

Garantir le bon fonctionnement d'un DM connecté : test de coexistence radio

Julien SARRADE

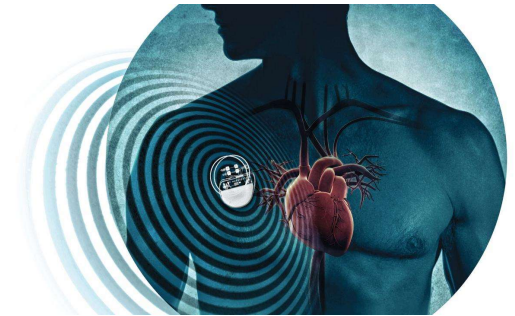
SEPT 2020

Medical Electronics Business Development Manager



Healthcare general landscape overview

- The first half of 2020 set new priorities for the healthcare industry.
- Electronic is at the heart of medical innovation.
- Areas of life-saving technologies likely to boom within one to two years:
 - Rapid point-of-care and home-based testing/diagnostics
 - Wearable, implantable, and remote sensors/imagers for physiological monitoring
 - Medical imaging technologies and algorithms/artificial intelligence (AI) for rapid detection, diagnosis, and monitoring of lung infection
 - Non-contact sensing and imaging for rapid mass screening and vital sign assessment
 - Robotic and automation technologies to limit caregivers' exposure and/or reduce burden on the healthcare system



Why Coexistence Test?

ADDRESSING COEXISTENCE CONCERNS

Coexistence concerns are driven by three key factors:

- ❖ increased use of wireless technology for critical equipment connectivity,
- ❖ intensive use of unlicensed or shared spectrum (e.g. 2.4 GHz ISM band), and
- ❖ higher deployment rates of sensitive equipment (e.g. intravenous infusion pumps, pacemakers, and defibrillators).

There are many recorded instances of wireless interference leading to medical issues:

- ❖ mobile phones causing infusion pumps to stop
- ❖ electrocautery devices making implants stop working
- ❖ pacemaker being controlled from an unauthorized source

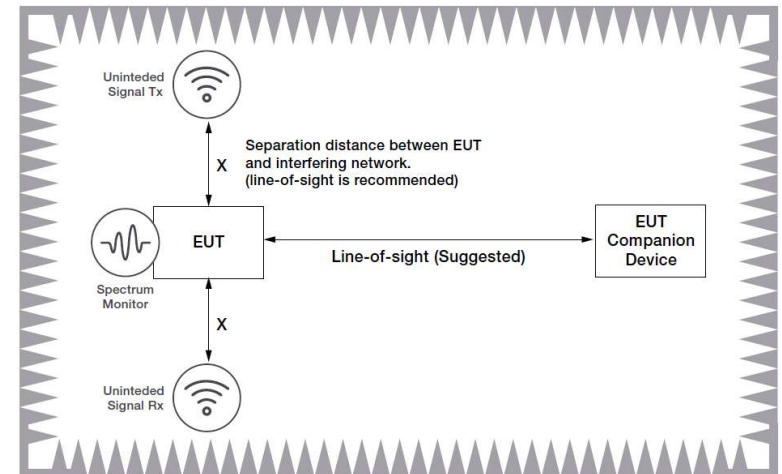
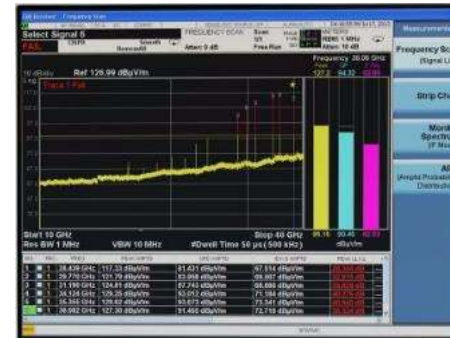


Radio protocols are incompatible and unable to cooperatively share channels.

Coexistence is not:

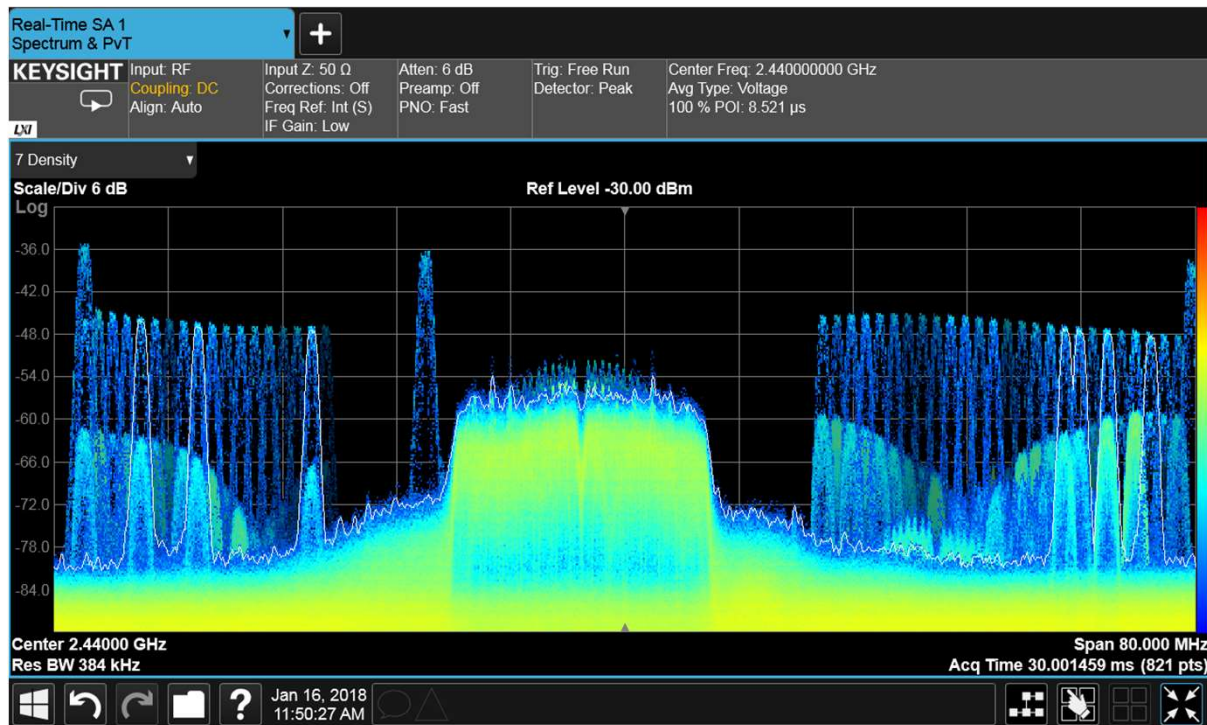
IT IS NOT TRADITIONAL EMI/EMC TESTING

- **EMI/EMC Testing:**
 - EMI tests emission of unintended RF signals
 - EMC tests susceptibility to signals other than the intended frequency (Pure Sine waves typically)
- **Regulatory Compliance Testing**
 - Compliance with Regulatory Standards
- **Coexistence Testing:**
 - Tests the whole device – RF HW, Digital HW, Firmware – in target RF environment
 - Evaluates device's ability to maintain its **functional wireless performance** (FWP) in the presence of unintended signals



It Can Happen Anywhere

LAPTOP STREAMING VIDEO AND BLUETOOTH HEADSET AT HOME



- WiFi router feeding video to laptop computer
- Laptop streaming the audio to BLE Headset
- Video and Audio breaking up.
- This is a Coexistence problem

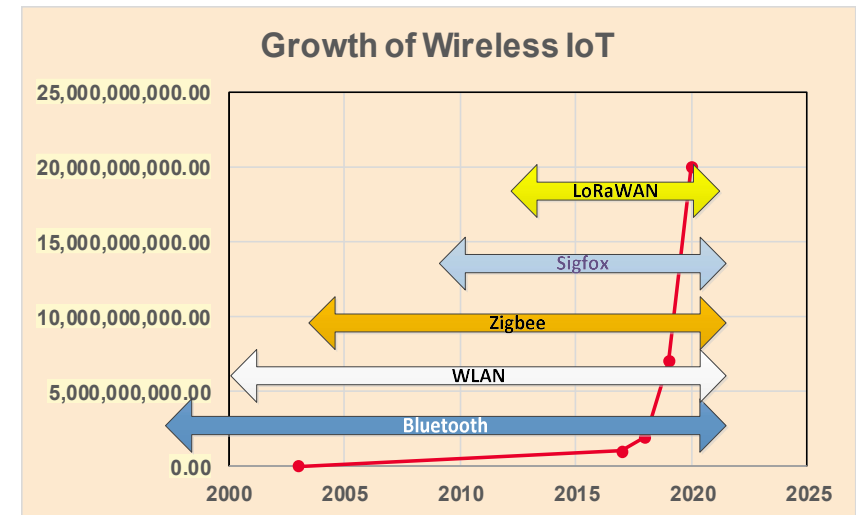
How is that working out for us?

BILLIONS OF DEVICES “SPEAKING” DIFFERENT LANGUAGES

- WLAN has many on-the-air modulation formats on the 2.4 GHz band
- There are several versions of Bluetooth modulation
- ZigBee, Thread, 802.15.4 are all related, but different protocols
- Microwave ovens use 2.45 GHz to cook food!

The result?

- Different formats cannot understand each other
- Do not cooperate well using the spectrum
- Sensing (Listen Before Transmit) partly effective
- Result → Failure to communicate!



Coexistence Concerns in Healthcare

REASONS YOUR NEW MEDICAL DEVICES WILL FAIL

Healthcare facilities are the most challenging RF environments:

- ❖ Wide range of wireless medical devices in use, as well as smart phones and wearables for personal use.
- ❖ Radio protocols are incompatible and do only a marginal job of detecting other signals.
- ❖ Critical medical applications require complete and uninterrupted connectivity to process medical alerts and transfer large amounts of data quickly.

Ensuring reliable wireless operation in severely overcrowded radio conditions, makes **coexistence test** absolutely essential.



Life Critical

Mission Critical

Patient Critical

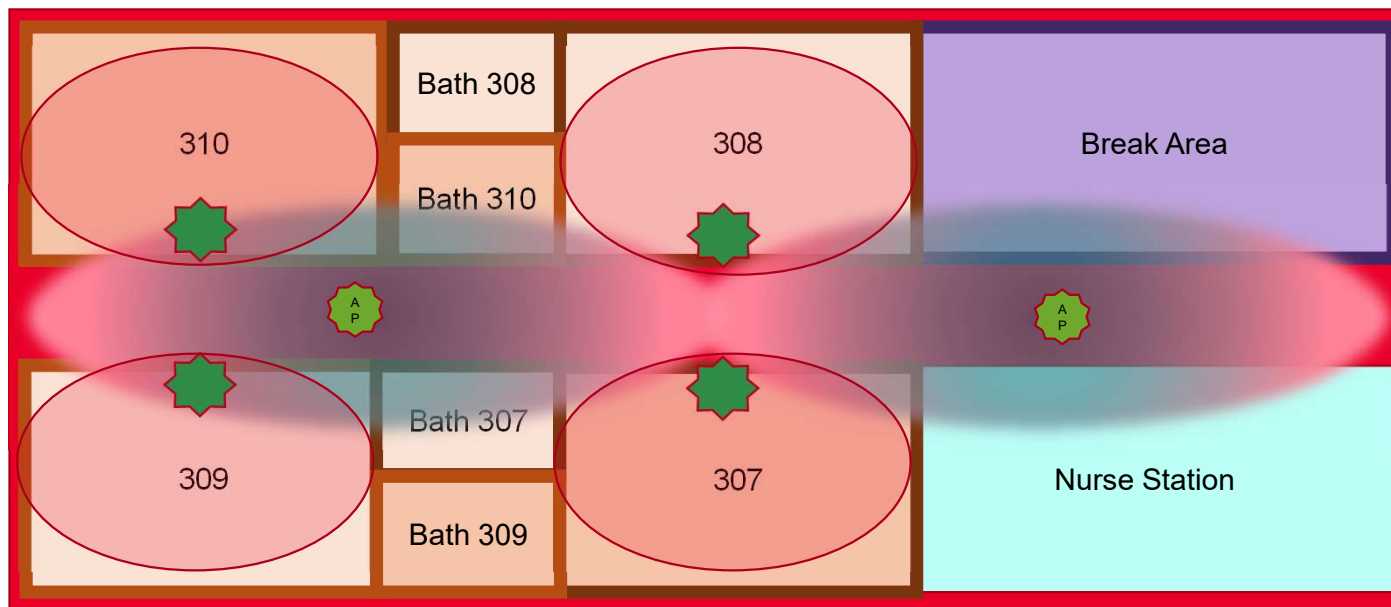
Coexistence challenge example

WLAN WIRELESS ACCESS POINTS (AP)



Coexistence challenge example

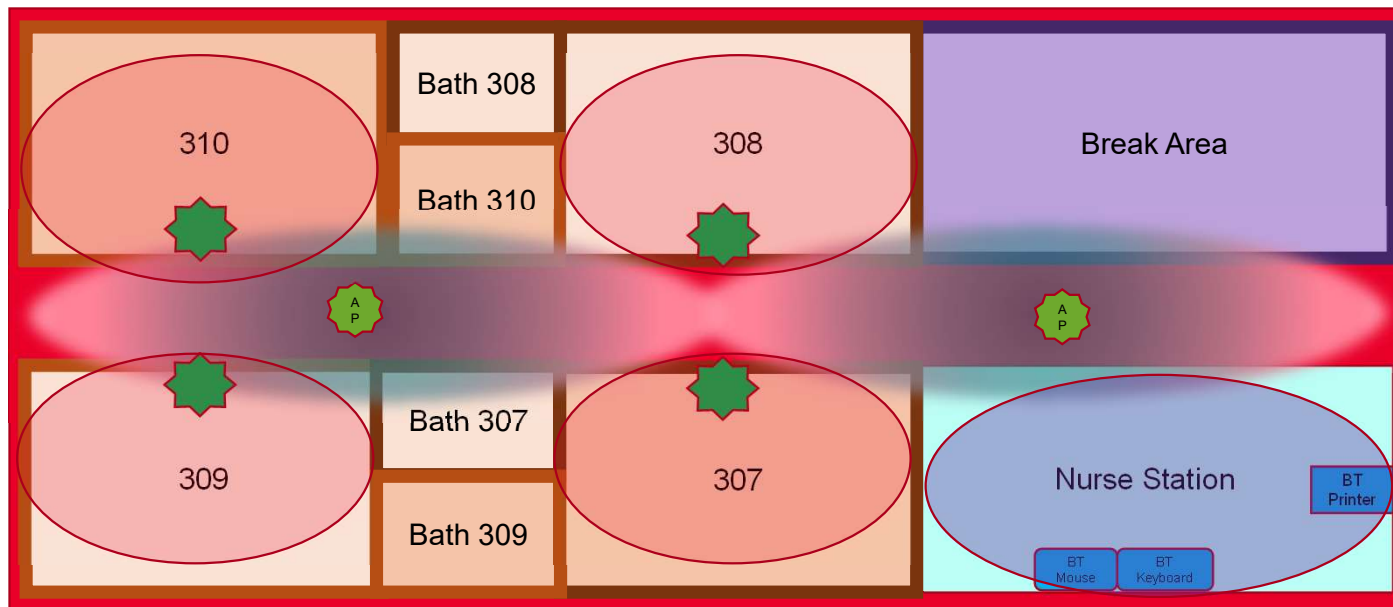
NURSE CALL SYSTEMS



Nurse location tracking

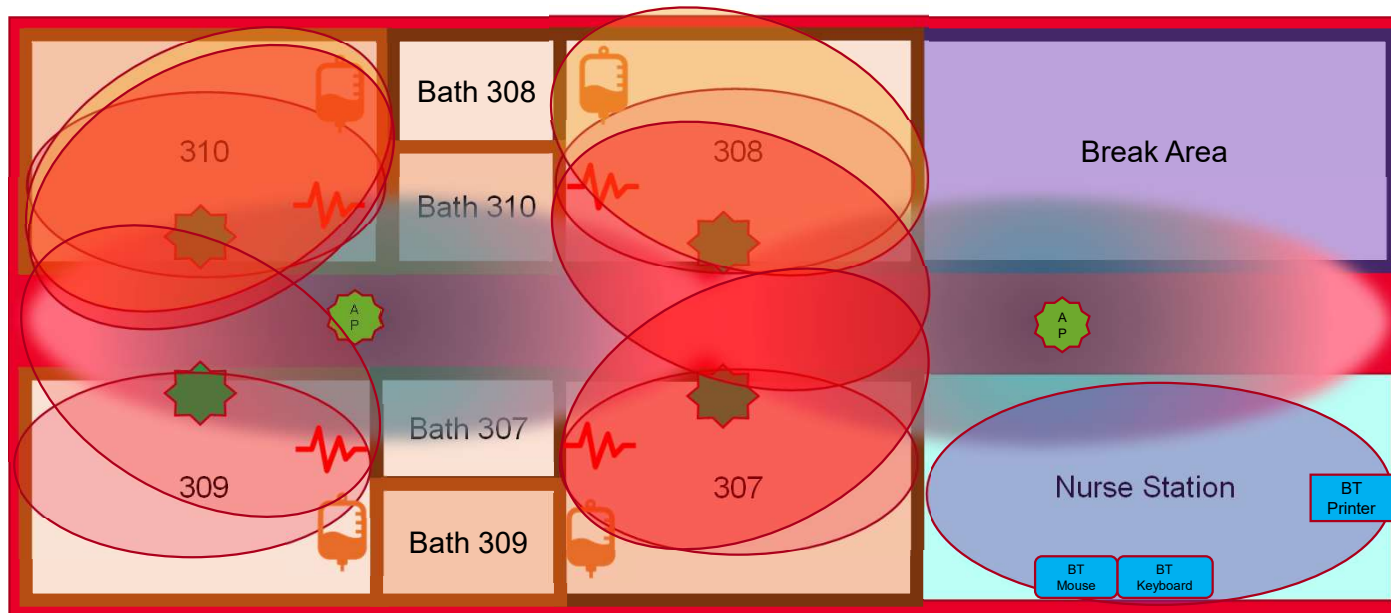
Coexistence challenge example

COMPUTERS USING BLUETOOTH



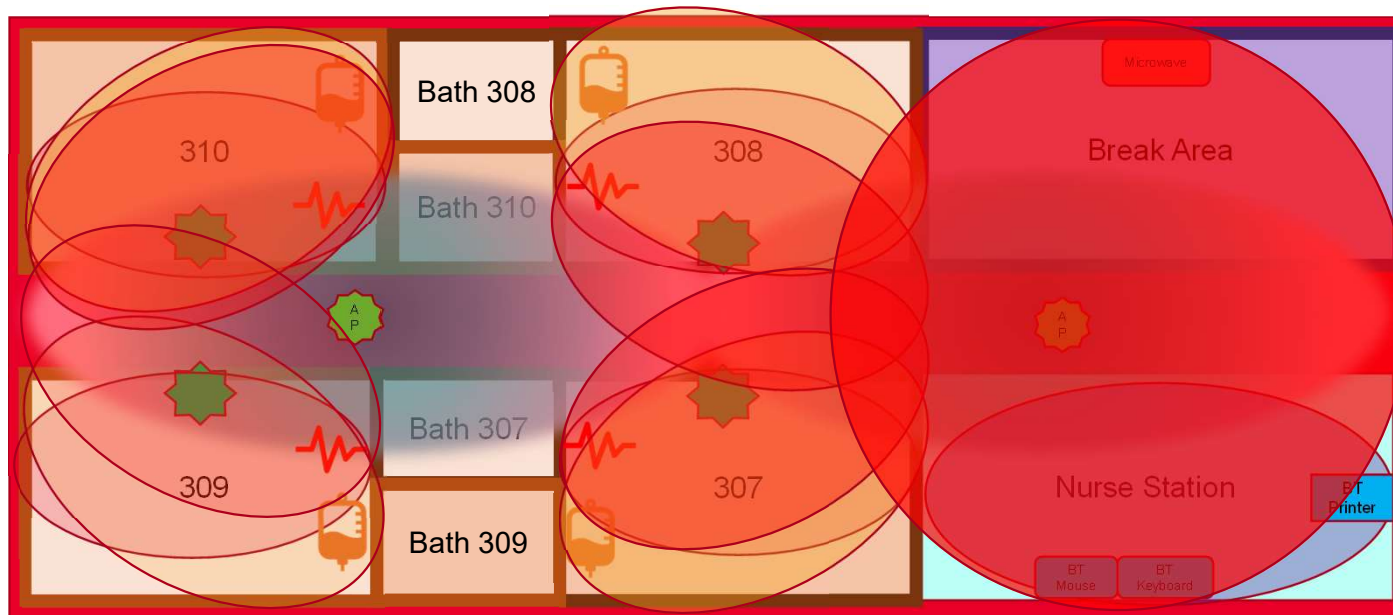
Coexistence challenge example

MEDICAL MONITORS AND TREATMENT DEVICES



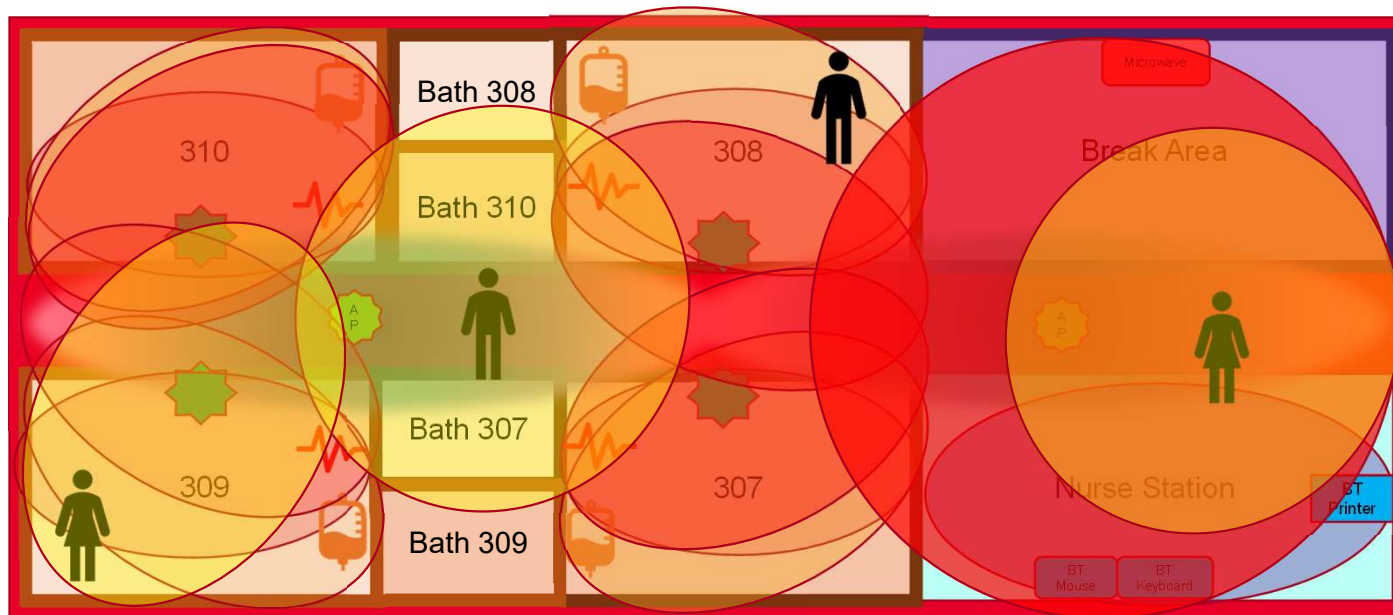
Coexistence challenge example

NON-MEDICAL DEVICES – MICROWAVE OVEN



Coexistence challenge example

VISITOR SMART PHONES, TABLETS, LAPTOPS



Hospital = crowded wireless environment

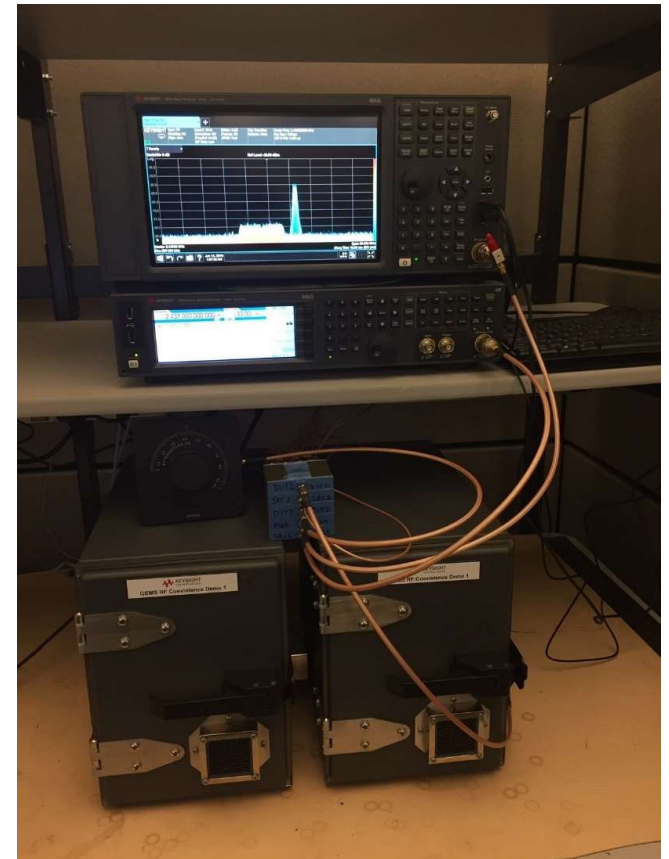
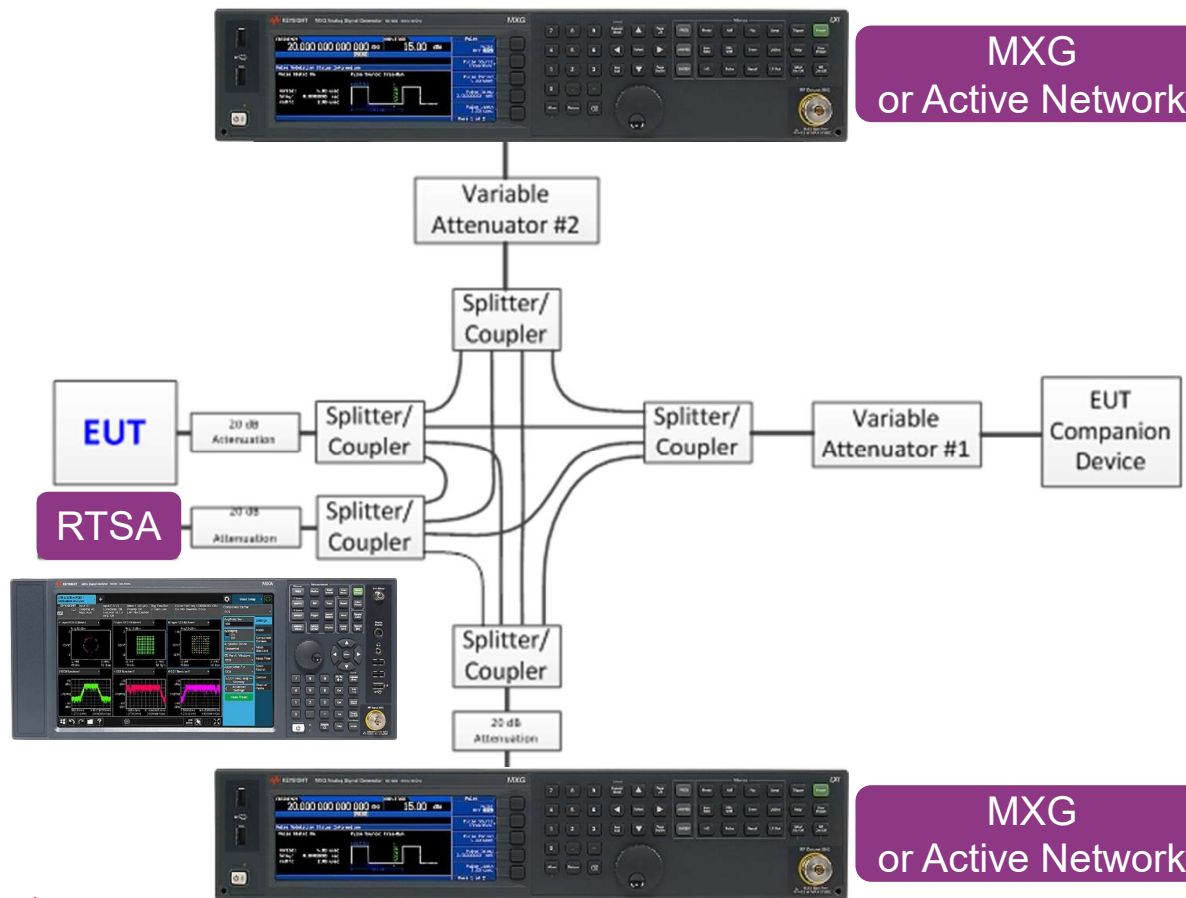
What is Coexistence Testing?

ANSI C63.27 TEST METHODS

- **You define** key functionality of your DUT (Functional Wireless Performance “FWP”)
- **You define** target RF environment (measure and identify ambient signals)
- Establish a wireless link and then challenge it with interfering signals
- Monitor the test RF environment during the test (use RTSA)
- Increase the interference till DUT fails the FWP objectives
- **No fixed specs** for pass/fail like EMI test has
- **You decide** what acceptable performance is for your DUT
- Repeat the test after modifications to measure improvement

Coaxial test method – one of four methods

BEST REPEATABILITY – EVALUATE DESIGN CHANGE EFFECTS



Medical RF Coexistence Test Solution

RF COEXISTENCE TEST BASED ON ANSI C63.27

Keysight RF coexistence test solution is developed based on ANSI C63.27 targeting all medical device and system manufacturers to address the rising risks associated with wireless coexistence in crowded wireless environment, especially for mission-critical applications.

Core Solution Components:

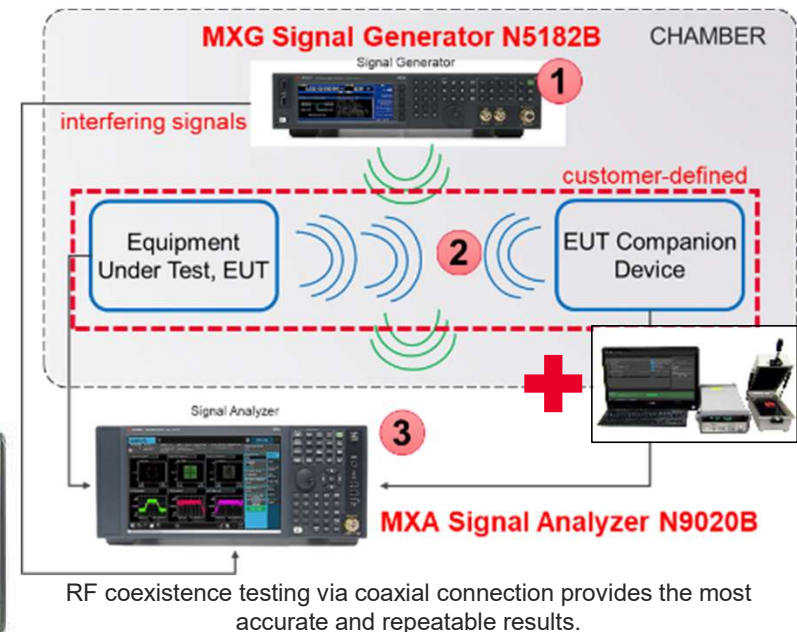
- *Interfering Signal Source: N5182B Signal Generator*
- *Coexistence Spectrum Monitor: N9020B Signal Analyzer*
- *Radiated-Anechoic Chamber (RAC) * typical setup*
- *Test Cases and Automation Software*

Key Differentiations

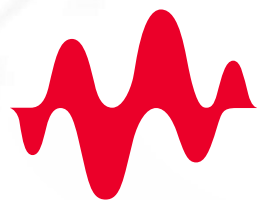
- Wide bandwidth interfering signal source covers both 2.4 and 5 GHz bands simultaneously.
- Advanced **real time spectrum analysis** to capture full spectrum occupancy during the test.
- Total coexistence test solution setup include test cases automation and program development.



Real-Time Spectrum Analyzer (RTSA)



Solution flyer: <http://literature.cdn.keysight.com/litweb/pdf/5992-2827EN.pdf>



KEYSIGHT
TECHNOLOGIES