

RF WIRELESS POWER TRANSFER TESTING

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Rohde & Schwarz



ROHDE & SCHWARZ

Make ideas real

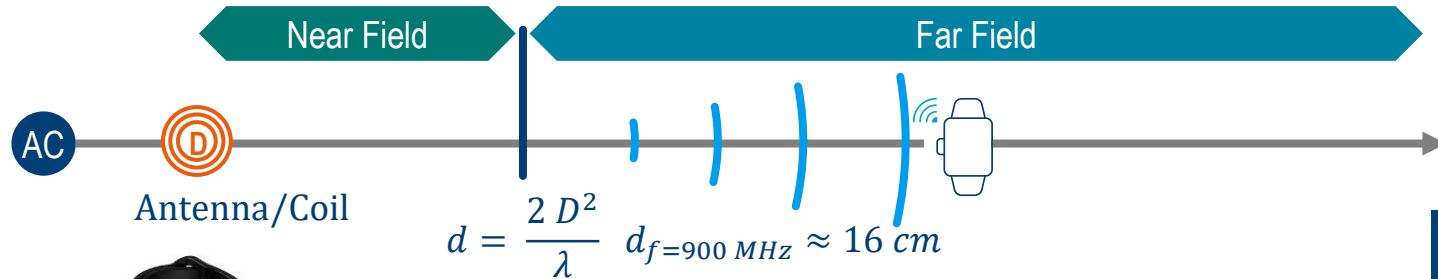


OUTLINE

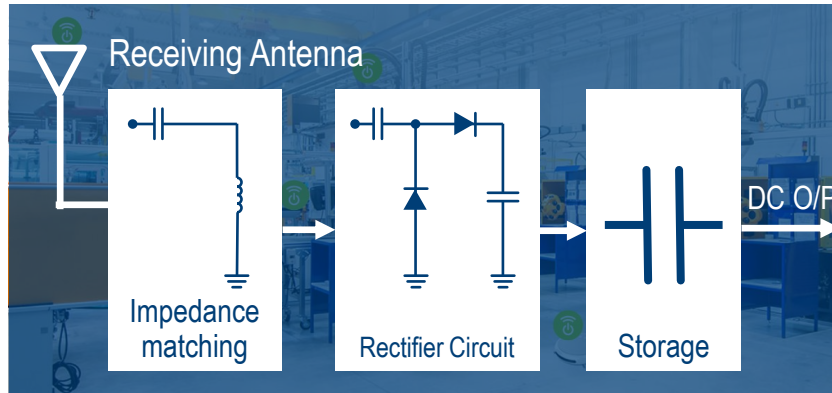
- ◆ **Wireless Power: Technology & Use Cases**
- ◆ Wireless Power Standards
 - ◆ AirFuel Alliance RF Standard
 - ◆ IEEE Japan WPT Initiative
 - ◆ 3GPP Ambient IoT
- ◆ Wireless Power Testing
- ◆ Conclusion



Principles of Wireless Power Transfer (WPT)



- ✓ Motion and device use while charging
- ✓ Scheduled Charging without down time



Wireless Power Transfer : use cases



Supply Chain



Retail



Patient care



Automotive



Smart home



Consumer

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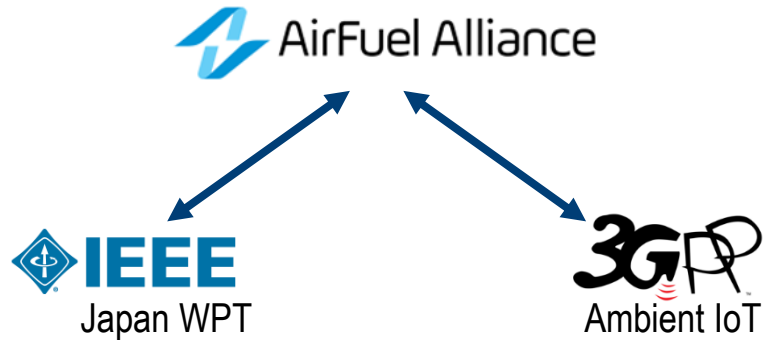


R&S WPT Standard

Standard

- AFA (BT for control)
- IEEE Japan
- 3GPP R19 Ambient IoT

- ITU
- FCC



Broad ecosystem support for the AirfulAlliance



AirFuel standards for short and long range charging

Magnetic Resonance Charging Standard For Multi-Device Charging



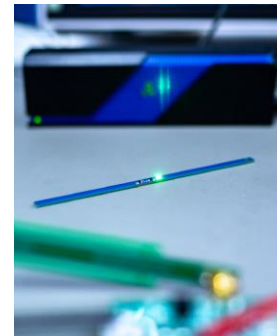
- Short-range: contact-based, at most a few cm
- Alignment-free wireless charging
- Multiple devices simultaneously
- At wired-speed



RF Wireless Charging Standard For Long-Range Power



- Over several meters distance
- For low-power devices: IoT devices & wearables
- Freq: 900 MHz range
- Received power levels: 1 μ W to 10 mW
- Transmit Signal waveform: not specified
- Control channel: Bluetooth low energy (BLE)
- RX types: full-BLE connected or Advertisement-only



IEEE WPT Japan

- ▶ IEEE Japan aims to regulate Wireless Power Transfer for Japan
- ▶ New: IEEE WPT initiative standard committee
- ▶ IEEE Japan aims to bring the Japanese requirements to AirFuel Alliance
- ▶ Panasonic is a main driver
 - i.e. proposing to use the 920 MHz and
 - i.e. multiple coordinated power transmitters to boost the total power



3GPP IoT: NEW “AMBIENT IOT”

- Study in Release 19 : full new IOT for 5G advanced/6G

Critical IoT

Time-critical data delivery with strict delay constraint and high reliability

Technology: LTE HURLLC, NR URLLC

Reliability: 99.999%

Latency: 1 ms (user plane)

Massive IoT

Delay-tolerant, low data rates

Technology: LTE-M, NB-IoT

Peak rate: ~25kbps – ~2 Mbps

Reliability: 99% – 99.9%

Latency: up to 10 s (start up in battery-efficient state)



Broadband IoT

High data rates and lower delay typical of mobile broadband services

Technology: LTE, NR (eMBB, RedCap UE)

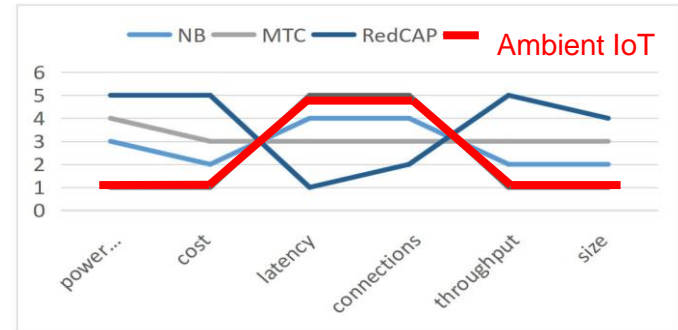
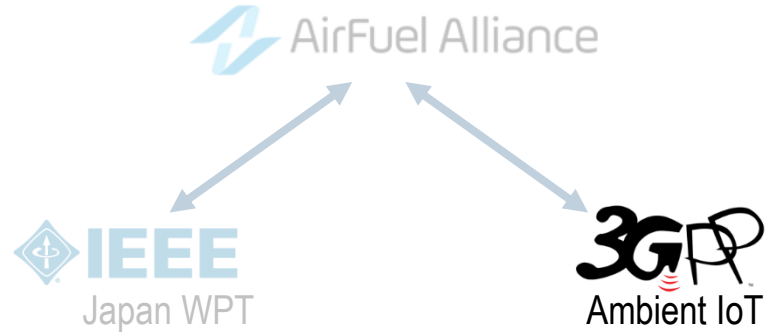
Peak rate: ~100 Mbps – ~5 Gbps

Latency: 4 ms (user plane)

Ambient IoT

Very-low end IoT

Technology: NR Rel-19+, 6G



3GPP Rel-19 A-IoT: device Type & Topology

Study cases for CW for backscattering agreed in RAN1#116 [2]

	CW inside topology	CW outside topology
Topo1	<p>Case 1-1 CW2D/D2R in DL Case 1-2 CW2D/D2R in UL</p>	<p>Case 1-4 CW2D/D2R in FDD-UL</p>
Topo2	<p>Case 2-2 CW2D/D2R in UL</p>	<p>Case 2-3 CW2D/D2R in FDD-DL Case 2-4 CW2D/D2R in FDD-UL</p>

„Ambient IoT,, device relies on „RF Energy Harvesting“ generated by extra source (CW) !

[1] RP-234058 New SID: Study on solutions for Ambient IoT (Internet of Things) in NR


[2] RAN1#116 Chairman's note

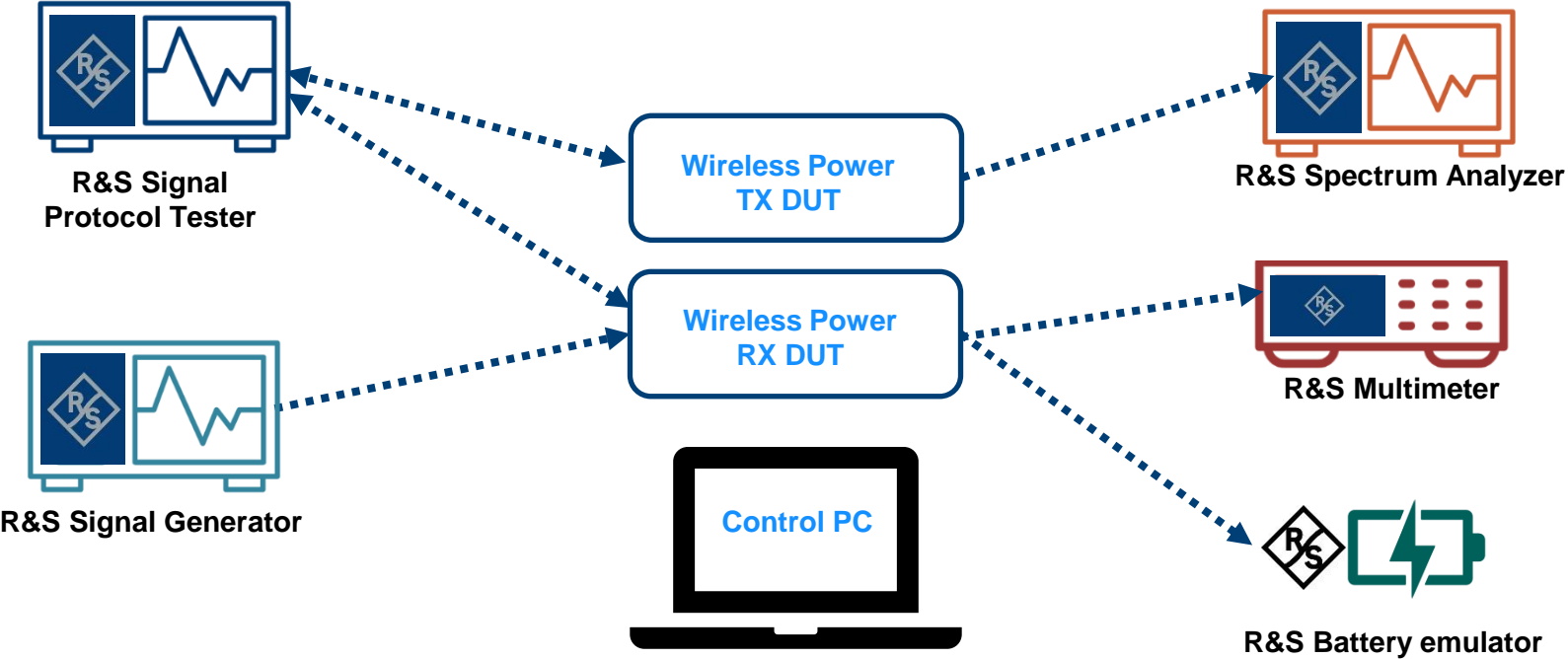
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WPT Test System

Optional connection (wireless or conducted)




R&S and WiRELESS Power Ecosystem: Testing

2022



Innovation Award
Nomination



IEEE Conf.

2023



Demo to InnoBoard

Expo



IEEE Conf + Demo



2024

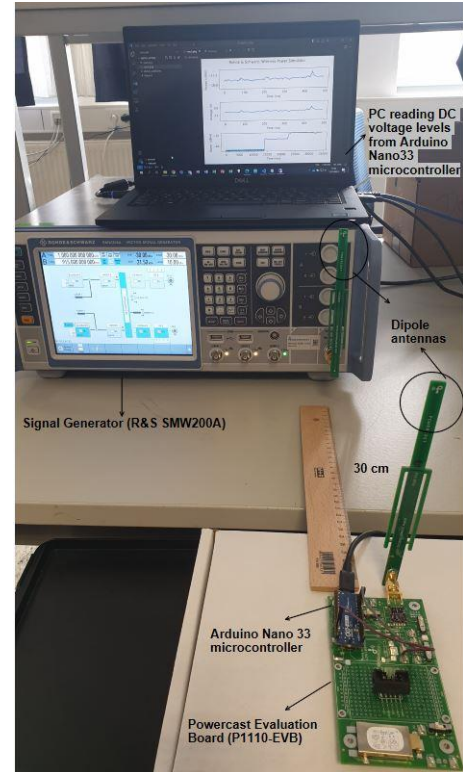
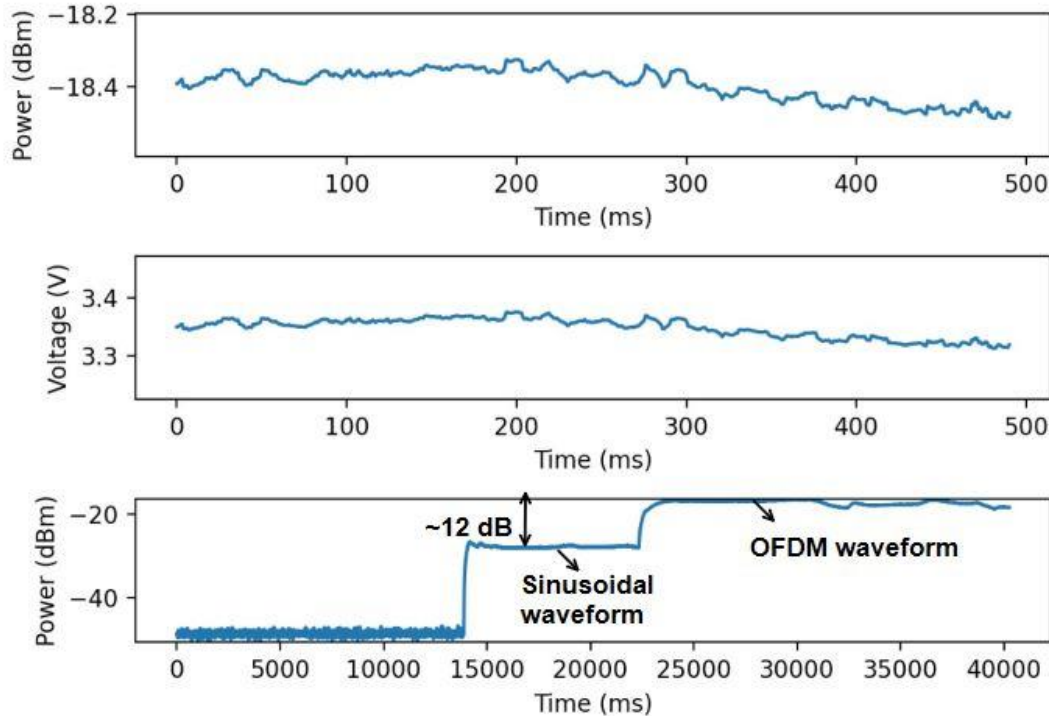


Joint press release with AirFuel Alliance

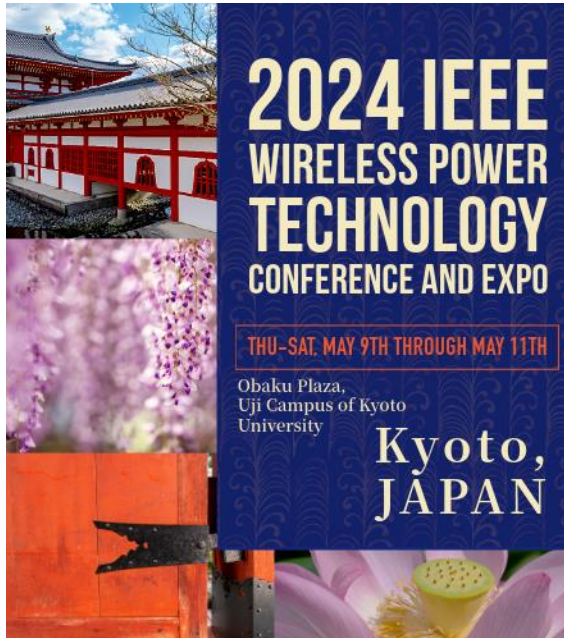
Rohde & Schwarz presents the first RF wireless power tester prototype to drive standardization efforts



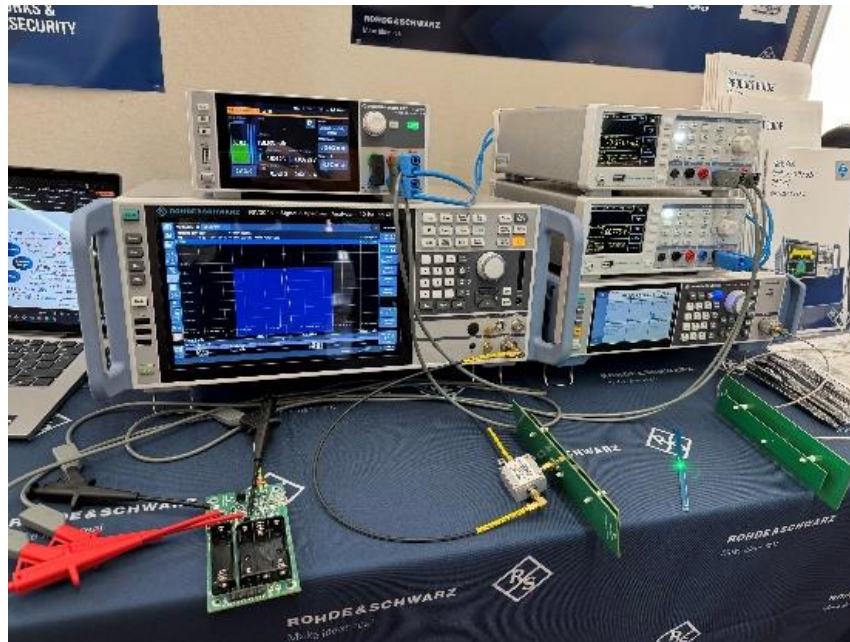
Rohde & Schwarz: Wireless Power Simulator



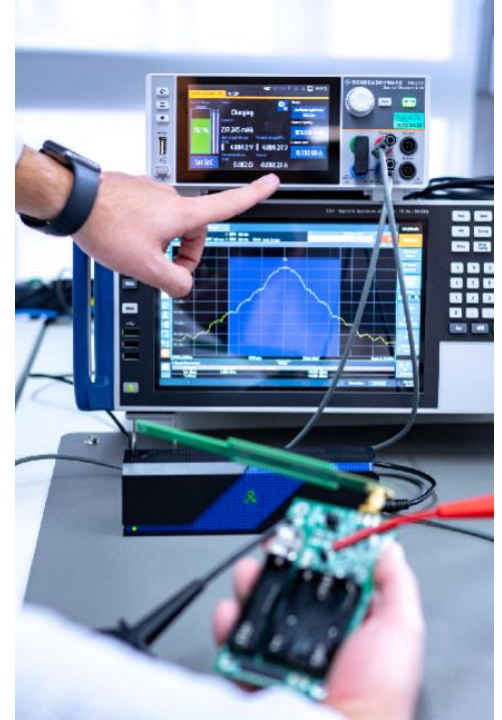
Automation of AirFuel Alliance tests using a web interface combined with SCPI commands and our T&M devices



IEEE WPTCE 2024 Kyoto 2024

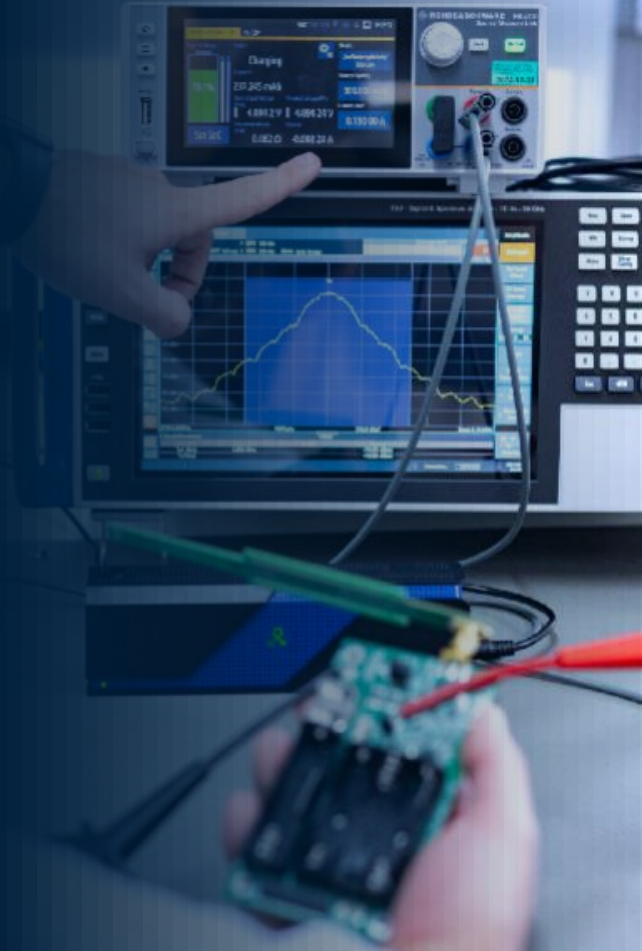


IDC 2022 – WPTCE 2023 -



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CONCLUSION

- ◆ RF WPT is an enabling technology for low-power large-scale IoT networks.
- ◆ RF WPT Standard from AirFuel Alliance. Cooperation with IEEE Japan and 3GPP.
- ◆ RF wireless power is a potential energy source for R19 3GPP Ambient IoT devices.
- ◆ High-PAPR signal waveforms are more efficient in RF WPT compared to constant-envelope signals
- ◆ R&S setup that automated the AirFuel RF conformance tests (IEEE conf. In Kyoto).



Test. Measure. Innovate

THANK YOU
VERY MUCH

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