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Indoor Testing Protocol

Conduct indoor tests to determine if certain procedures correctly implement phase synchronicity between RTL SDRs on the Coherent Receiver.

Five indoor tests: ~5 trials each, each trial has three 500-sample recordings (AoA/Phase-diff/IQ info). Each recording takes place 5 seconds after each other.

* **Test 1:** Noise source/noise card. **Purpose:** Determine whether there is a problem inherent to the use of the noise card as the source for calibration. Use of wired RF will circumvent other issues with multipath interference, and will provide an unambiguous correct answer (90 degrees) to test results against.

1. Begin the test with the coherent receiver switched to the noise card

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Subtract the calculated phase difference to zero.

4. Switch to the RF inputs on the RTL SDRs

5. See if a wired sinusoidal signal source yields zero phase difference and a 90 degree angle of arrival (start data recording now).

* **Test 2**: Wired RF noise and signal source (I). **Purpose:** Identical to Test 1 except that this test will identify whether a wired pseudo-noise source other than that of the noise card results in the expected outcome (i.e. 90 degree phase), and represents an improvement over the noise card. The use of the wired RF source serves the same purpose as in Test 1.

1. Begin the test with the coherent receiver switched to RF inputs connected with a wired CC1310. Make sure the CC1310 is sending noise.

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Subtract the calculated phase difference to zero.

4. Program the CC1310 to send a sinusoidal signal from now on

5. See if the wired sinusoidal signal source yields zero phase difference and a 90 degree angle of arrival (start data recording now).

* **Test 3:** Wired RF noise and signal source (II). **Purpose:** Determine whether phase calibration requires a separate signal (i.e. sinusoidal signal) after the bulk offset corrections to achieve true calibration.

1. Begin the test with the coherent receiver switched to RF inputs connected with a wired CC1310. Make sure the CC1310 is sending noise.

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Program the CC1310 to send a sinusoidal signal from now on

4. Subtract the calculated phase difference to zero.

5. See if the wired sinusoidal signal source yields zero phase difference and a 90 degree angle of arrival (start data recording now).

* **Test 4:** Beacon (I). **Purpose:** Determine whether an unwired beacon transmitter (sending both noise and phase signals) results in correct phase offset and AOA calculation. Compare results of Test 4 with those of 1-3 to assess whether the primary problem lies in the use of wired versus unwired bulk offset and phase calibration signals.

1. Begin the test with the coherent receiver switched to RF inputs connected to antennas. Make sure the unwired CC1310 is sending noise.

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Program the CC1310 to send a sinusoidal signal from now on

4. Subtract the calculated phase difference to zero.

5. See if the sinusoidal signal yields zero phase difference and a 90 degree angle of arrival (start data recording now).

* **Test 5:** Beacon (II). **Purpose:** Determine whether unwired beacon sending only noise is sufficient for both bulk offset and phase offset calibration. Compare result with Test 4; if results are similar there is no need for a sinusoidal beacon signal, only a noise source beacon.

1. Begin the test with the coherent receiver switched to RF inputs connected to antennas. Make sure the unwired CC1310 is sending noise.

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Subtract the calculated phase difference to zero.

4. Program the CC1310 to send a sinusoidal signal from now on

5. See if the sinusoidal signal yields zero phase difference and a 90 degree angle of arrival (start data recording now).

Test 6: Beacon (III)

1. Begin the test with the coherent receiver switched to RF inputs connected to the noise card.

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Subtract the calculated phase difference to zero.

4. Switch RF Inputs to antennas. CC1310 sending sinusoid.

5. See if the sinusoidal signal yields zero phase difference and a 90 degree angle of arrival (start data recording now).

Test 7: Beacon (IV)

1. Begin the test with the coherent receiver switched to RF inputs connected to the noise card.

2. Cross-correlate the noise received at two RTL SDRs to correct for timing offsets

3. Switch RF Inputs to antennas. CC1310 sending sinusoid.

4. Subtract the calculated phase difference to zero.

5. See if the sinusoidal signal yields zero phase difference and a 90 degree angle of arrival (start data recording now).

Remark:

I recall that the phase difference of the noise signal (from the unwired CC1310) changed drastically depending on the angle of the CC1310 to the antenna array when we (Julian and I) conducted a brief indoor test before moving the system out to the baseball field.