Publicly traded on Warsaw Stock Exchange since

7000 EMPLOYEES

North America, Europe, Asia, Middle East, Latin America, Africa, Australia

GLOBAL PRESENCE

RECOGNIZED BY

Gartner, Forrester Research, IDC

and more

THOUSANDS OF SUCCESSFULLY **COMPLETED PROJECTS** ON

6 Continents in about **100** Countries

93%

of revenues from sales of own software and products

SUBSIDIARIES

58

The total value of Comarch's shares on a Stock Exchange

USD 400 mln

HEADQUARTERS

KRAKÓW, **POLAND**

ADDED VALUE

Comarch is a software house which sells its own software products to large corporations and provides implementation and managed services

COMARCH

02

COMARCH IOT SECTOR OVERVIEW

History of Comarch IoT Divison

2006

NOKIA

- Embedded Software Development
- Connectivity
- Interoperability

2007

Certification Alliances

- Test Tool Development
- Test Automation Systems

CARCONNECTIVITY consortium®

OPEN CONNECTIVITY FOUNDATION™ UPnP™

2008

Automotive

- Mobile Apps,
- WebApps,
- Backends and Frontends Development,
- Voice Assistants
- 3rd party integrations

2012

Connectivity modules manufacturers, Premium Audio Brands

- Embedded Software Development
- Hardware Development Support
- Apps Development

JBL SILICON LABS

2015

COMARCH IoT SECTOR

- PROFESSIONAL SERVICES
- IoT DEVICES
- IoT CLOUD
- IoT PLANT (electronics manufacturing)
  - Medical devices

COMARCH

Selected examples of Comarch implementations for certification organizations

COMARCH

Comarch’s contribution to shaping FiRa UWB standard

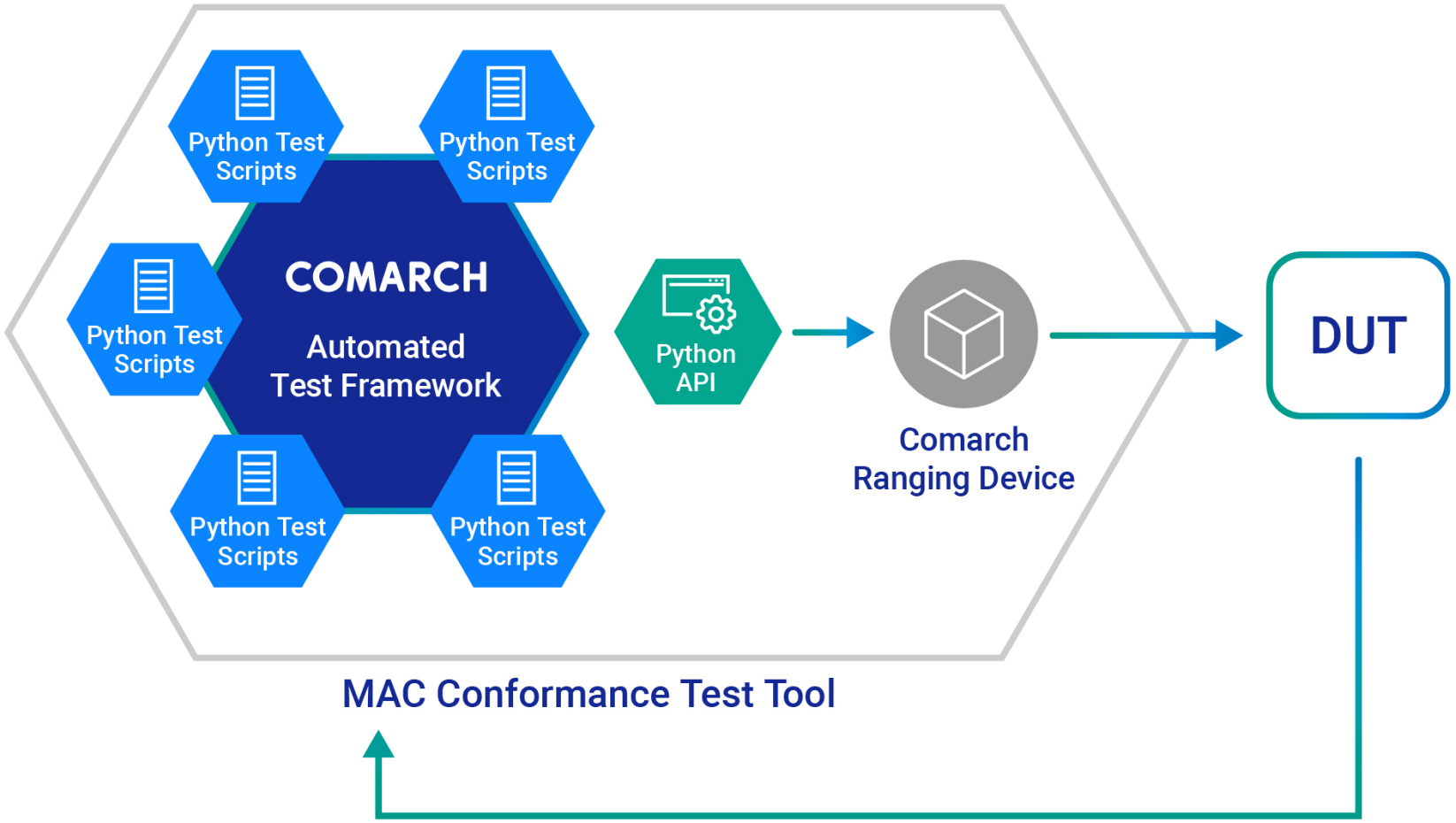
03

MAC CONFORMACE TEST TOOL (MCTT)

COMARCH

MAC Conformance Test Tool:

Architecture 1/5



MAC Conformance Test Tool:

Architecture 2/5

- Test Framework
  - Core of the architecture
  - Manages the process of testing
    - DUT Discovery
    - DUT Capabilities
    - Browsing and running tests
    - Collecting results
- Based on Comarch Automated Test Framework

MAC Conformance Test Tool:

Architecture 3/5

Python test scripts

- Python 3
- One script, one test case scenario
- Test steps
- Test checks
- Maintainable and self explanatory code

```
def run(self, api):
    self.timeline.start()
    self.set_reference_timestamps()

    for _ in range(self.number_of_ranging_iterations):
        self.start_ranging_iteration()

        rcm, rcm_timestamp = self.step(1).dut_transmits_control_msg(check
        self.step(2).dut_transmits_ranging_initiation_msg(check_number=2,
        self.step(3).mctt_transmits_2x_ranging_response_msg()
        self.step(4).dut_receives_2x_ranging_response_msg()
        self.step(5).dut_transmits_measurement_report_2_msg(check_number_
                                                            control_msg_t

        if self.current_ranging_iteration == 1:
            self.step(6).repeat_steps((1, 5))
        self.update_last_iteration_end_time()
        self.timeline.increment_block_index()
```

MAC Conformance Test Tool:

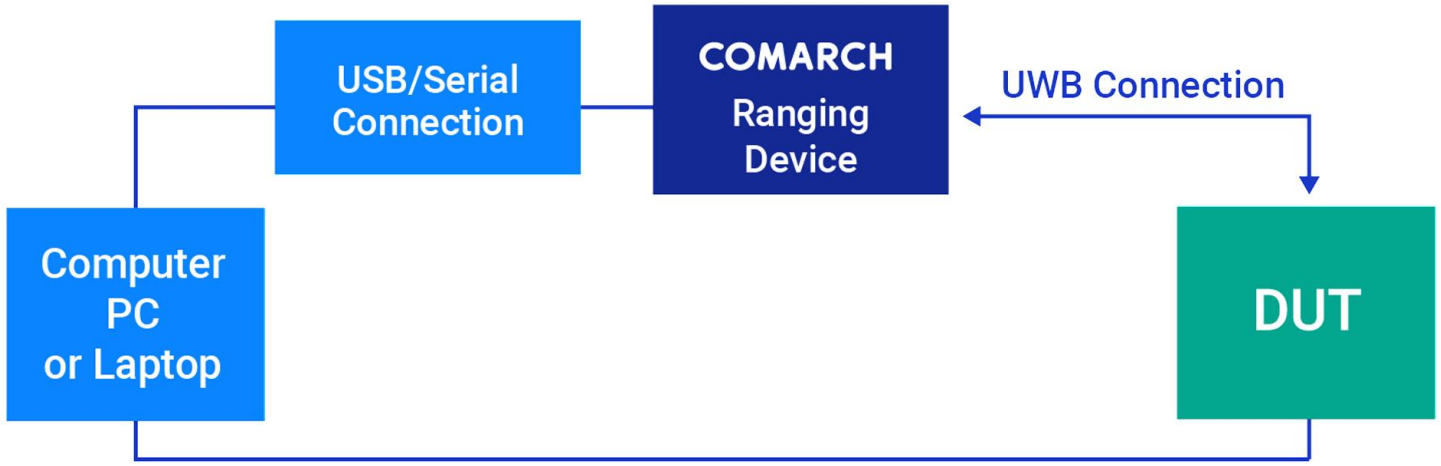
Architecture 4/5

- MCTT Ranging Devices
  - Manufactured by Comarch
  - In test specification called MCTT 1 and MCTT 2
  - They simulate FiRa devices interacting with DUT
  - They capture UWB traffic and pass it to MCTT

MAC Conformance Test Tool:

Architecture 5/5

- Test Host: Windows PC
- DUT physical connection: serial over USB
- MCTT Ranging Device connection: same as DUT



MAC Conformance Test Tool:

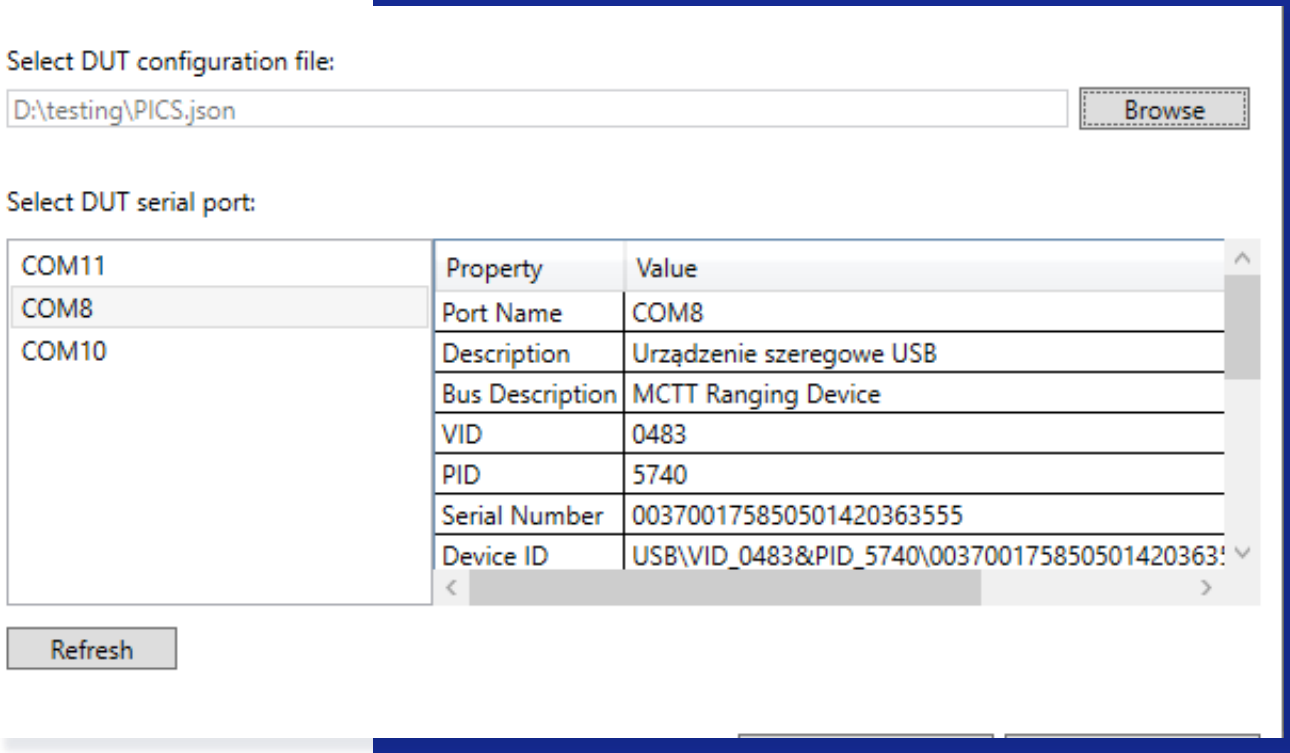
CATF overview

- Comarch Automated Test Framework - generic tool for certification testing
- Allows to shorten the time needed to kick off certification
- Modular design
- Customization via plugins, e.g. for DUT selection
- Can be provided as a white label solution

MAC Conformance Test Tool:

Features overview 1/6

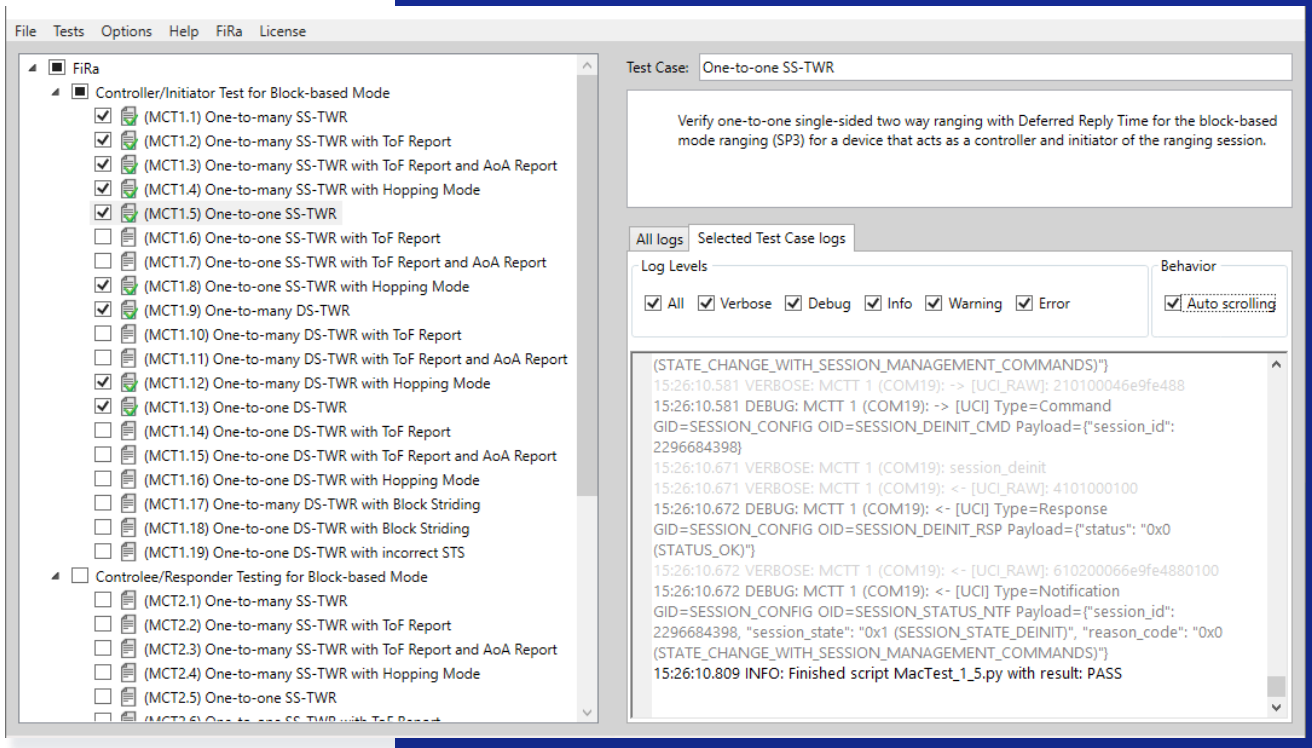
- Discovery of the DUT and specifying DUT's capabilities



MAC Conformance Test Tool:

Features overview 2/6

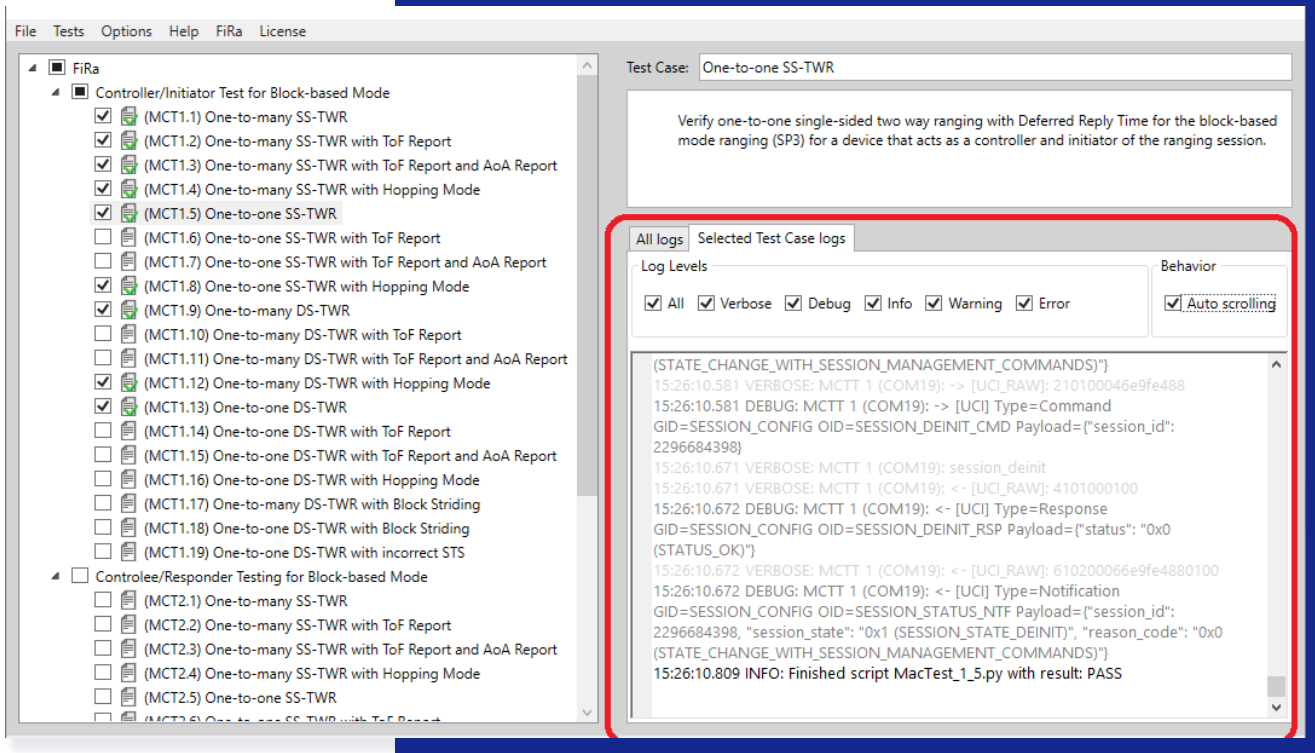
- Browsing and running tests against the DUT



MAC Conformance Test Tool:

Features overview 3/6

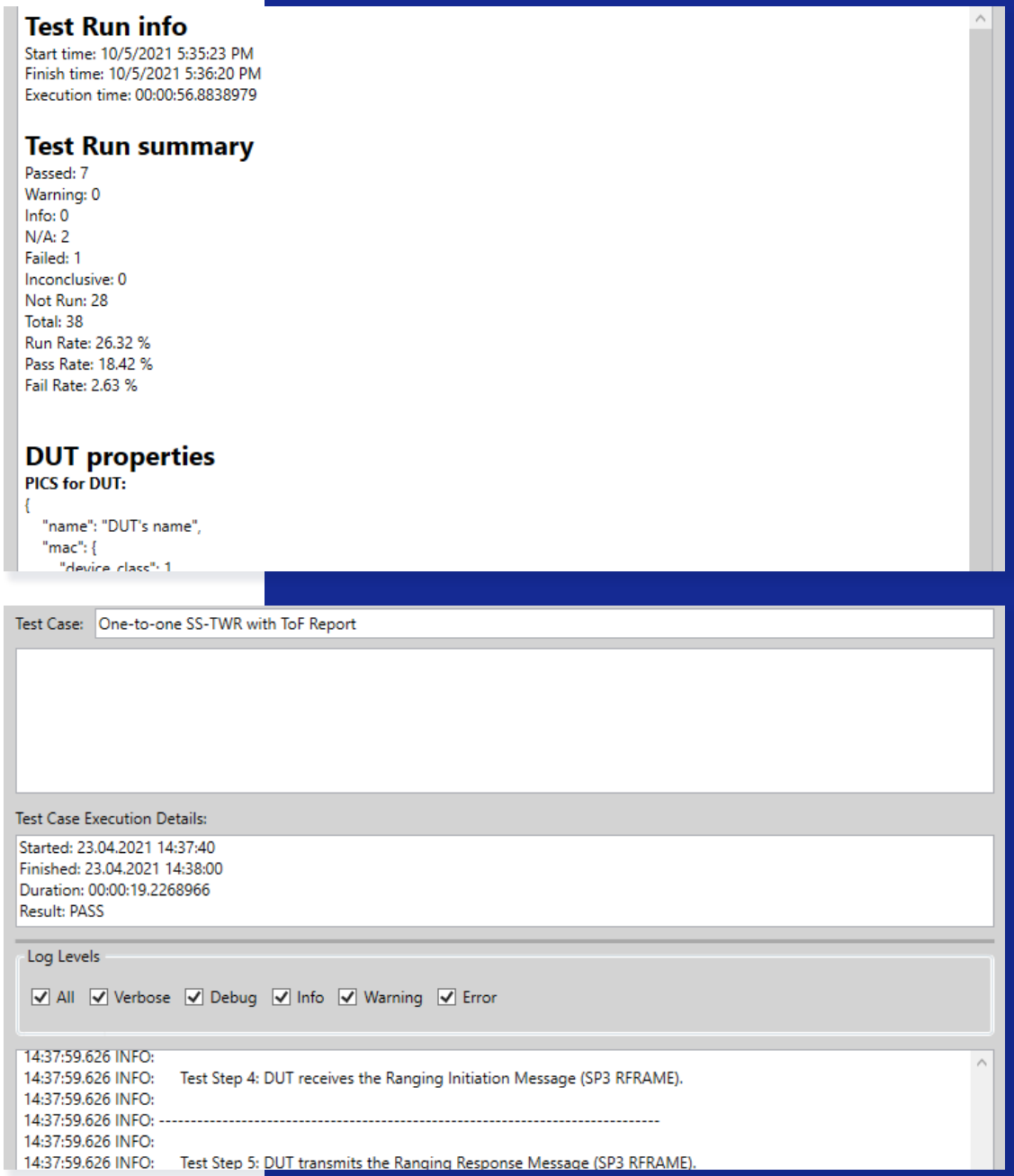
- Collecting test logs



MAC Conformance Test Tool:

Features overview 4/5

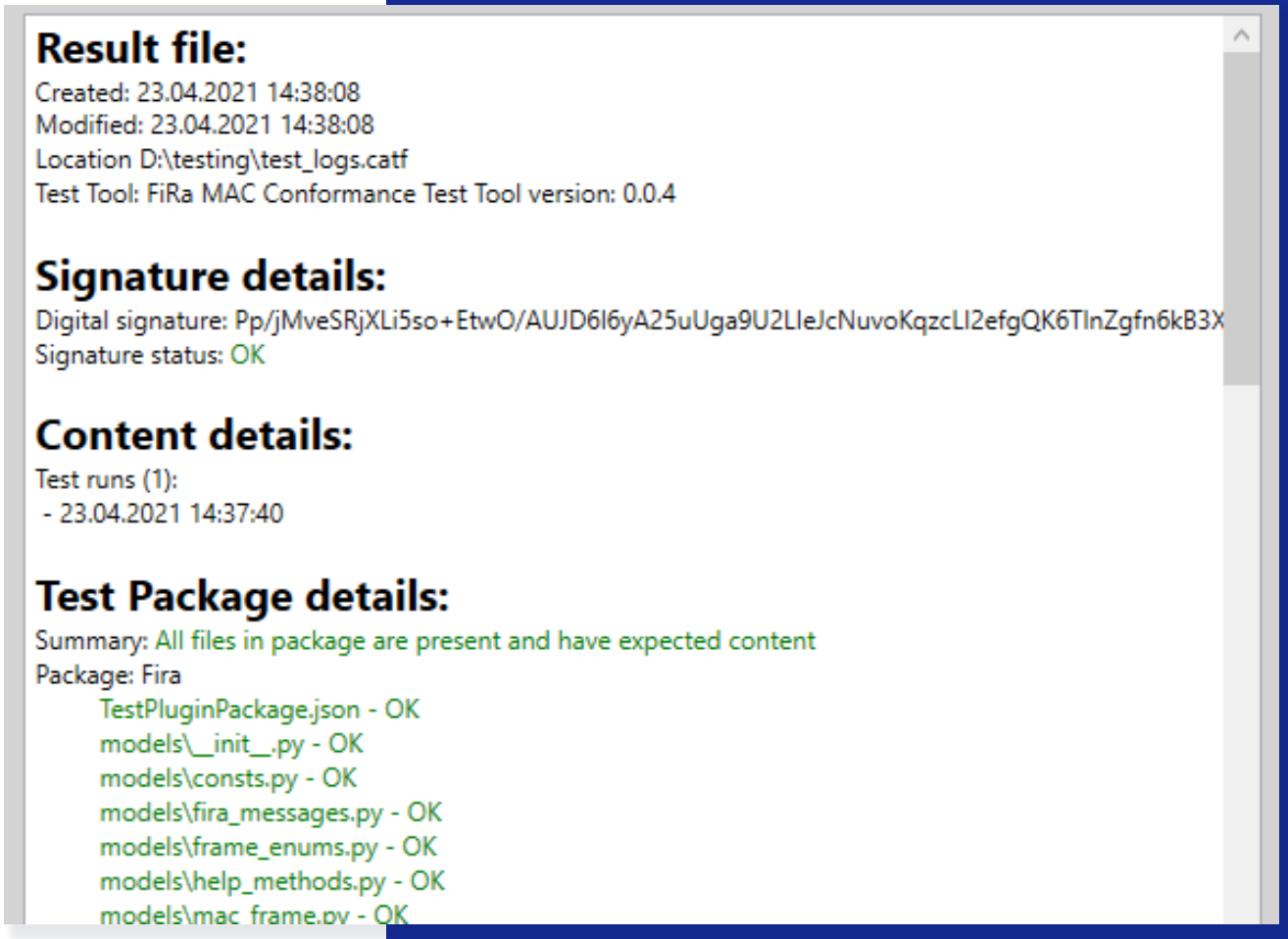
- Result Viewer: viewing test logs and test run information



MAC Conformance Test Tool:

Features overview 5/6

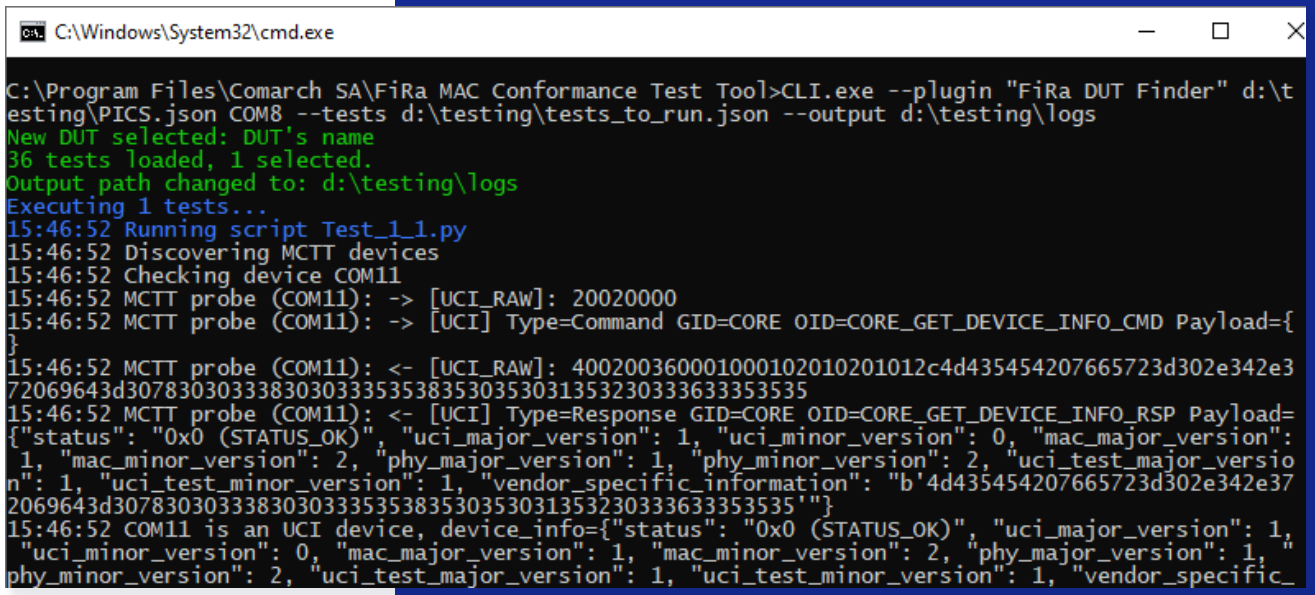
- Result Viewer:
  Checking signatures of result file and python code



MAC Conformance Test Tool:

Features overview 6/6

- Command-line interface for continuous integration



MAC Conformance Test Tool:

Sample Device set

- Can be used in MCTT as a DUT replacement
- Sample Device: GOLD
  - Passes all MCTT tests
- Sample Device: RED
  - Can be configured to fail test cases in different ways
- May be useful to:
  - Device vendors
  - Authorized Test Labs

04

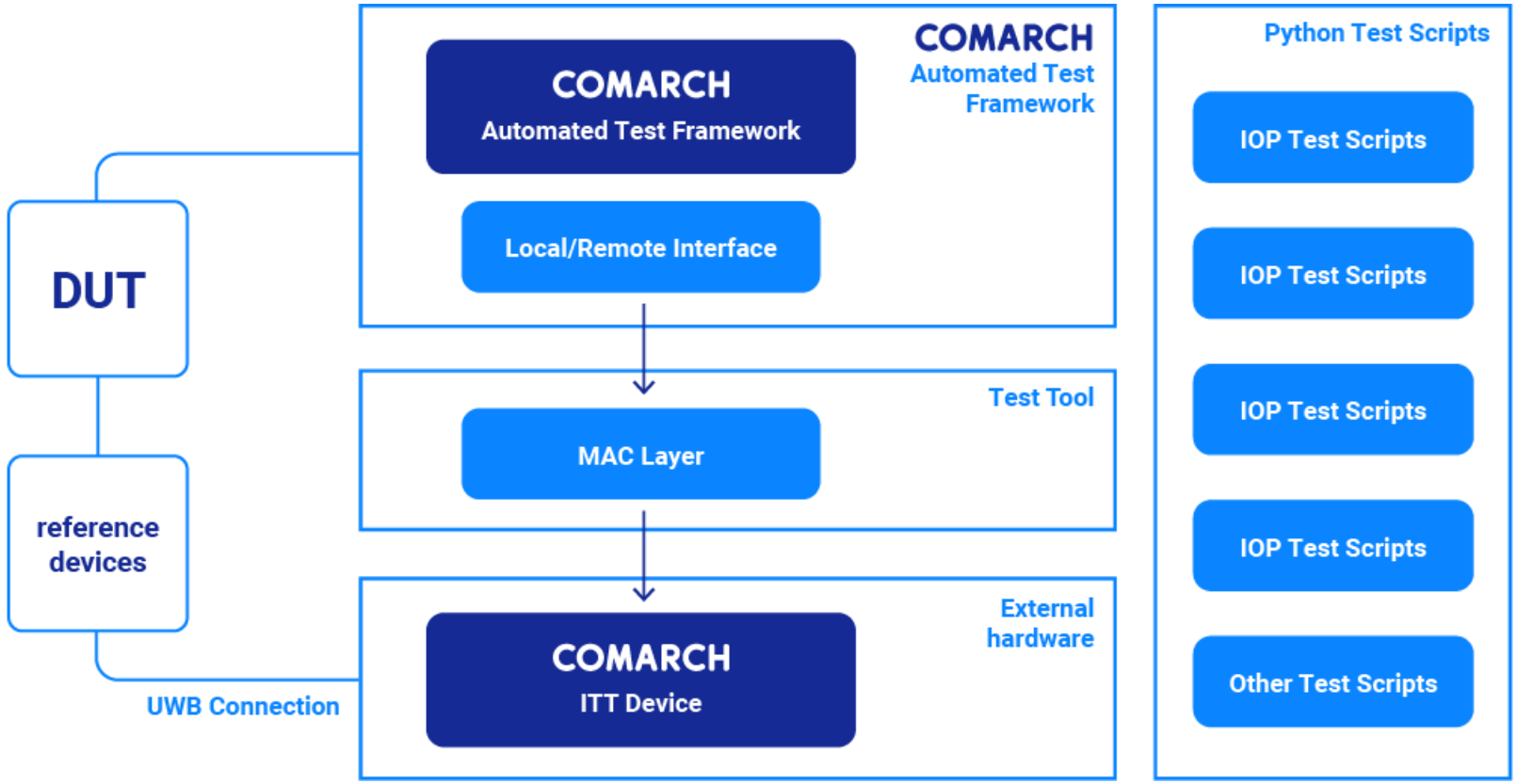
Interoperability Test Tool (ITT)

COMARCH

Interoperability Test Tool:

Architecture 1/2

- Similarities to MCTT:
  - DUT
  - Specifying DUT capabilities
  - Comarch Automated Test Framework



Interoperability Test Tool:

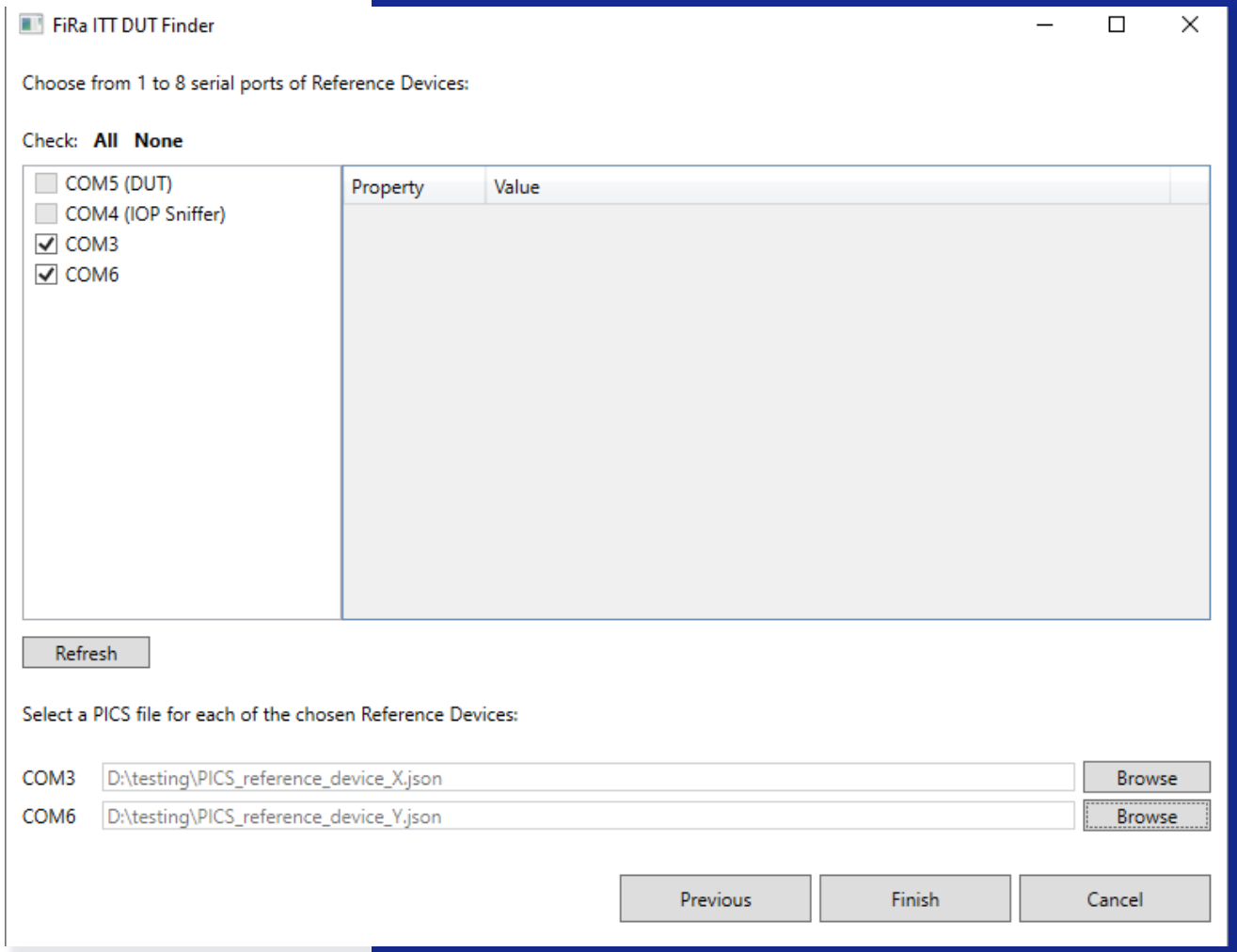
Architecture 2/2

- Differences between ITT and MCTT:
  - One hardware component: ITT Device
  - Test tool hardware does not take part in ranging
  - Reference Devices instead of MCTT Ranging Devices
  - Different set of test cases

Interoperability Test Tool:

Features overview

- Based on Comarch Automated Test Framework
- Same features as in MCTT
- Additional stage in DUT Selection



Interoperability Test Tool:

Comarch FiRa Device

- Can be used in ITT as a Reference Device replacement
- Cannot be used in official testing (not certified)
- May be useful to:
  - Device vendors
  - Authorized Test Labs

Comarch - Trustworthy Business Partner

COMARCH

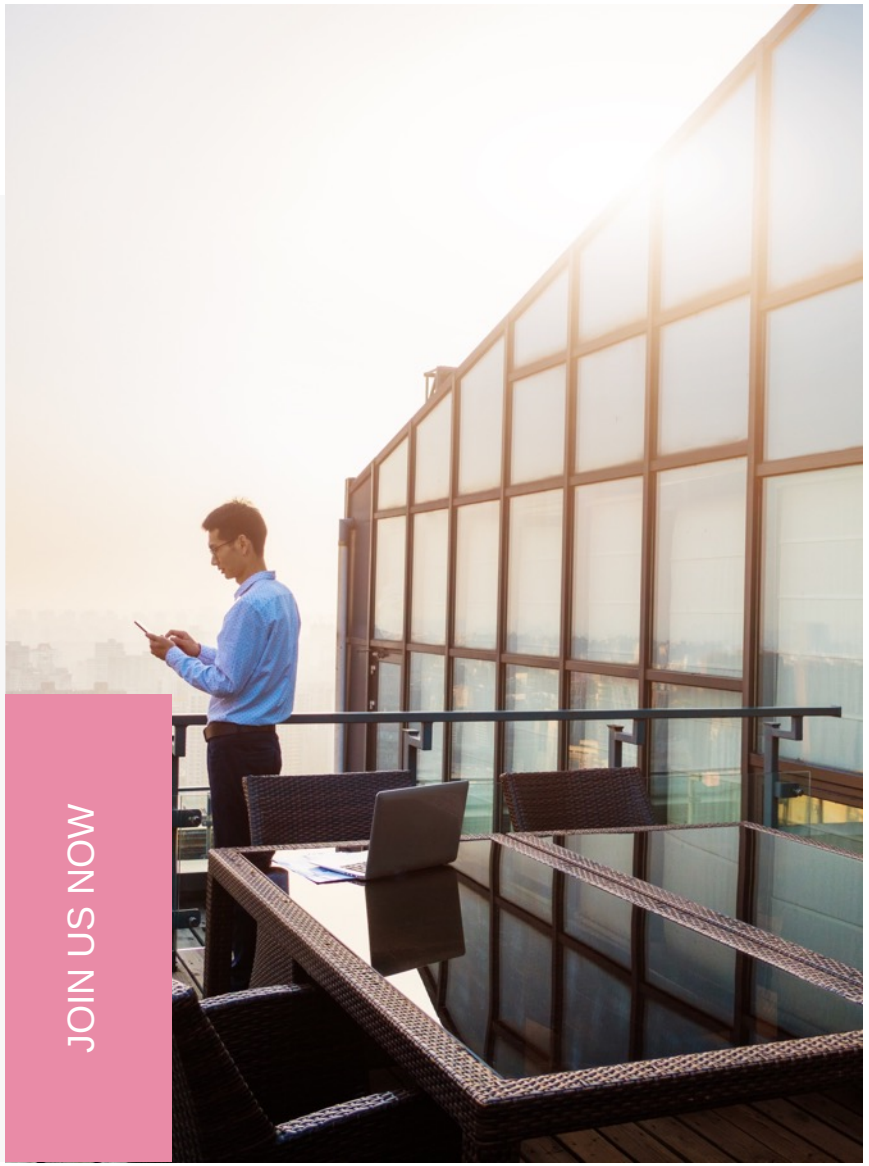
Developing the future

Join Us

www.firaconsortium.org

Participation in the Consortium provides Member Companies the opportunities to directly engage in creating a broad UWB ecosystem that will benefit all members.

Certification Program is available only to FiRa members.

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