5G Private Network Seminar

CLEAN RF ENVIRONMENT INSIDE SMART FACTORY - INTERFERENCE HUNTING

Nellie Pang
Product Manager – Handheld Analyzers

ROHDE&SCHWARZ
Make ideas real

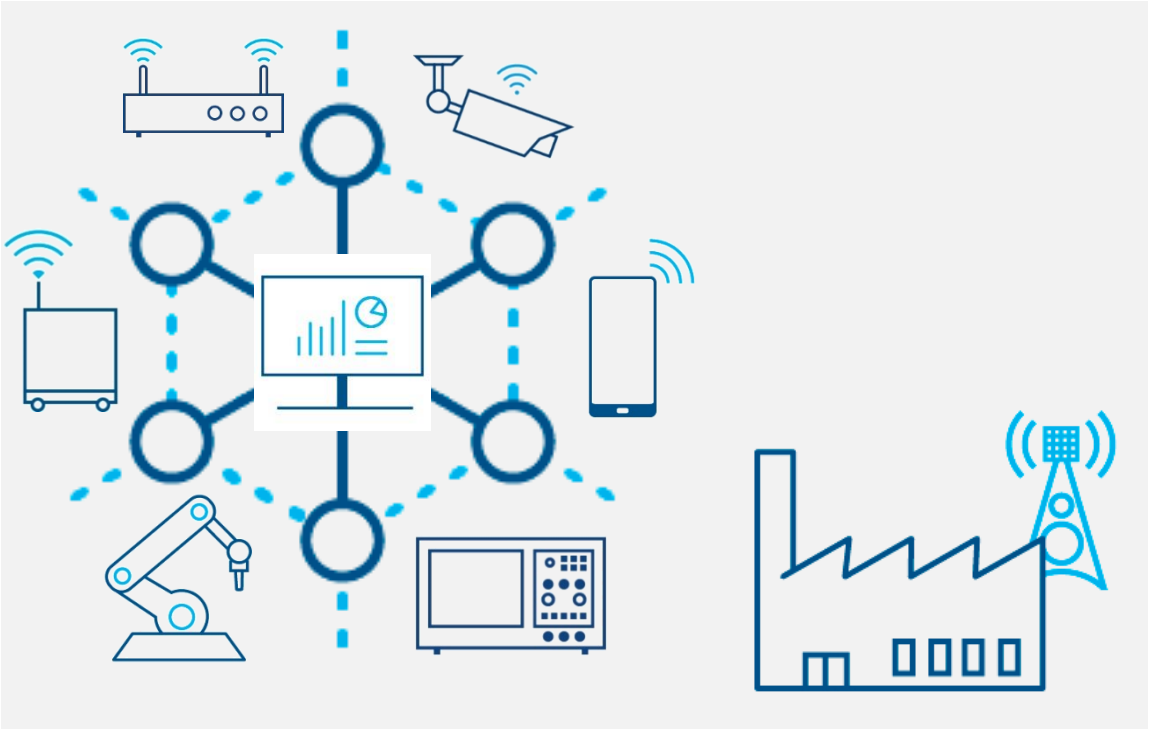
CONTENT

- RF communications in smart factory
- Why need clean RF environment inside the factory?
- Potential interference sources
- How to find the interference source?

RF COMMUNICATIONS IN SMART FACTORY
INDUSTRY 4.0

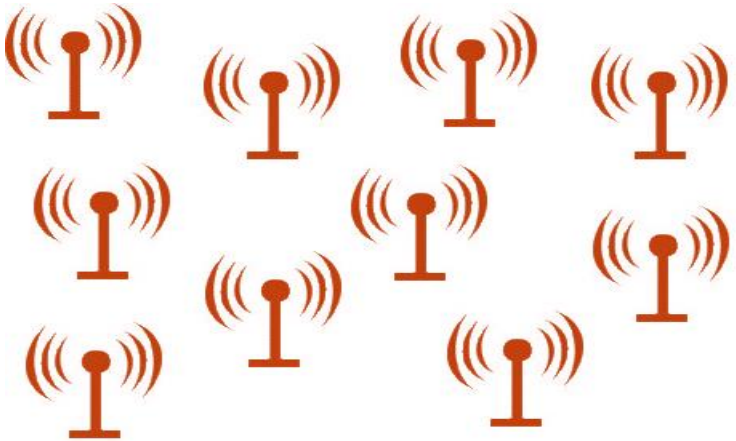
Multiple communication technologies are deployed in the factory

- NFC – RFID, Bluetooth
- IIOT, Zigbee, LoRa WAN
- WiFi
- LTE / 5G (cellular-IOT) [NB-IoT, eMTC, etc.]



WHY NEED CLEAN RF ENVIRONMENT INSIDE THE FACTORY?

- Internet of things → Interference of things
  - "dirty" transmitters will emit excessive out-of-band energy, some receivers will contain little or no filtering to reject out-of-band energy
  - many connected devices won't be designed well enough to withstand outside EMI
  - Reduce reliability if smart sensors are unable to transmit or receive due to interference

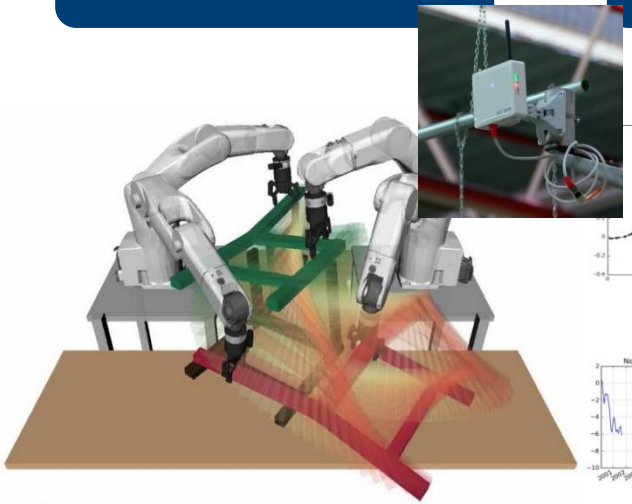


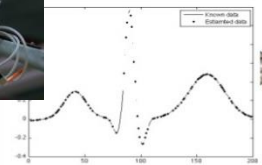
WHY NEED CLEAN RF ENVIRONMENT INSIDE THE FACTORY?

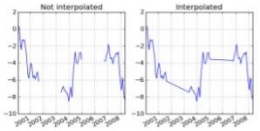
Misplacement

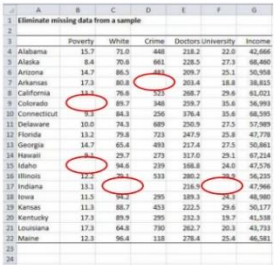
Collision

Data loss









POTENTIAL INTERFERENCE SOURCES

- Anything is Possible!

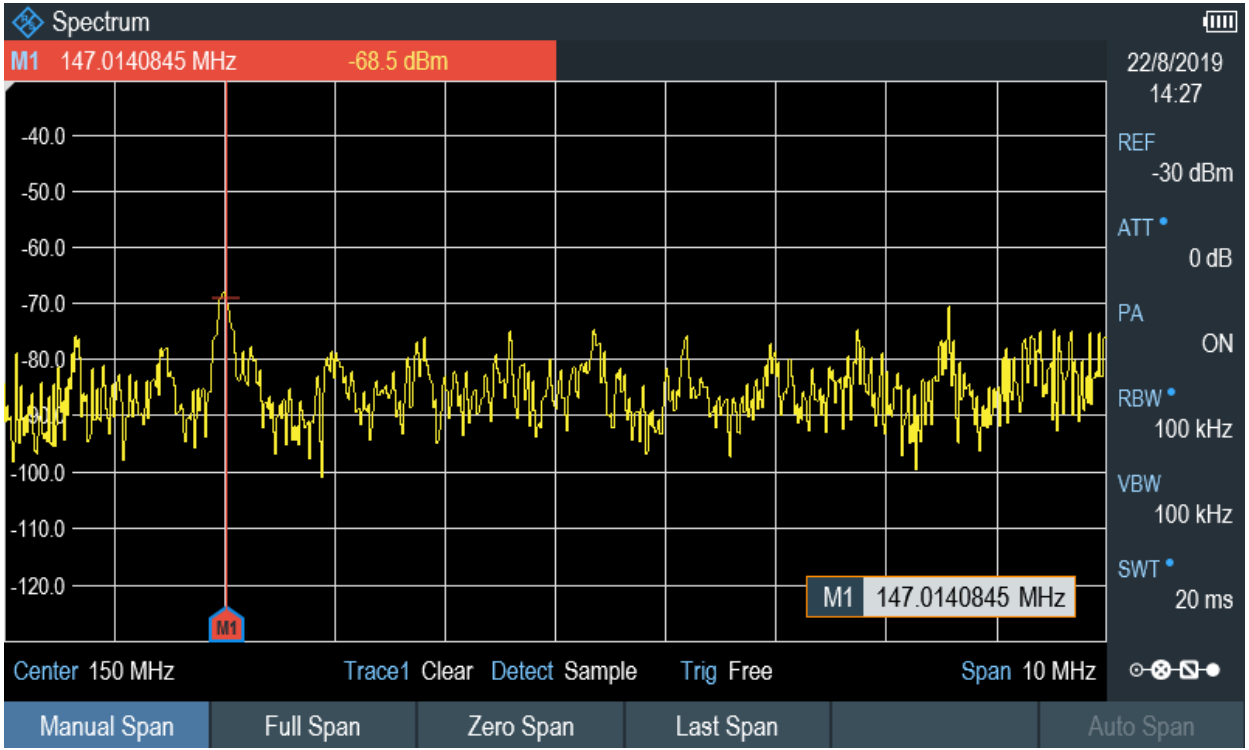






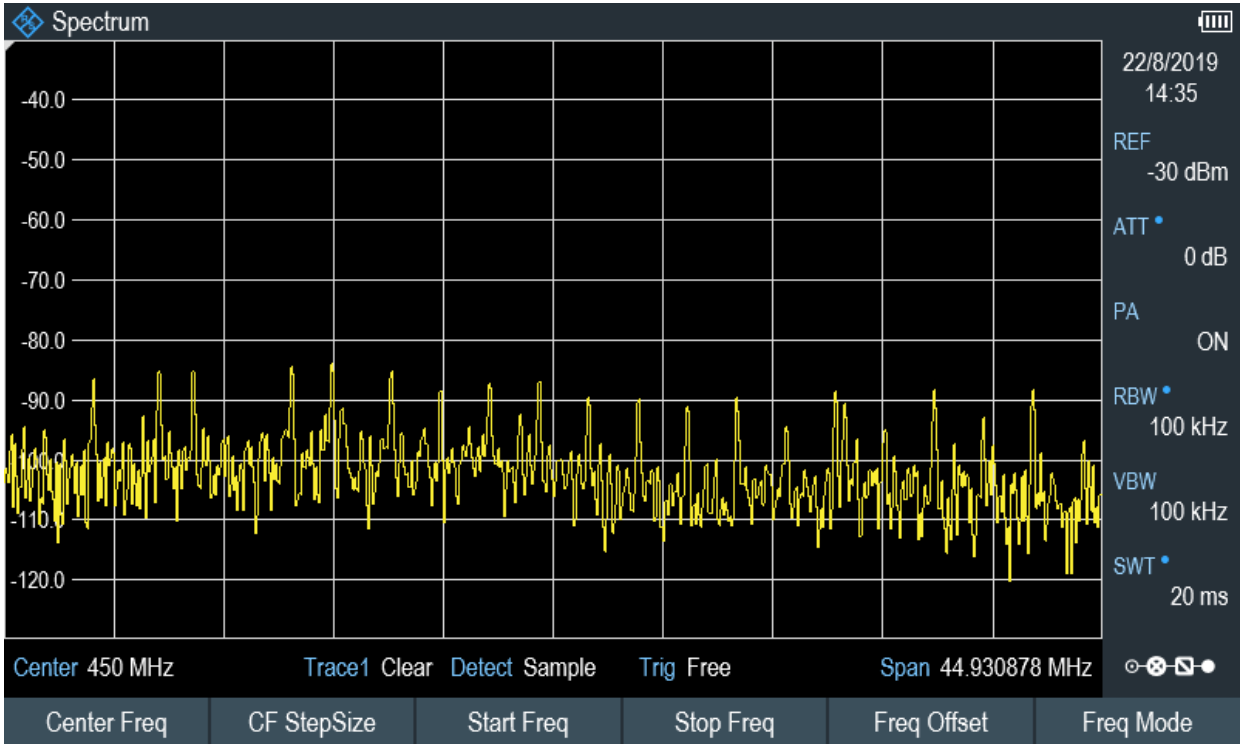

POTENTIAL INTERFERENCE SOURCES

- LED light noise



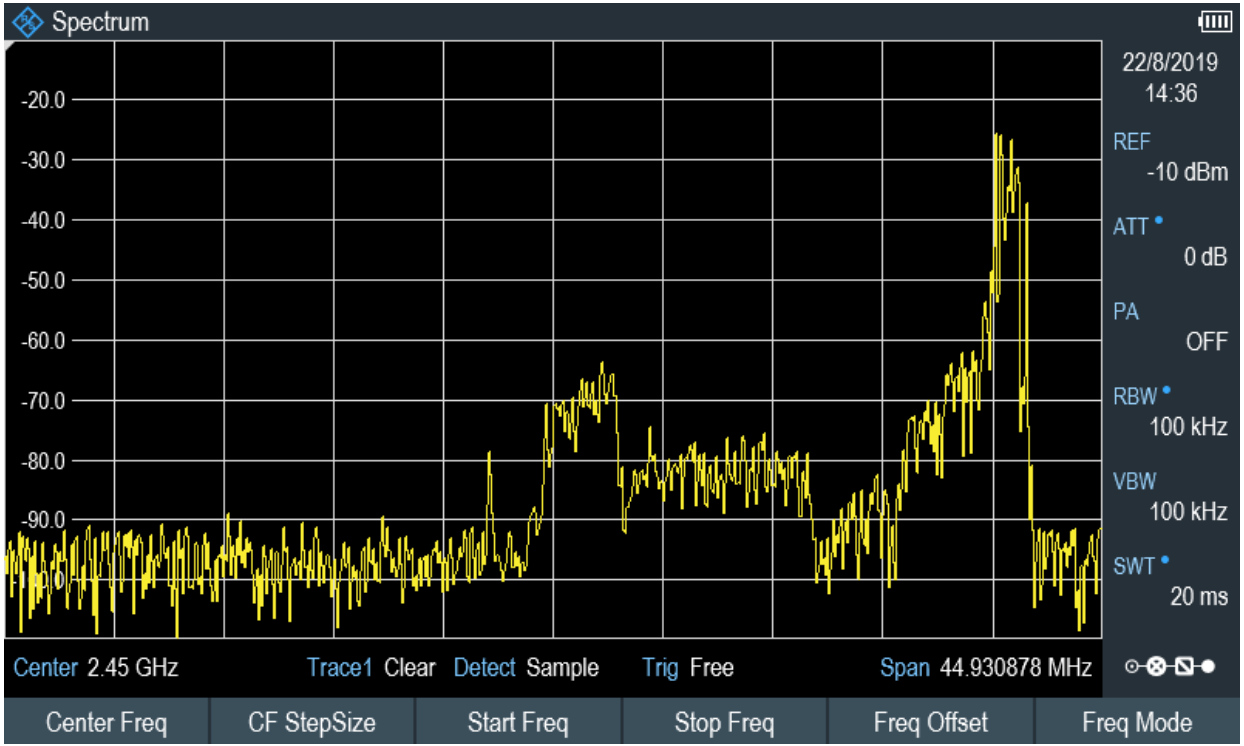
POTENTIAL INTERFERENCE SOURCES

- Harmonics from RFID access control system



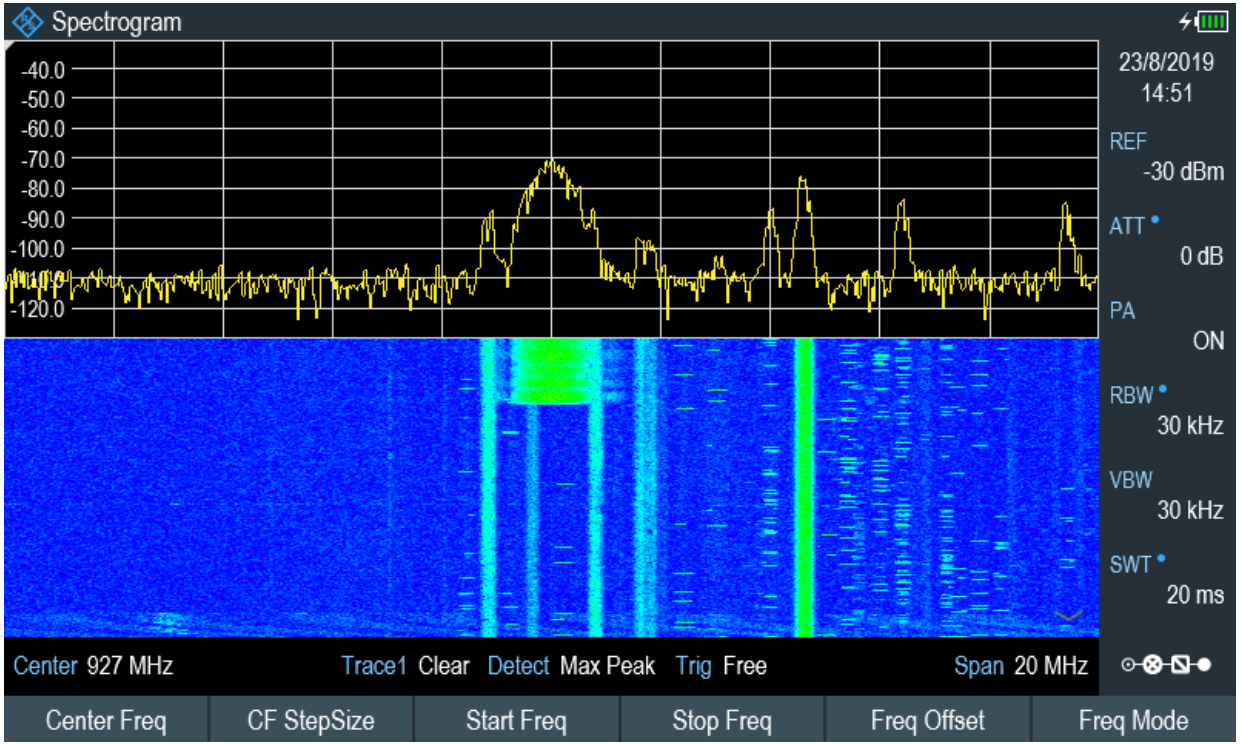
POTENTIAL INTERFERENCE SOURCES

- Microwave oven emission

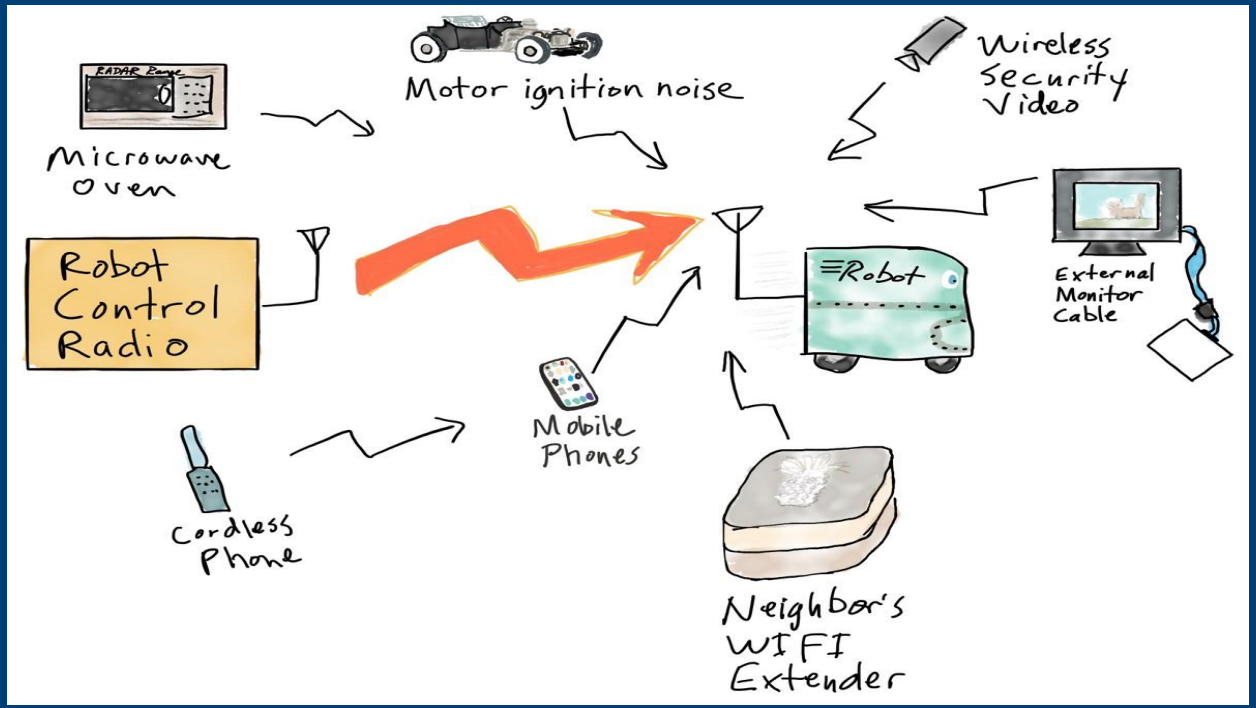


POTENTIAL INTERFERENCE SOURCES

- DECT Phone



POTENTIAL INTERFERENCE SOURCES



HOW TO FIND THE INTERFERENCE SOURCE?
INTEFERENCE HUNTING IN 1-2-3 STEPS

1. DETECT The Effects of Interference	2. CHARACTERIZE The Interferer	3. LOCATE The Interferer
• Abnormality in frequency spectrum caused by interference • Effects of interferer on parameters like RSSI, Signal strength, C/I, C/N => interference causes high RSSI / Noise floor (UL), low C/I (DL)	• Spectrogram : check for signal time pattern and periodicity • Spectrum analyzer measurements (Channel power, OBW, ACLR, SEM) • Max hold, save on event (can be applied to all measurements) to capture the interferer in action	• Triangulation used to locate the position of an interferer using directional antennas and handheld spectrum analyzers • Outdoor/Indoor mapping and tone features to also help narrow down the interferer location

HOW TO FIND THE INTERFERENCE SOURCE?
ROHDE & SCHWARZ SOLUTIONS

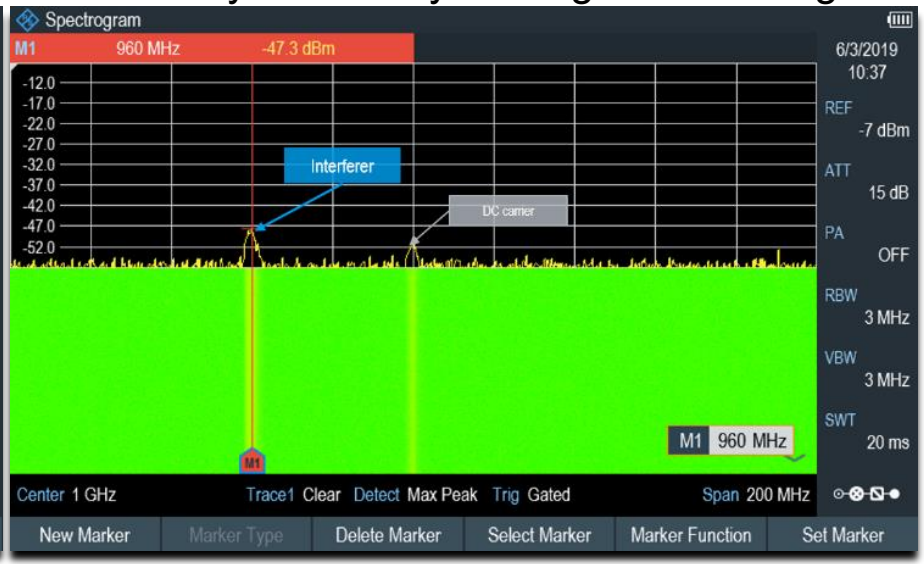
- Handheld Spectrum Analyzer with directional antenna

R&S®Spectrum Rider FPH + R&S®HA-Z900 Yagi Antenna

R&S®HE400 Directional Antenna

HOW TO FIND THE INTERFERENCE SOURCE?
ROHDE & SCHWARZ SOLUTIONS

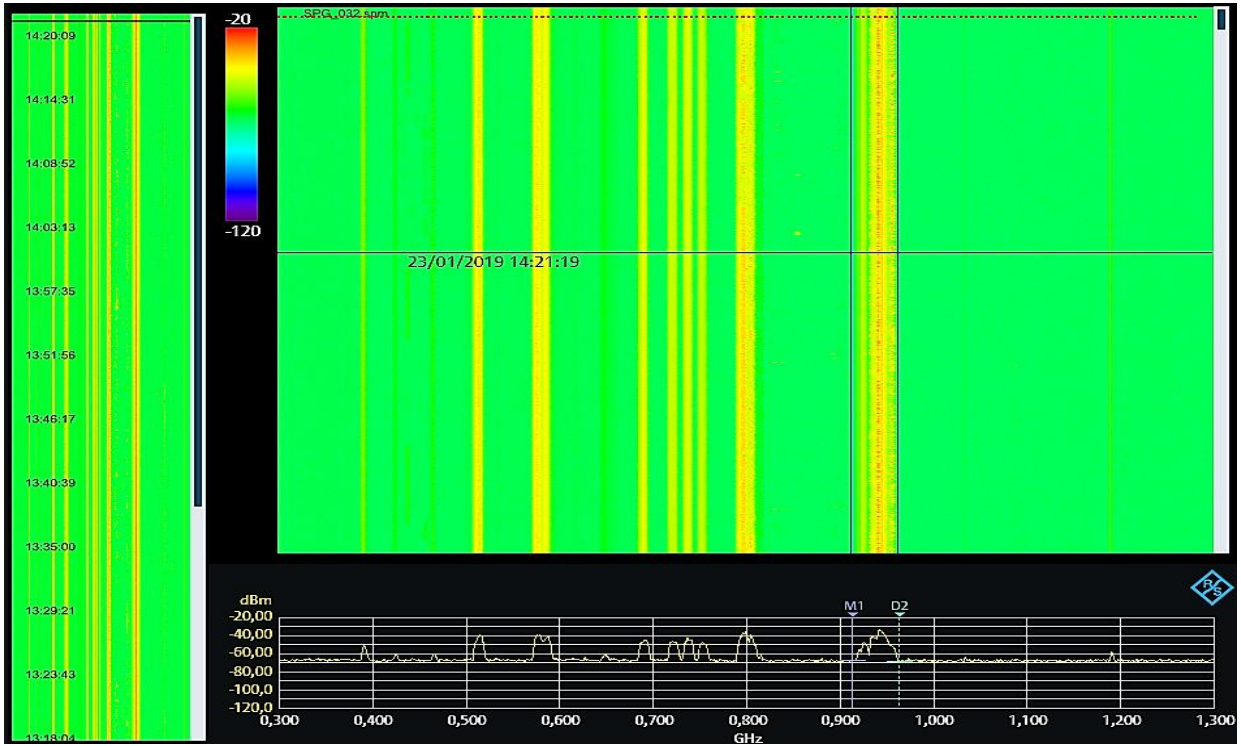
- Separating uplink from downlink with **gated trigger**
- Support in Spectrum, Channel Power and Spectrogram mode.
- Application : To identify uplink interferer which is normally “buried by” strong downlink signal.



HOW TO FIND THE INTERFERENCE SOURCE?
ROHDE & SCHWARZ SOLUTIONS

- Can record the RF activities for up to 999* hours using R&S®Spectrum Rider FPH (required R&S®FPH-K15)

- Post-analysis can be done using R&S®InstrumentView software (free)

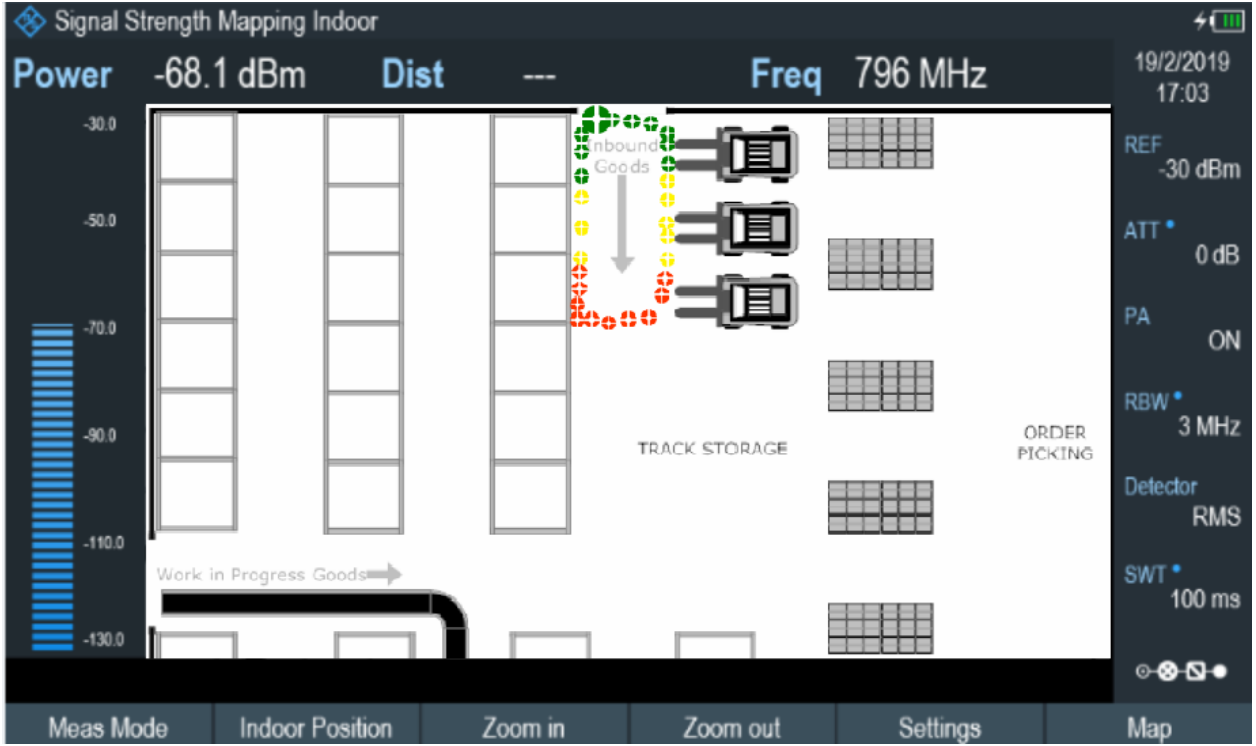


*Depend on recording interval setting

HOW TO FIND THE INTERFERENCE SOURCE?
ROHDE & SCHWARZ SOLUTIONS

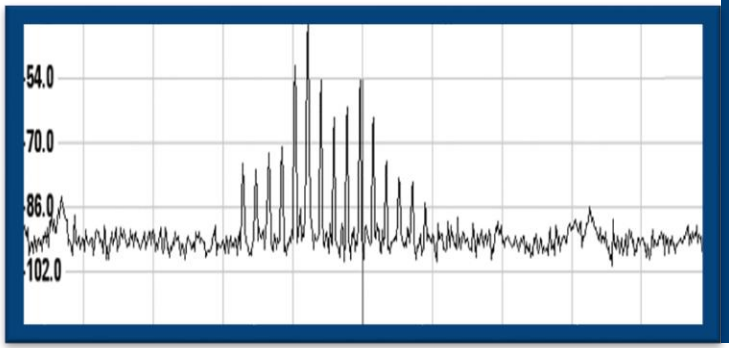
- Download factory/production floor plan into R&S®Spectrum Rider FPH (required R&S®FPH-K16)

- The green dots gave an indication of where the potential interferer located



HOW TO FIND THE INTERFERENCE SOURCE?
ROHDE & SCHWARZ SOLUTIONS

- In this example, faulty components in the digital advertising board near the entrance is the interferer to IOT sensor at a assembly line



THE R&S®SPECTRUM RIDER FPH APPLICATION CARDS

- Interference hunting in smart factories
- Fast 5G waveform verification in the field
- 5G NR interference hunting in the uplink of TDD networks

Together, we shape the future of communications …

R&S®Spectrum Rider FPH with R&S®HE400 antenna

…to enable a safer and connected world

ROHDE&SCHWARZ