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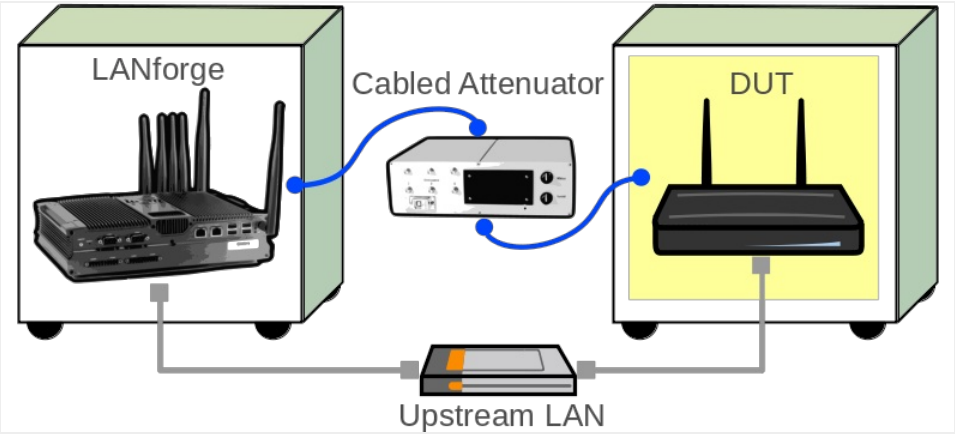
Calibrating TR-398 Issue-2 and Mesh on a 4-Chamber Setup

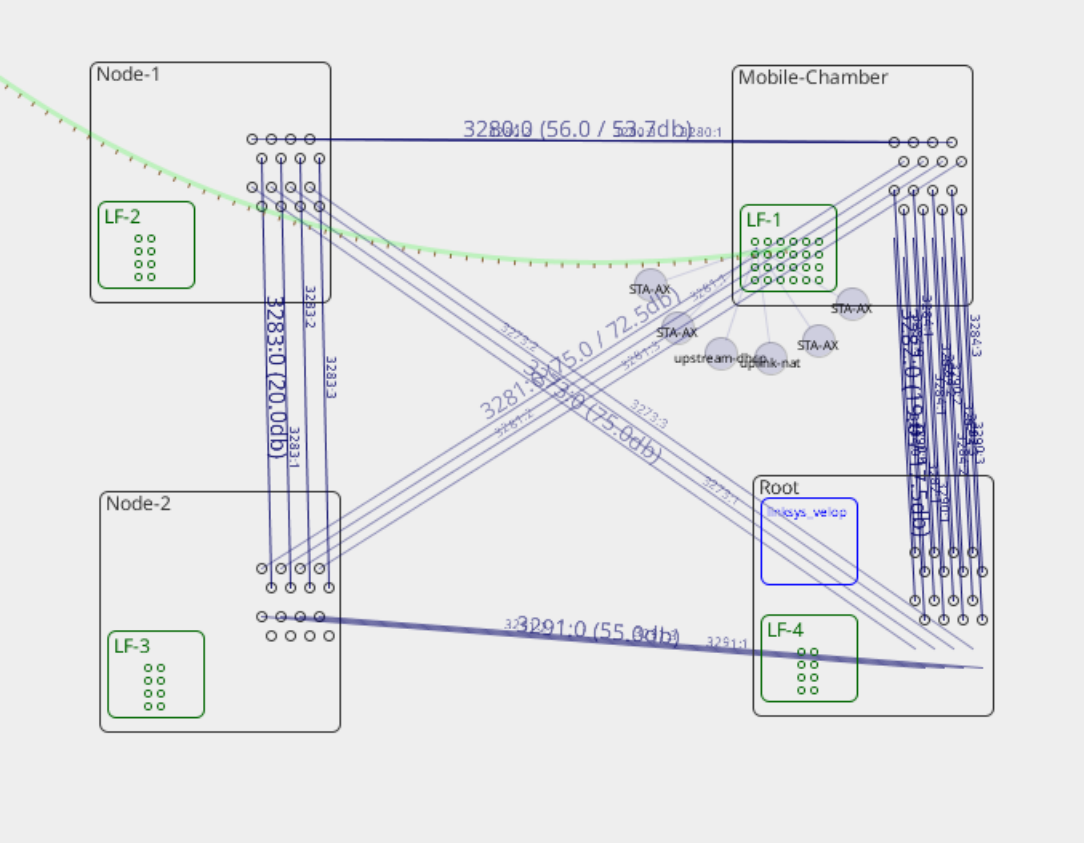
Goal: Setup and run a TR-398 Issue 2 test for an AP using a 6-radio version of the LANforge CT523c or similar system in order to test how well the AP can handle the various test cases specified in the TR-398 Issue 2 test document.

In this test scenario, a LANforge cluster (of a 1 523c and 3 521as) is used to emulate different station and AP scenarios and generate and receive traffic with an AP. This example assumes user has some experience with Chamber View, and has an appropriate LANforge system (fit for TR-398 Issue 2), programmable attenuators like the CT714 and some isolation chambers like the CT820a and CT840a. Please contact *support@candelatech.com* for assistance in setting up the TR-398 testbed.

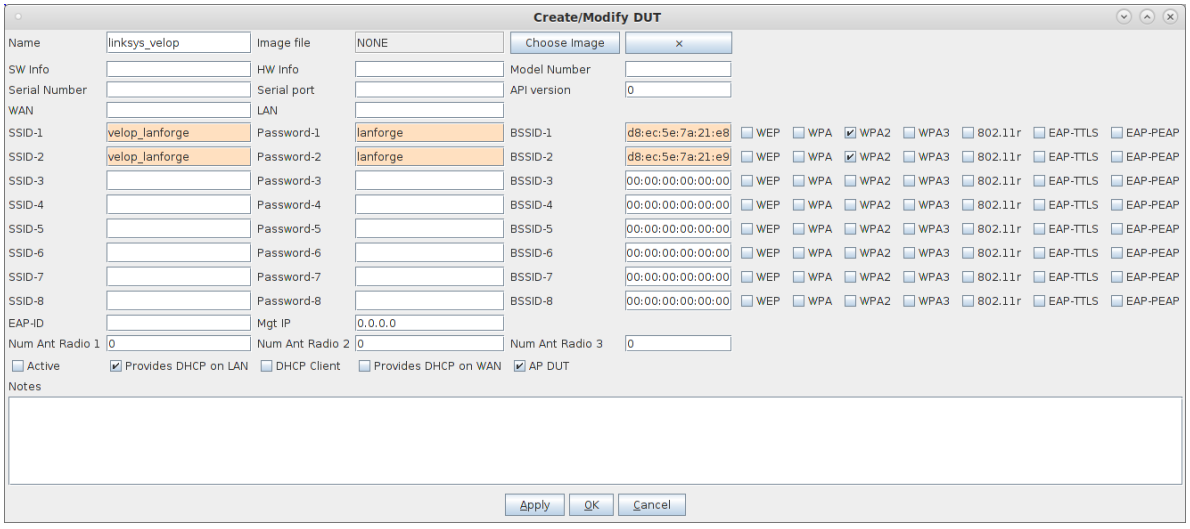


1. Configure Chamber View for TR-398 and Similar Tests.

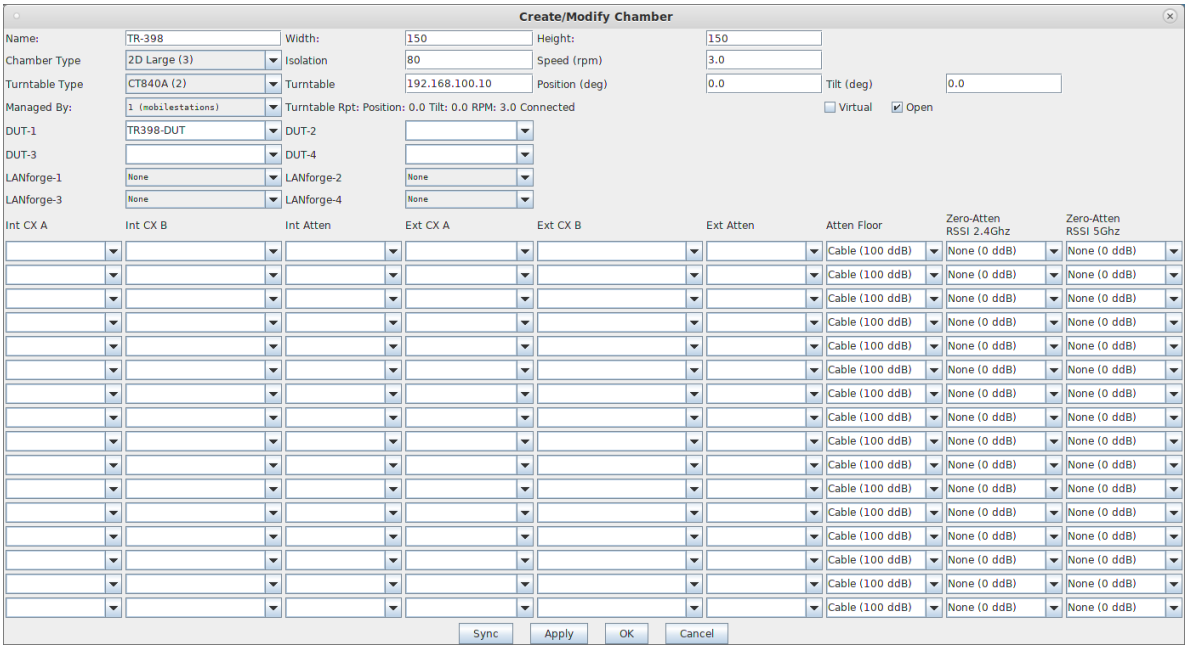
A. Open Chamber View by clicking on the 'Chamber View' button in the LANforge-GUI. If you have an appropriate scenario already created, please skip to the next section, otherwise you will need to build a scenario that matches your system. Right-click in Chamber View to create various objects. This cookbook will use the Chamber View scenario seen below.



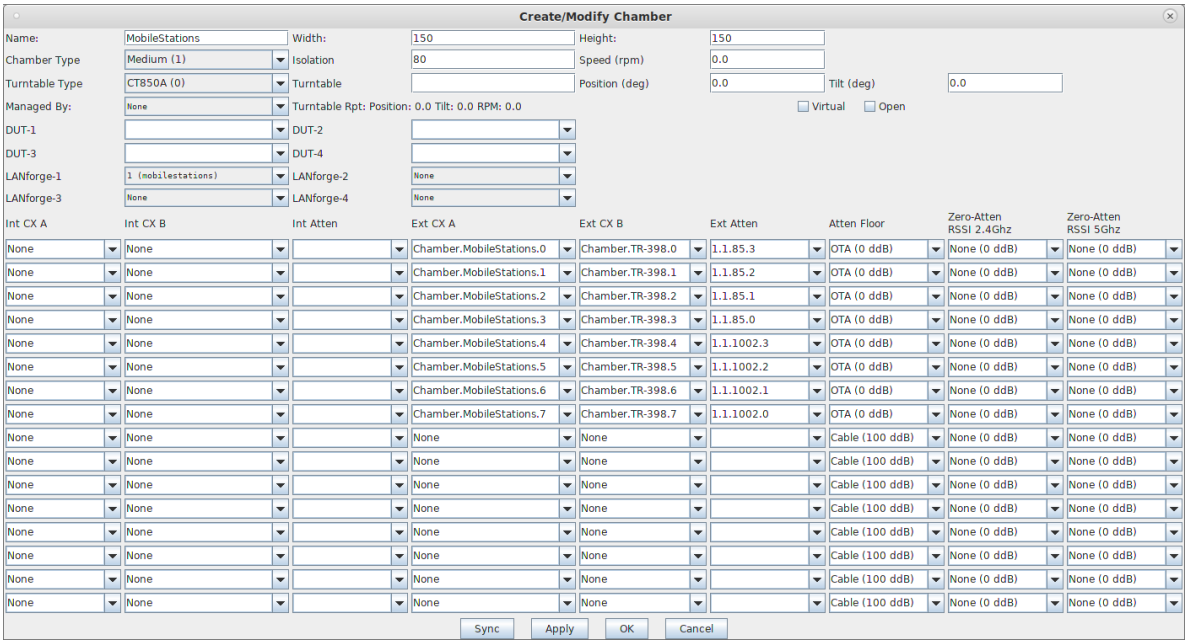
B. Create a Device Under Test (DUT) Profile that matches your AP. The BSSID is important to configure so that LANforge knows when it is connected to the correct AP. In a mesh scenario, 3 DUT objects may be created, one for each of the mesh AP chambers.



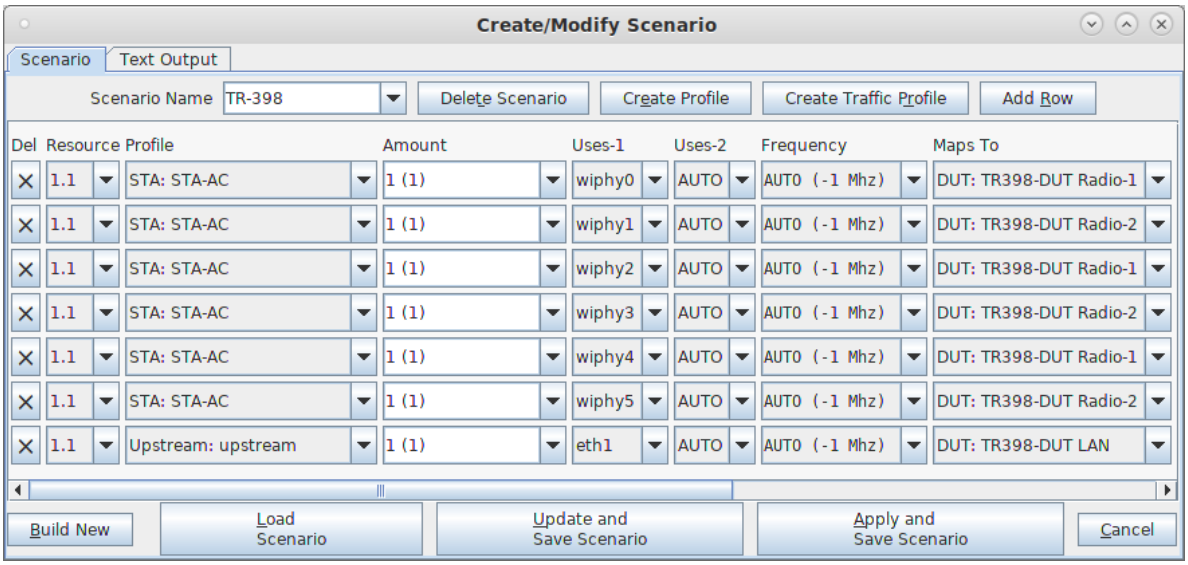
C. Create a chamber object to hold the DUT and add the DUT to that chamber. If you have no chambers, create a fake chamber, but the test will not be isolated and may not function as desired. The turntable configuration is different for different models of chambers, this example (bare IP address) is for the CT840a chamber.



D. Create a chamber object to hold the LANforge system and add the LANforge to it. Add connections from this chamber to the DUT chamber, specifying the proper Attenuator modules. Please note we use the 'OTA' attenuation floor since we have OTA connection between DUT and antennas inside the DUT chamber. Please view our other cookbook on setting up attenuator connections in LANforge.

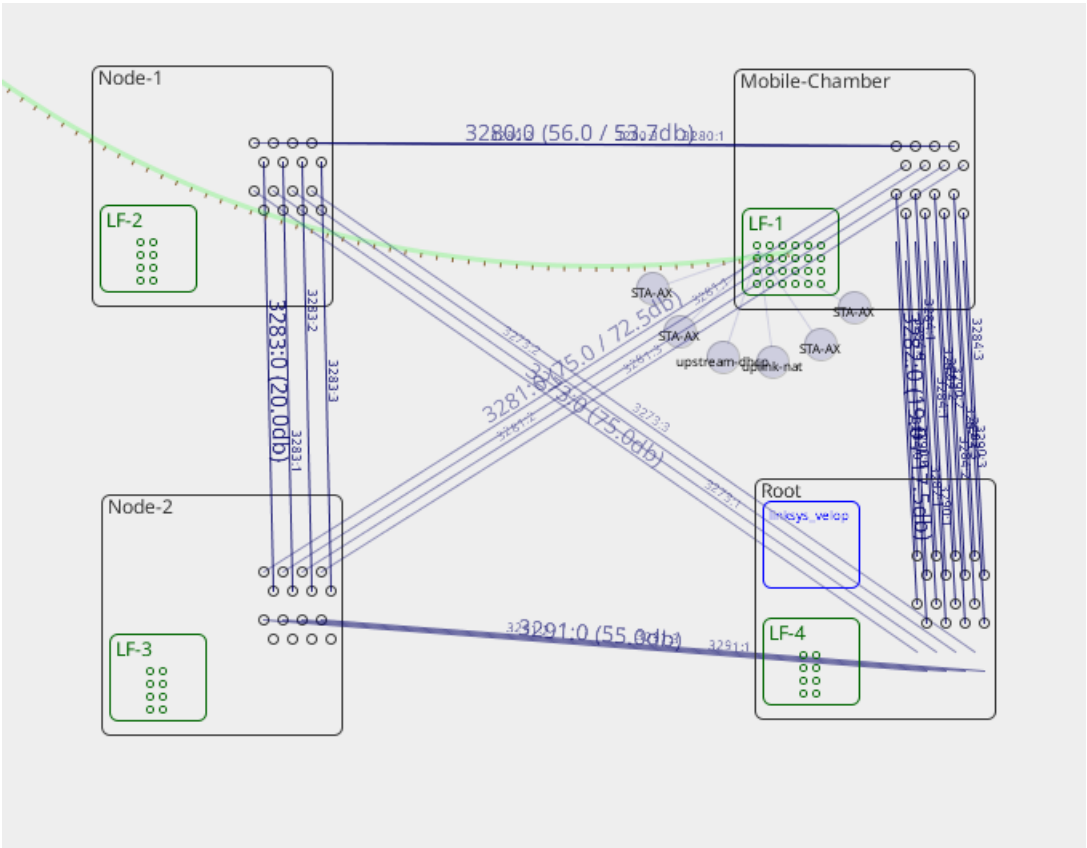


E. Configure a Chamber View Scenario and add the STA profile (mapped to desired wiphyX radio and DUT). Add an upstream profile mapped to DUT LAN side (or possibly WAN side if that is more appropriate for your DUT).

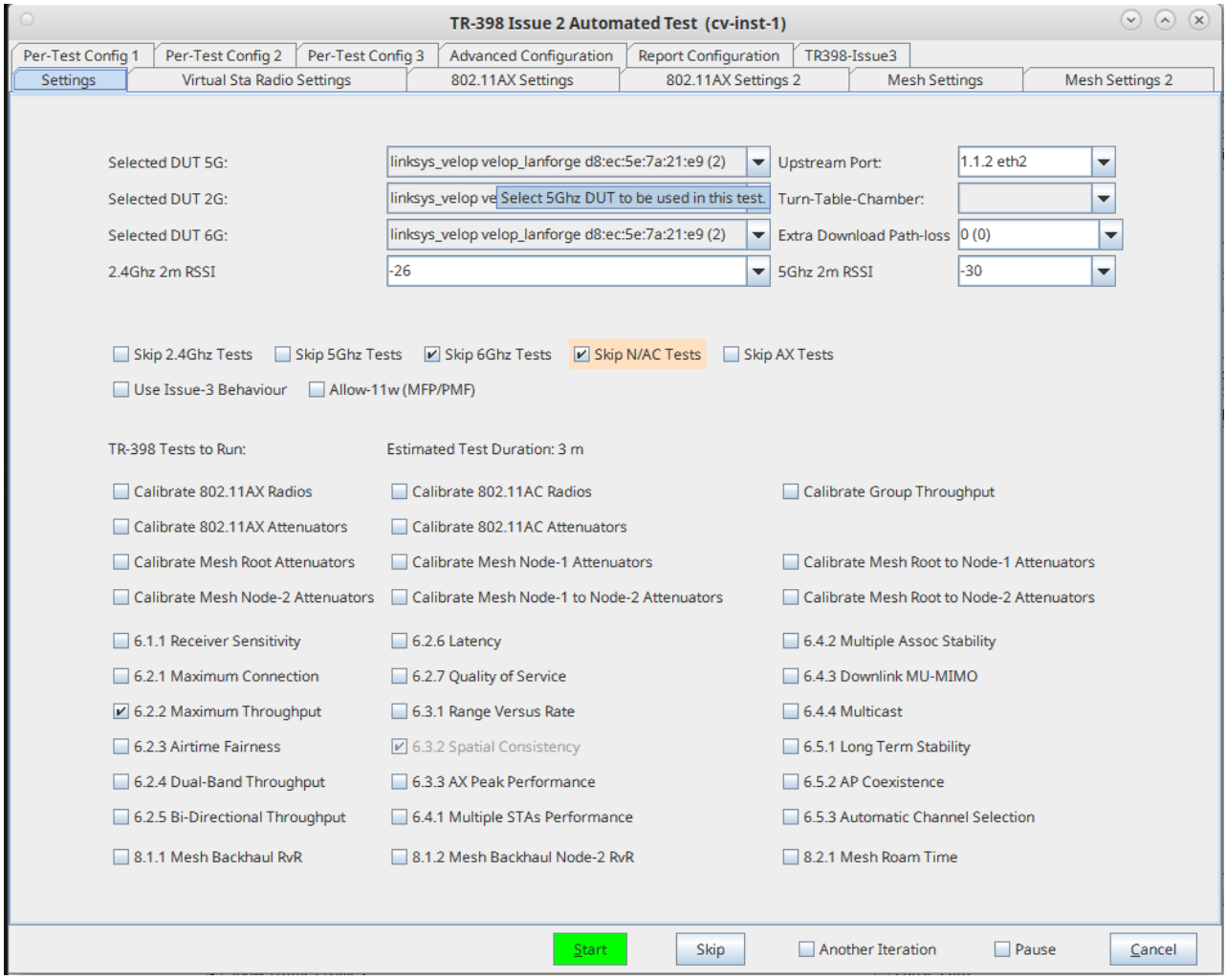


2. For TR398 tests, the DUT AP's front should face the antennas for the Group-1 stations. Or, optionally, one can use the Advanced configuration tab to specify the default turntable angle for non rotational tests.

3. Open Chamber View by clicking on the 'Chamber View' button in the LANforge-GUI. Load appropriate scenario. Apply the Scenario, then Build the scenario.

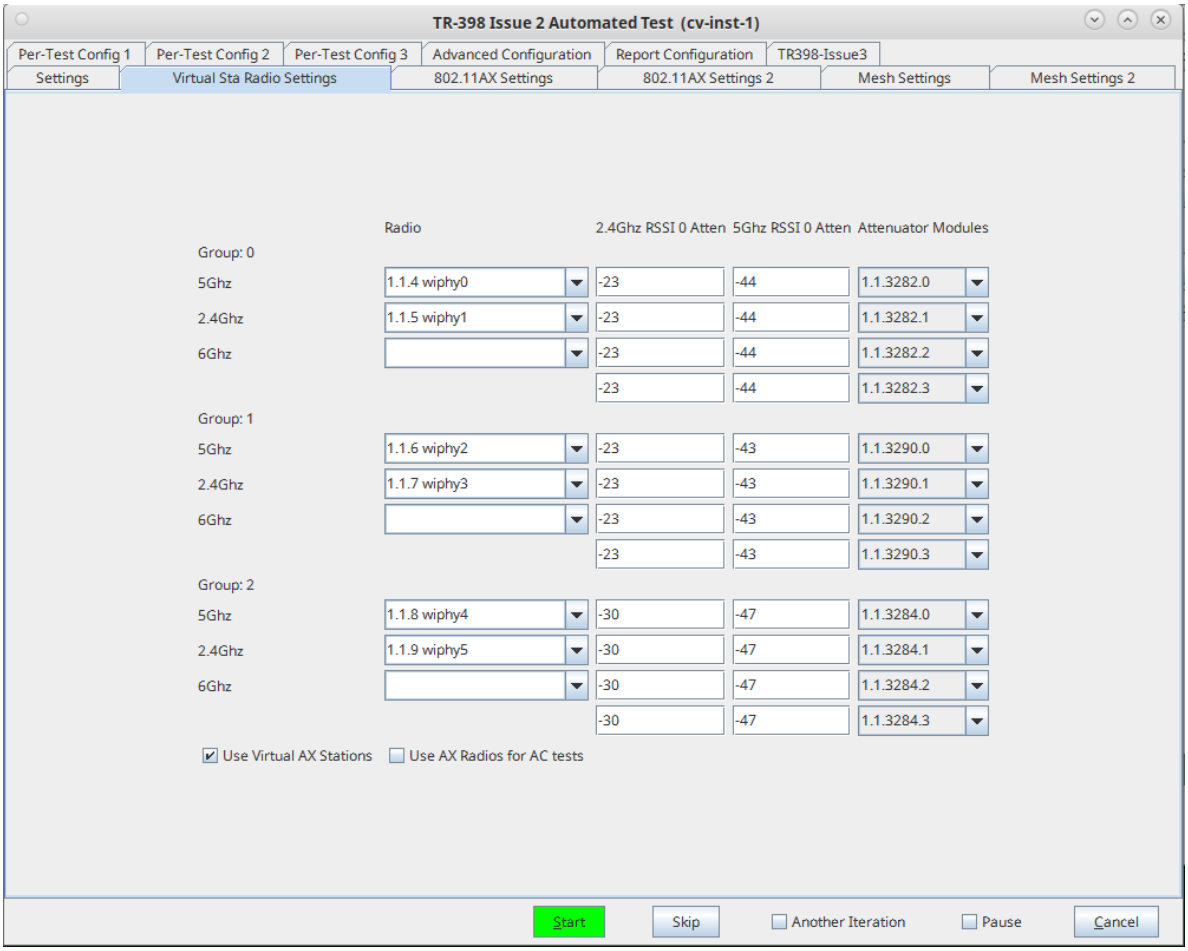


4. Select the **TR-398-Issue-2** test from *Tests* dropdown in the right panel. Then click *Run Test*. The following window below should pop up. In the *Settings* tab, set slots 'Selected DUT 5G', 'Selected DUT 2G', and 'Selected DUT 6G' the according BSSIDs found in the 'Root' Chamber. Also set the upstream port. In this example, the upstream port is the *eth2* port on the LANforge in *Mobile Stations* chamber.



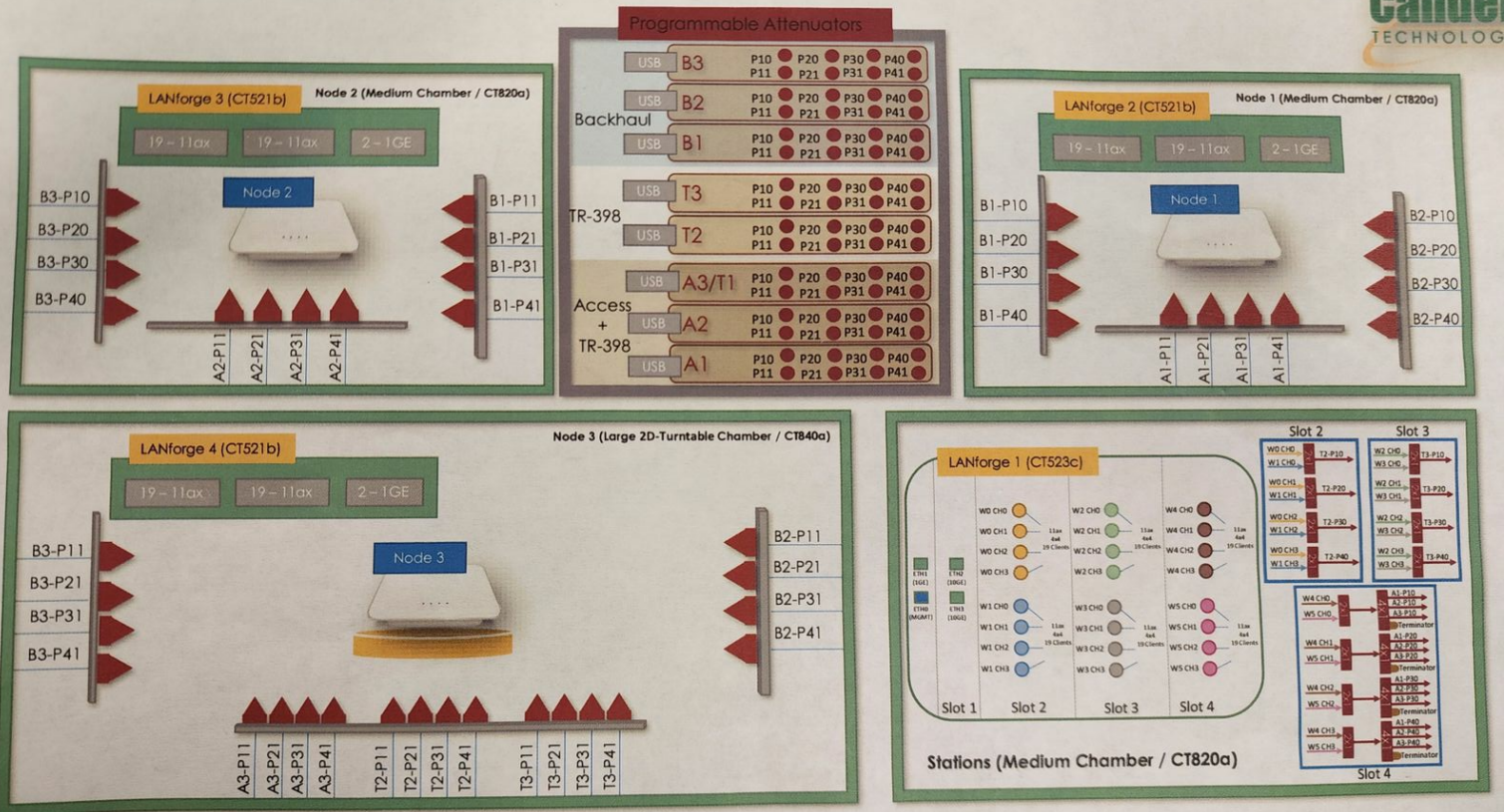
5. Configure the *Virtual Sta Radio Settings* tab.

A. Select the *Virtual Sta Radio Settings* tab. This tab is for radios that can have virtual stations on them (either AC, N, some AX). Notice that there are 3 groups here, this will be the 3 slots of radios (Slots 2, 3, 4) in the *Mobile Clients* Chamber. Visit the pictures in the next 2 steps to see close ups of the attenuator diagram that has the slots. Slot 2 (Group 0) has W0 ad W1 (wiphy0 and wiphy1). Slot 3(Group 1) has W2 and W3 (wiphy2 and wiphy3). Slot 4 (Group 2) has W4 and W5 (wiphy4 and wiphy5). Leave the '2.4Ghz RSSI 0 Atten' and '5Ghz RSSI 0 Atten' blank, those will be auto calculated when we calibrate the attenuators. Lastly, fill out the attenuator modules column (with the correct serial numbers that relate to each group). All these attenuators will be the TR-398 section of the attenuator stack. In this case, those are attenuators T1, T2 and T3. These attenuators are also all connecting the **Node 3/Root** chamber to the **Mobile Clients** chamber. Match the according attenuator to each group on the attenuator diagram. Fill out all the dropdowns under 'Attenuator Modules' for ports 0-3 on the matching attenuator. Select the 'Use Virtual AX Stations' checkbox.

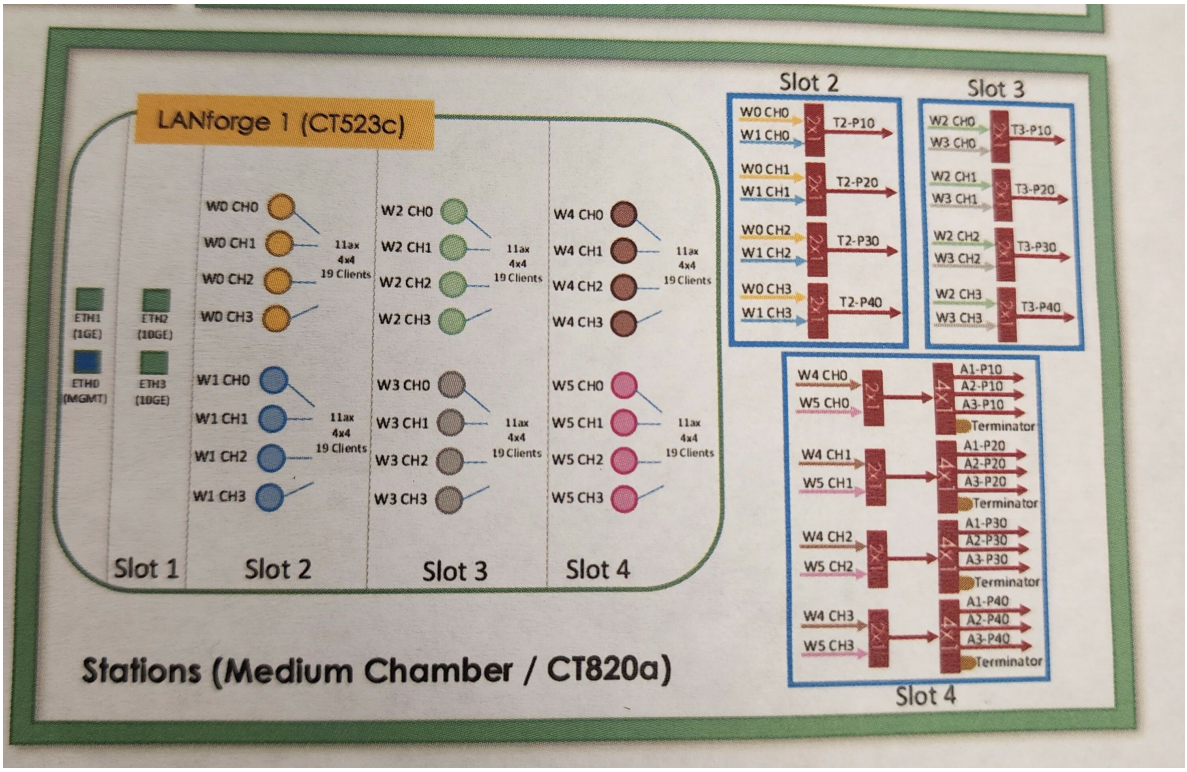


B. Below is the attenuator diagram of the 4-chamber setup in the example. Another name for the *Node-3* Chamber is the *Root* chamber.

Three Node Mesh + TR-398



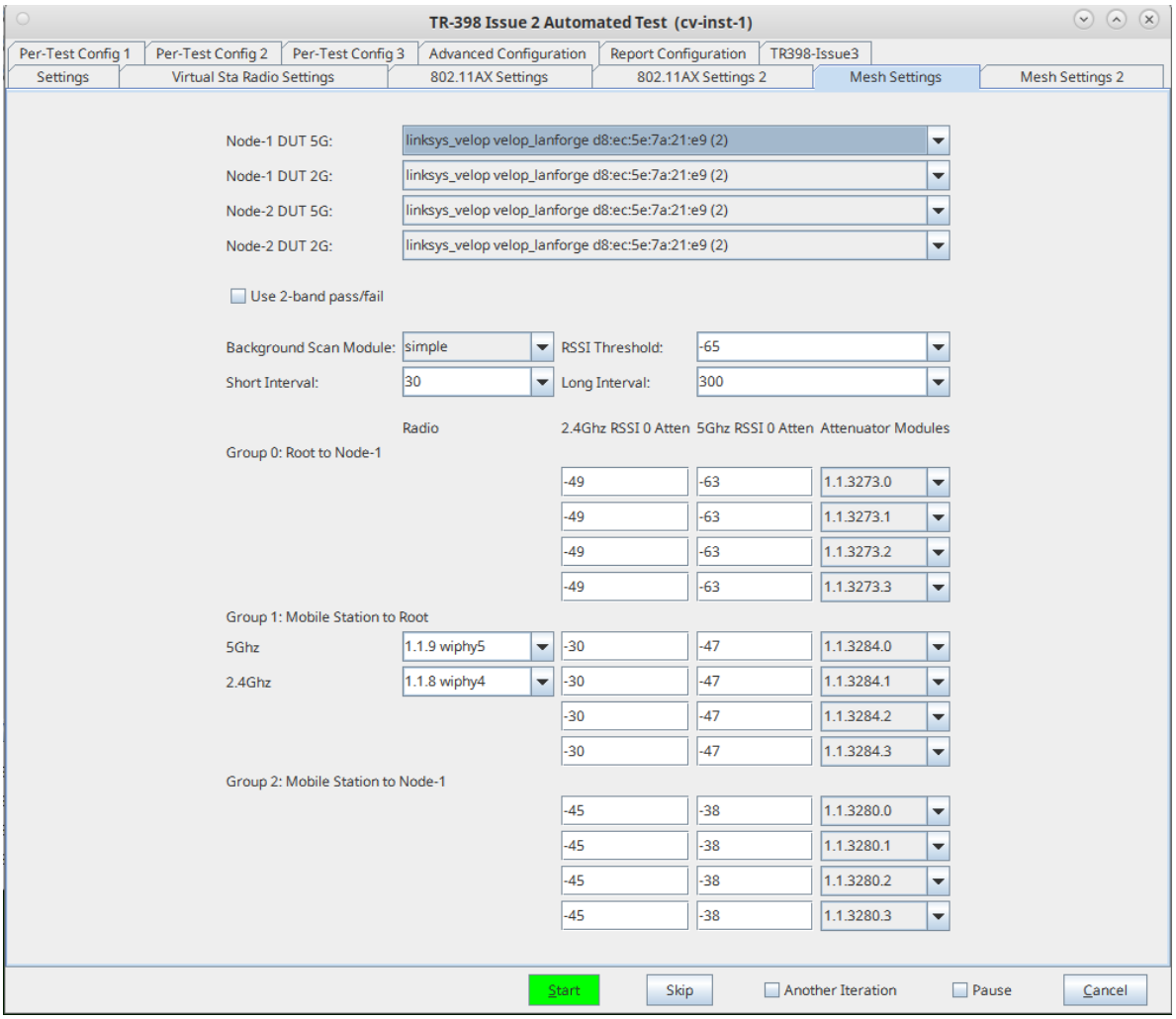
C. Below is a closer look at the bottom right box of the attenuator diagram in the step above.



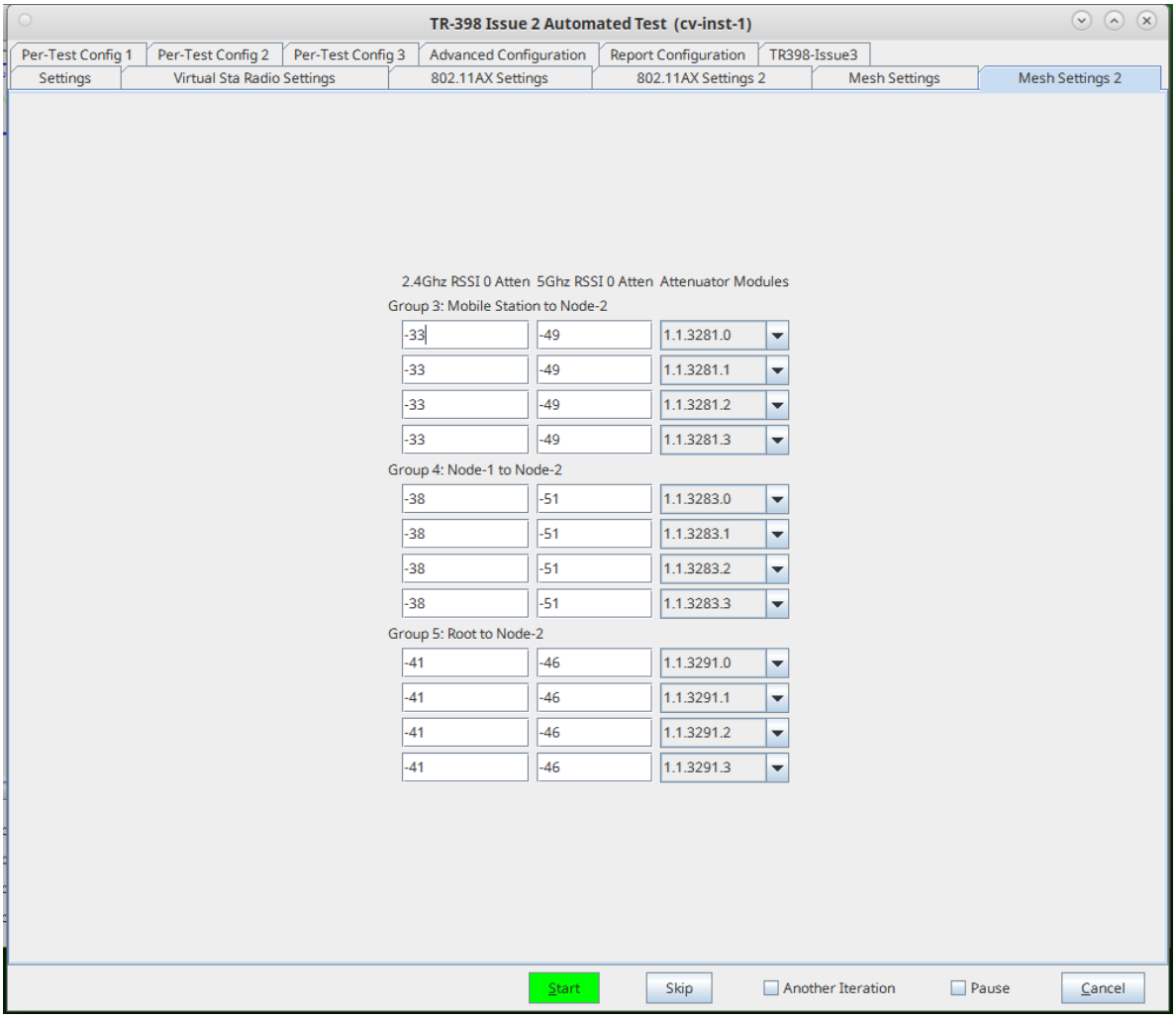
D. Below are the serial numbers of the attenuator stack. They are stacked in the same order as the attenuator diagram.

6. Configure the *802.11 AX Settings* (1 & 2) tabs. Please contact *support@candelatech.com* for assistance in filling out these tabs. These settings only apply to AX capable radios that do not support virtual stations.
7. Configure the *Mesh Settings* and *Mesh Settings 2* tabs. If the test bed being setup has no need for Mesh, please skip this step.

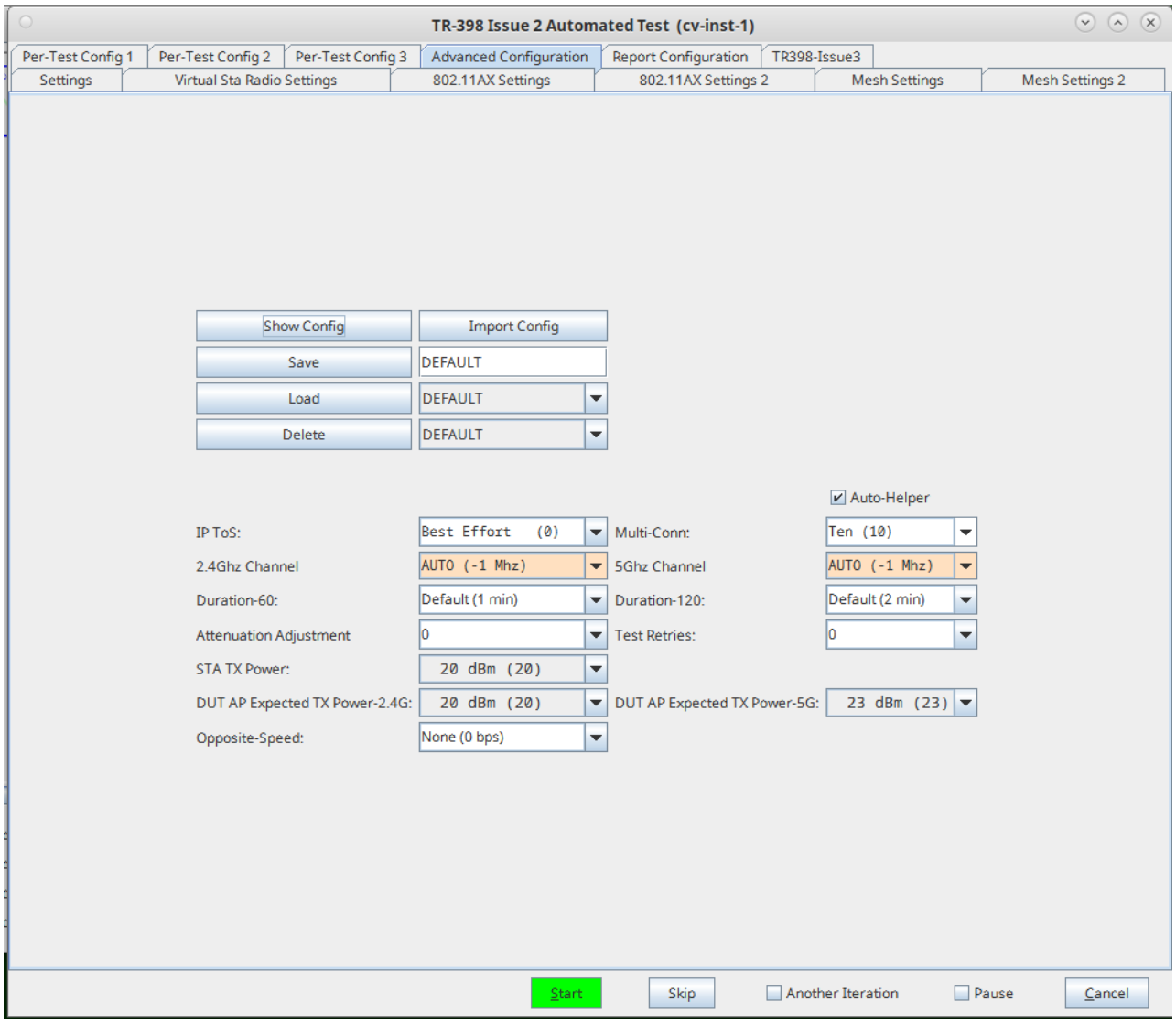
A. Select the *Mesh Settings* tab. The picture below is a final version of the calibrated mesh setup. In an un-calibrated version (yours), all the rows in the 'RSSI 0 Atten' columns will be empty. Fill out select the 2.4Ghz and 5Ghz BSSIDs for both Node 1 and Node 2 Chambers in the top section. Fill out the 'Atten Modules' column for each group (using ports 0-3 for each attenuator). To find out the correct attenuator, trace the attenuator diagram to find out which attenuator connects which 2 Chambers. In Group 1 (in this section), use the attenuator and radios used in 'Group 2' of the *Virtual Sta Radio Settings* tab. This attenuator is both TR398 and Access (A3/T1), so it belongs in both *Virtual Sta Radio Settings* and *Mesh Settings*



B. Fill out the *Mesh Settings 2* tab similarly to *Mesh Settings 1*



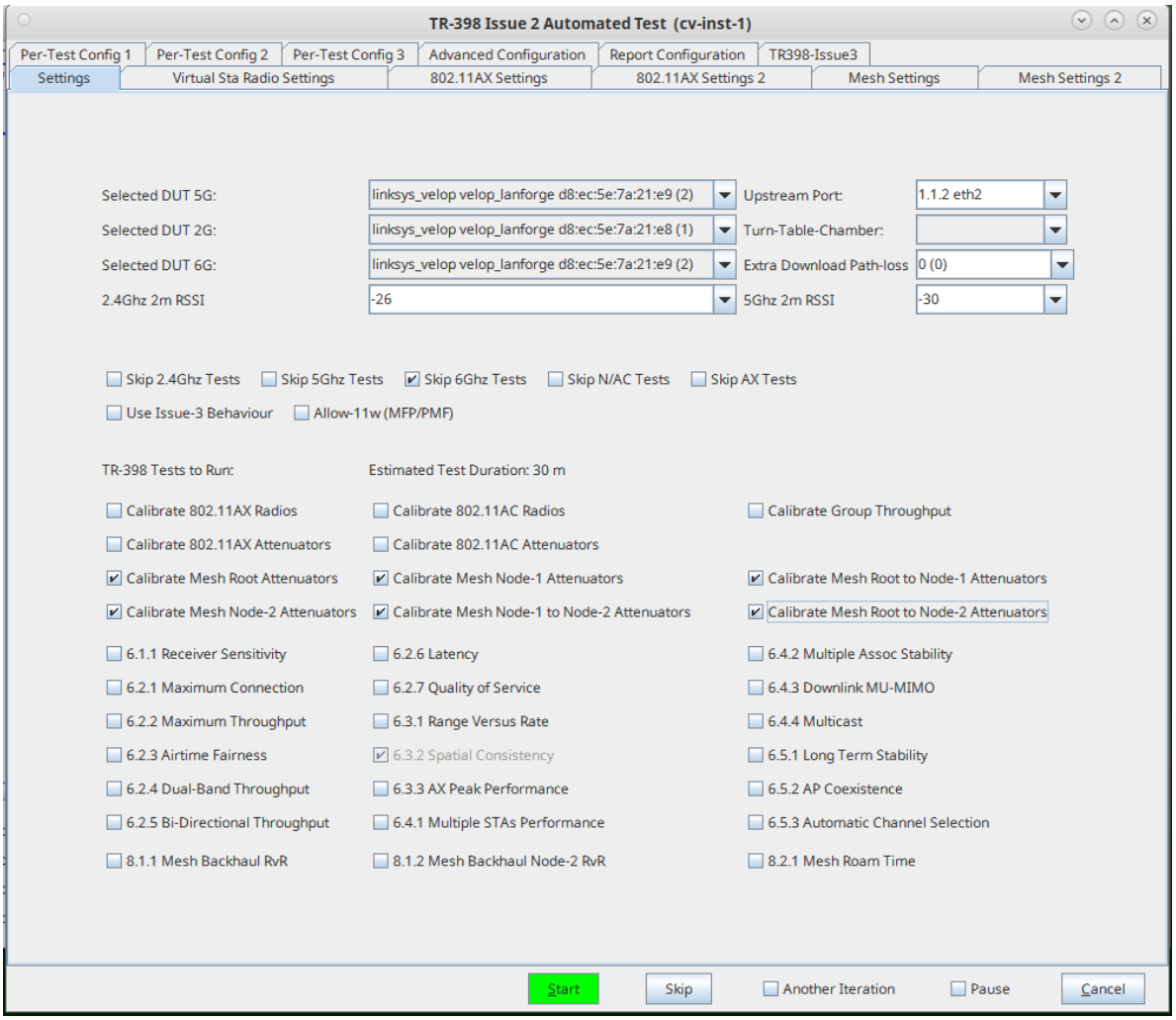
8. Click on the *Advanced Configuration* tab. Set 2.4GHz channel and 5GHz channel to '-1'/ AUTO. AUTO won't work for all cases (like the ap-coex test), but will work for most of them.



9. Calibrate Zero Attenuation RSSI for all chamber to chamber connections and attenuators. This also verifies attenuators are connected and functioning as expected. We are calculating 0 atten against the LANforge.
    A. Start by setting the LANforge in the center of all the chambers to be calibrated, with the LANforge wiphy0 antenna pointing straight up, while the other antennas lay flat. Then point all the chamber antennas to the LANforge wiphy0 antenna sticking straight up.

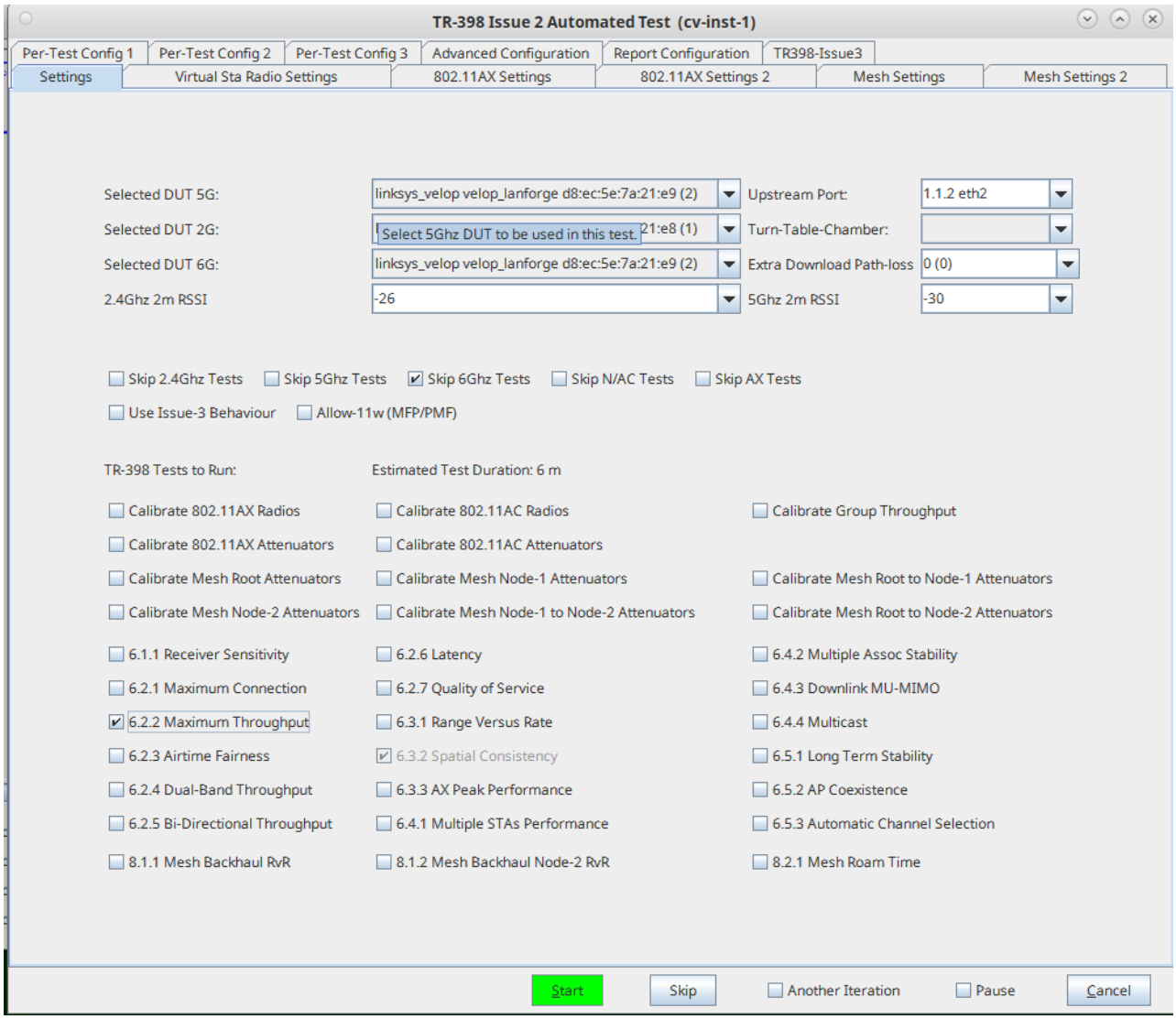
    B. Calibrate the attenuators first. In this example, we calibrated the 802.11AC attenuators first. Similarly in other testbed setups, if there are AX radios or single-sta radios, calibrate the attenuators for those first (**one checkbox at a time**). Do 3 trials of each attenuator calibration and take the average as your final value to put as the box values. Make sure to rotate 'AP' and 'station' LANforge (if able to and the LANforge is not cabled into the wall) with the LANforge W0 antennas still pointed in the middle of all the chamber antennas on every trial.

C. In the image below, similarly as above, run each of the checkboxes **one** at a time, until all are run. Do 3 trials of path calibration and take the average as your final value. Make sure to rotate 'AP' and 'station' LANforge (if able to and the LANforge is not cabled into the wall) with the LANforge W0 antennas still pointed in the middle of all the chamber antennas on every trial.



10. At this point, all the 0 Atten values should be filled out (for Virtual Sta Radio Settings and Mesh Settings 1 & 2 tabs in this example). **Save these values as a database in both the TR398 window database and the LANforge 'Status' tab database sections. May also be good to take screenshots of all the final values and save it off-LANforge.**

11. Run a TR-398 Issue 2 throughput test. Select the *6.2.2 Maximum Throughput* checkbox to run the test. After verifying the throughput test is working as expected, select and run other tests as desired.



12. When the test is complete, click the **Save HTML** button to save an HTML report and generate the PDF. The PDF file will be linked from the HTML page. Another option is to click 'Save PDF' and the browser will be directed to open the pdf file directly. Please see this passing example TR-398 Issue 2 Maximum Throughput Test Report .