# 802.11 / LTE-U Coexistence Testbed

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Authors:

| Name | Affiliations | Address | Phone | email |
|------|-------------|---------|-------|-------|
| Randy Oltman | octoScope | | 7325131553 | Randy.oltman@octoscope.com |
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# Abstract

**Discussion of coexistence testbed;  This is a follow-on to document 802.19-15/0055r2 [2]**

# Introduction

**octoScope is partnering with multiple companies and organizations to provide repeatable and reproducible RF environments for coexistence testing**

**Common, neutral, and open testbeds help:**

1. 802.11 experts get hands-on experience with unlicensed LTE to evaluate and explore performance of applications and devices in mixed-use signal environment

2. 3GPP/Unlicensed-LTE community by being able to demonstrate their technology and alleviate concerns about coexistence mechanisms

# Intro to Unlicensed-LTE Coexistence Testbed

- **Goal was to design an RF environment that was flexible for testing variety of Unlicensed LTE/LTE-LAA/LTE-U/802.11 scenarios**

- **Based on our understanding, the requirements for a wireless coexistence test bed are:**

  - High Isolation from external devices

  - Good control over power levels across devices

  - Ability to test real applications (VoIP, Video streaming, file transfer, etc)

  - Flexibility to test high channel load environments

  - Repeatability and in a lab environment

  - Ease of use, portability, and near-term timeline

- **Focused on simple initial scenario:**

  - 802.11 AP-STA baseline with added 802.11 or LTE eNB traffic

  - Cross coupling of signals between the two technologies

# 4 Chamber Co-Existence Testbed

# Testbed Characteristics

- Complete isolation from external interference

- Anechoic environment provides high repeatability of measurements

- "Portable"

- Client pools connected over-the-air providing ease of use

- Broadband (700 MHz - 6 GHz) so all 802.11 and cellular frequencies can be tested

- Electronic attenuators provide fine control over power levels (emulating LTE-U/802.11 overlap)

- High link count and low losses enable highest MIMO throughput as baseline

- Use of real devices allow testing of real applications (VoIP, video streaming, etc.)
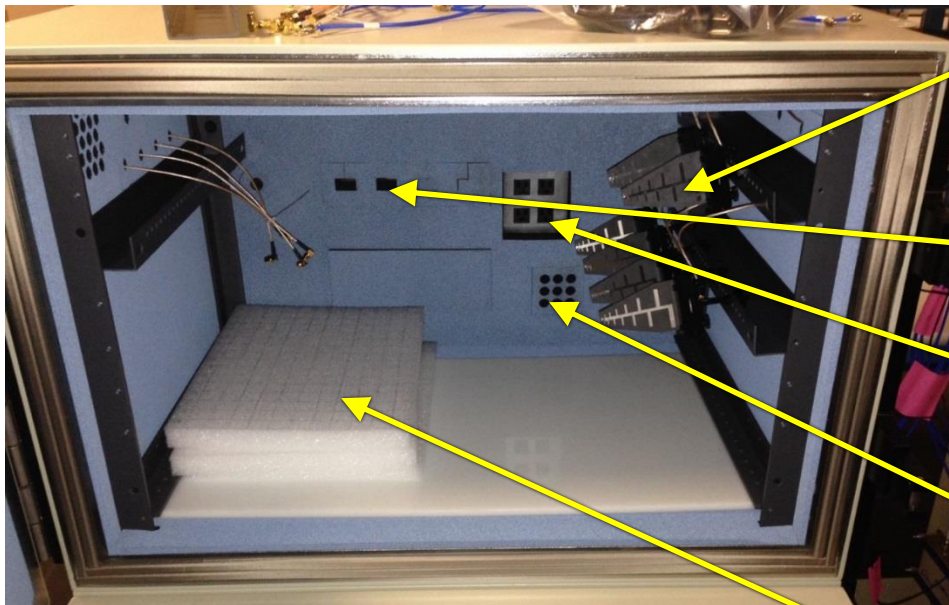
# Connection Diagram
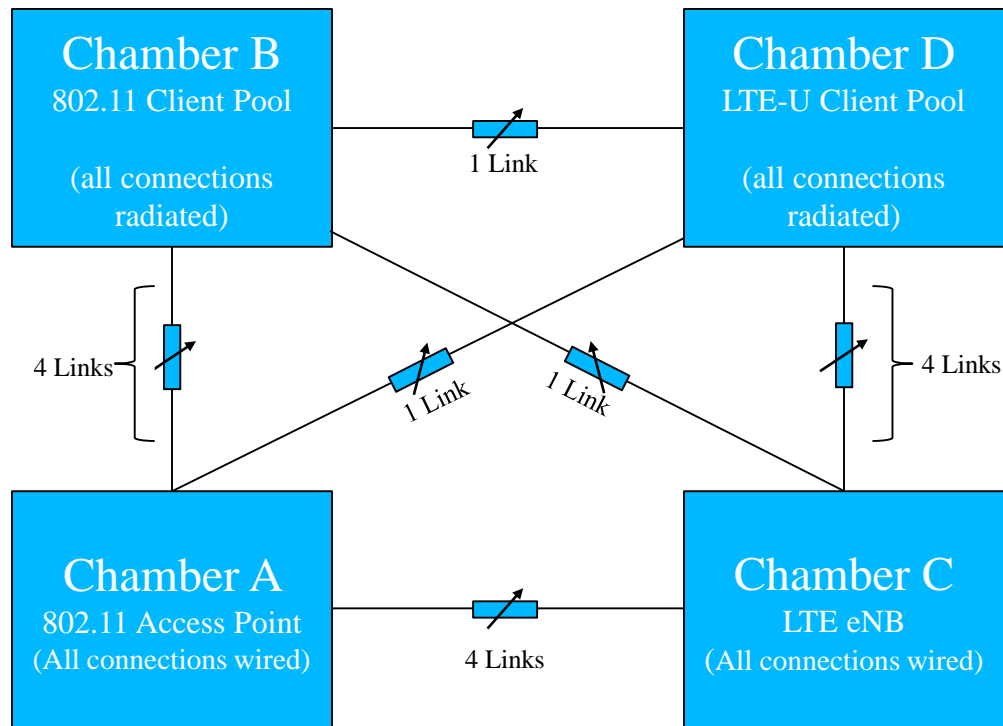
# Test Setup Minimum Insertion Losses
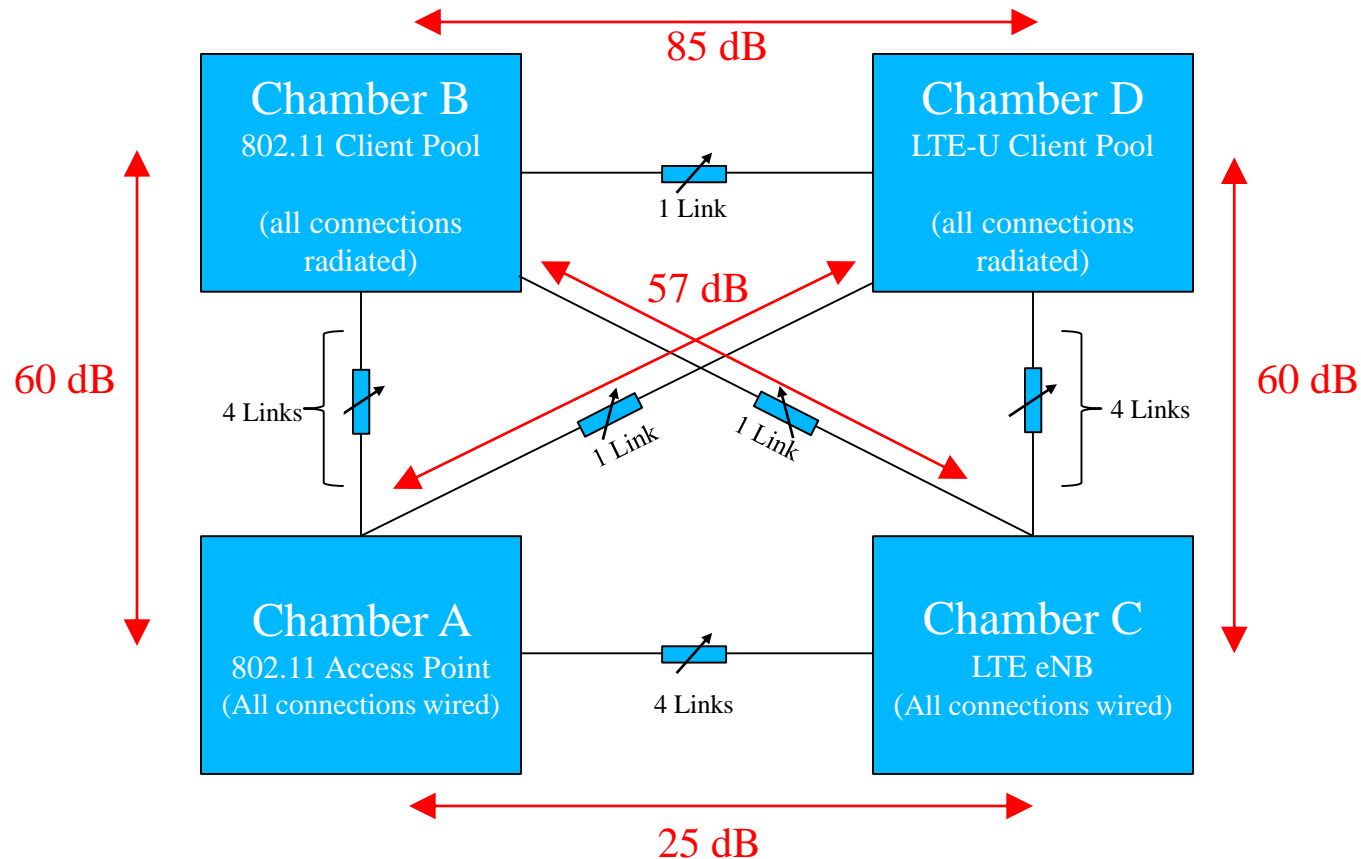
# Client Pool Chamber



High Gain Antennas

USB/HDMI Filters

AC Power

Fan/Exhaust

STA/UE Area

# Call to Action

- 3GPP is contribution driven; a significant # of coexistence contributions are expected;  Members of IEEE 802 need to provide their input

- Consensus not only requires simulation but also test data based on testing that includes the following characteristics:
    - Real devices with agreed scenarios
    - Repeatable and <u>reproducible</u> results

- In order to proceed, access to LTE-U and LAA devices required;  Vendors will only provide these pre-release devices with confidence in the process:
    - Testbed repeatability and reproducibility
    - Open process and test conditions
    - Willingness to debate/negotiate/adjust test conditions
    - Confidentiality prior to publishing (if an LTE-U/LAA pre-commercial device is used)

# Extra Slides

# Possible STA arrangement



C-RAM LF-77

10 dB loss
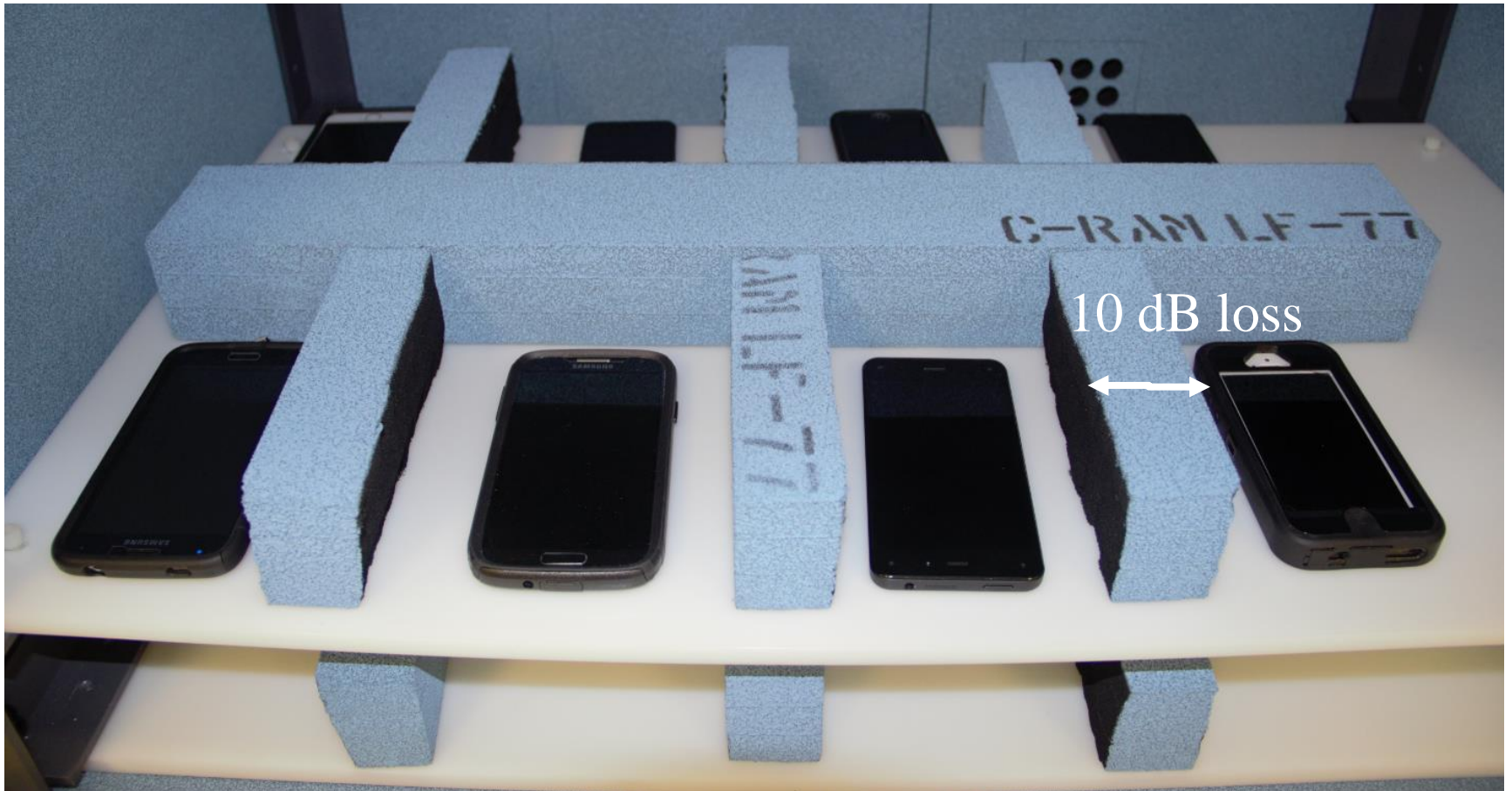
# Other thoughts

- On connectivity to client pool:
  - Purely conducted testbeds limits the number of client devices since high order RF combining becomes exponentially more complex as # of connected nodes increases
  - Client connectivity of commercial devices is often challenging due to lack of connectors or access (e.g. phones)
- On traditional OTA chamber rooms:
  - Permanent EMC chambers vary in size and environment, which makes it challenging to replicate results;
  - May not be available to all members for a number of economic reasons including already being in use for ongoing regulatory testing;
  - Requires additional shielded enclosures to separate co-existing cells with controlled level of coupling

# Connection Diagram
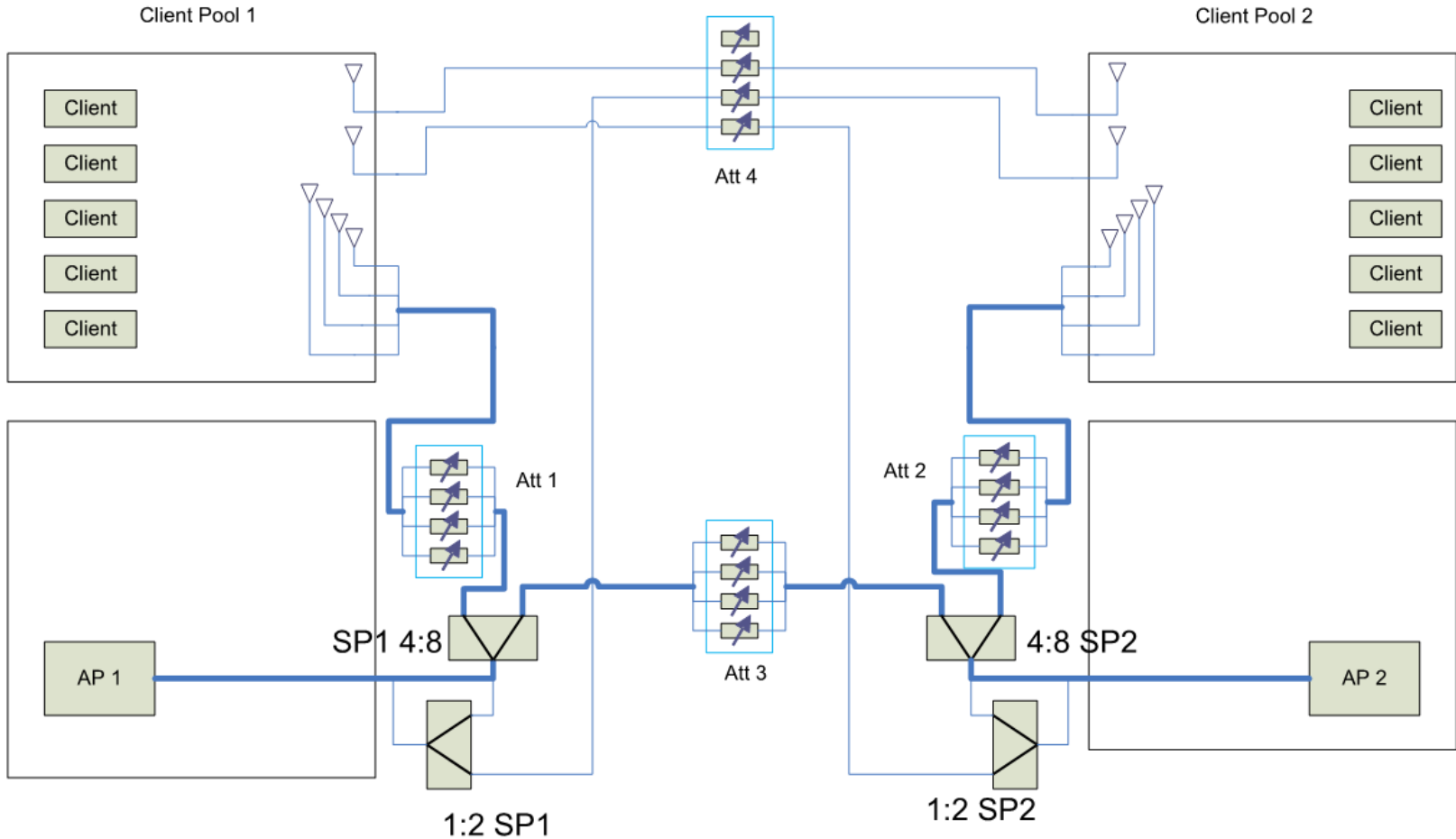
# References

**[1] LTE-LAA 3GPP Document 36.889-011**

**[2] IEEE 802.19 contribution 802.19-15/0055r2**