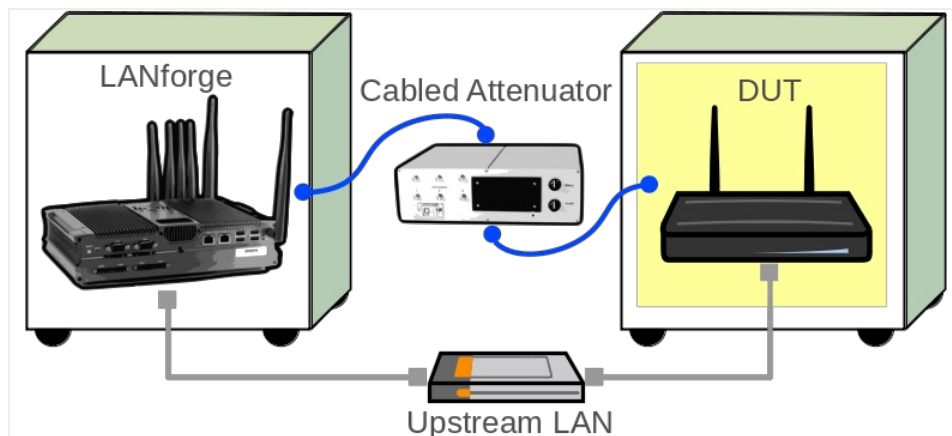


Testing AP with automated TR-398 scenario

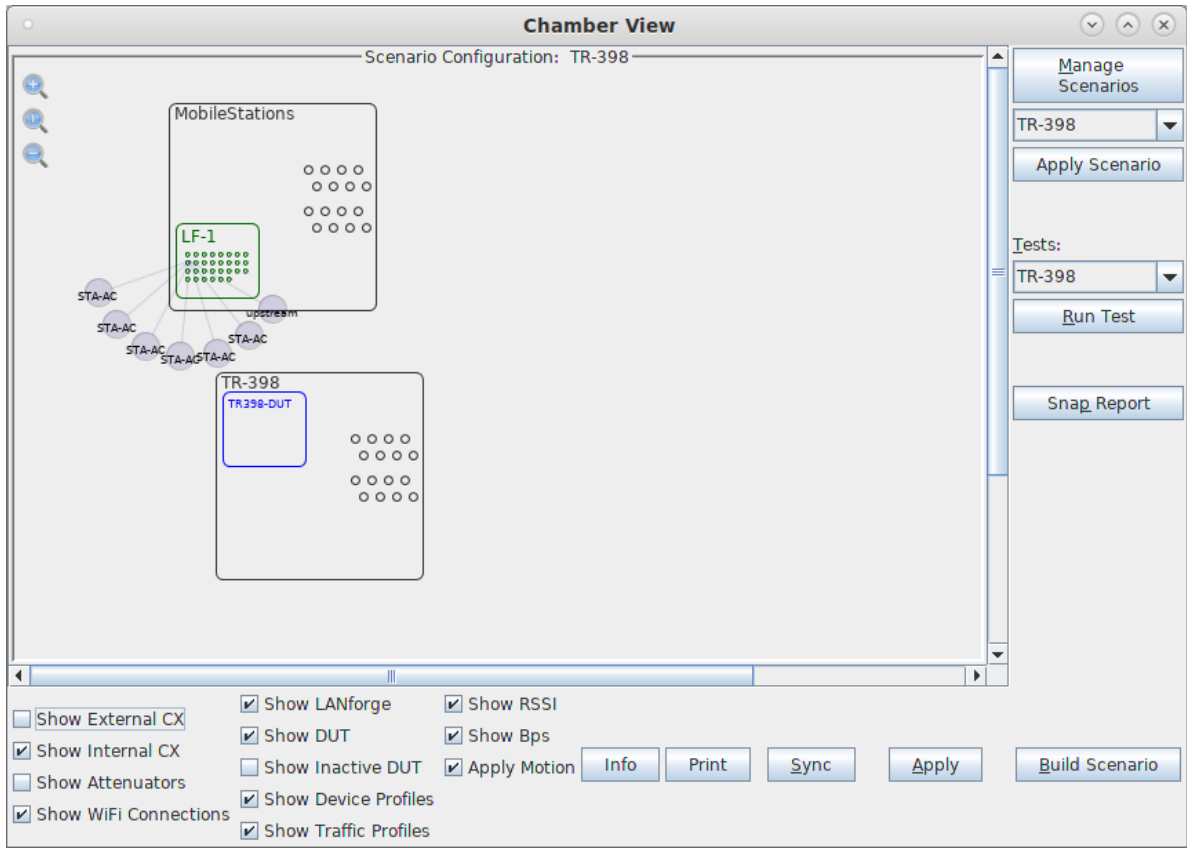
Goal: Setup and run a TR-398 test for an AP using a 6-radio version of the LANforge CT523c or similar system in order to test how well the AP can handle the various test cases specified in the TR-398 test document.

In this test scenario, the LANforge CT523c is used to emulate different station and AP scenarios and generate and receive traffic through an AP. This example assumes you have some experience with Chamber View, and that you have an appropriate LANforge system, programmable attenuators like the CT714 and two isolation chambers like the CT820a and CT840a. The AP should be in the chamber with the 2D turntable, the LANforge system is in the other chamber, and the attenuators are cabled between them. This feature requires LANforge version 5.4.1 or higher and the LANforge TR-398 automation software license.



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, then skip to the next section, otherwise you will need to build a scenario that matches your system. You can right-click in Chamber View to create various objects. In this example, the 'MobileStations' chamber holds the LANforge, and the TR-398 chamber holds the Device Under Test. Your configuration should look like this when these steps are complete.



- B. Create a Device Under Test (DUT) Profile that matches your AP. The BSSID is important to be configured so that LANforge knows when it is connected to the correct AP.

The screenshot shows the 'Create/Modify DUT' dialog box. The title bar says 'Create/Modify DUT'. The 'Name' field is 'TR398-DUT'. The 'Image file' field is 'NONE' with a 'Choose Image' button and a close button. The dialog is divided into two columns of fields. The left column contains: 'SW Info', 'Model Number', 'Serial port', 'LAN', 'SSID-1' (s-lanforge5), 'SSID-2' (s-lanforge2), 'SSID-3', 'Mgt IP' (0.0.0.0), 'Ant-2' (0), 'BSSID-1' (00:00:00:ff:b4:ad), 'BSSID-3' (00:00:00:00:00:00), 'STA DUT', 'WPA3', and 'Provides DHCP on WAN'. The right column contains: 'HW Info', 'Serial Number', 'WAN', 'API version' (0), 'Password-1' (lanforge123), 'Password-2' (lanforge123), 'Password-3', 'Ant-1' (0), 'Ant-3' (0), 'BSSID-2' (00:00:00:ff:b4:aa), 'Active' (checked), 'AP DUT' (checked), 'WPA' (checked), 'WPA2' (checked), '802.11r', '802.1x EAP-TTLS', and 'Provides DHCP on LAN' (checked). At the bottom, there are 'Apply', 'OK', and 'Cancel' buttons.

- 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](#).

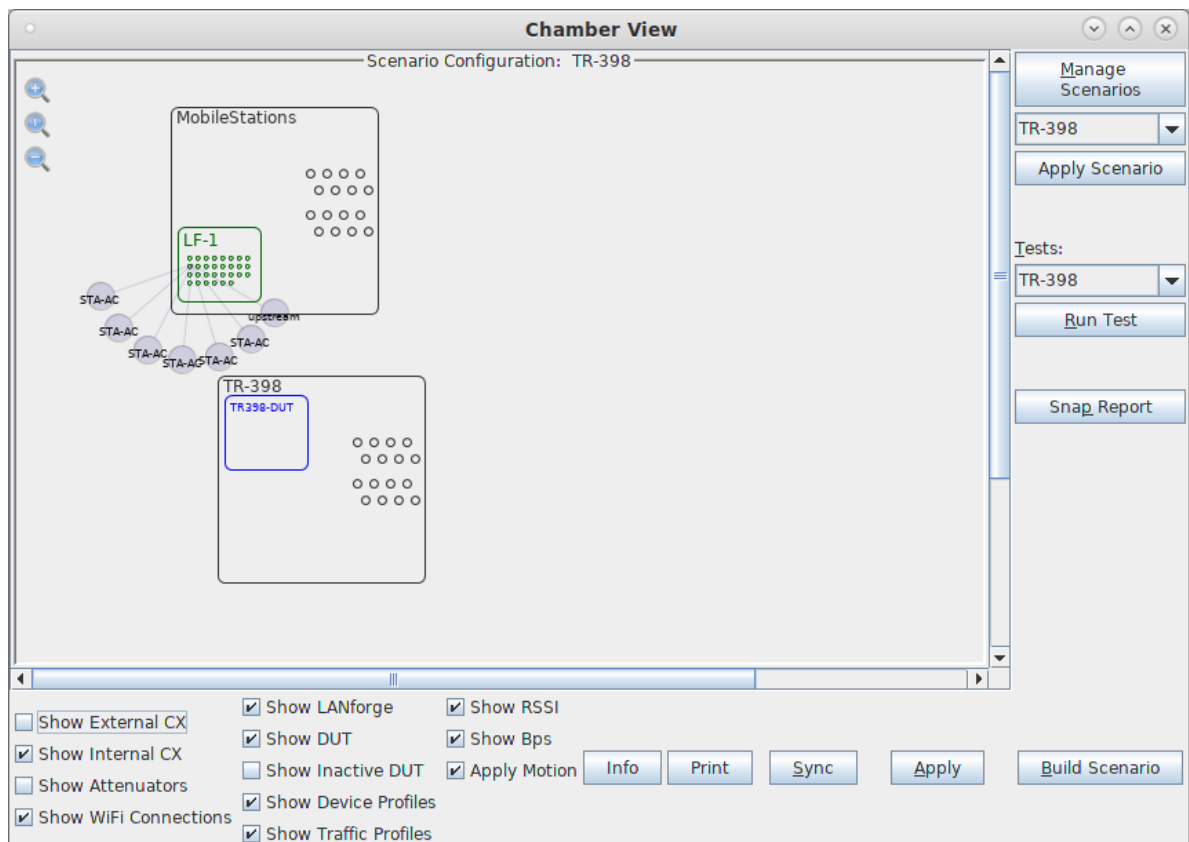
Create/Modify Chamber									
Name:	MobileStations	Width:	150	Height:	150				
Chamber Type	Medium (1)	Isolation	80	Speed (rpm)	0.0				
Turntable Type	CT850A (0)	Turntable		Position (deg)	0.0	Tilt (deg)	0.0		
Managed By:	None	Turntable Rpt: Position: 0.0 Tilt: 0.0 RPM: 0.0				☐ Virtual	☐ Open		
DUT-1		DUT-2							
DUT-3		DUT-4							
LANforge-1	1 (mobilestations)	LANforge-2	None						
LANforge-3	None	LANforge-4	None						
Int CX A	Int CX B	Int Atten	Ext CX A	Ext CX B	Ext Atten	Atten Floor	Zero-Atten RSSI 2.4Ghz	Zero-Atten RSSI 5Ghz	
None	None		Chamber.MobileStations.0	Chamber.TR-398.0	1.1.85.3	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.1	Chamber.TR-398.1	1.1.85.2	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.2	Chamber.TR-398.2	1.1.85.1	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.3	Chamber.TR-398.3	1.1.85.0	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.4	Chamber.TR-398.4	1.1.1002.3	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.5	Chamber.TR-398.5	1.1.1002.2	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.6	Chamber.TR-398.6	1.1.1002.1	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None		Chamber.MobileStations.7	Chamber.TR-398.7	1.1.1002.0	OTA (0 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	
None	None	None	None	None		Cable (100 ddb)	None (0 ddb)	None (0 ddb)	

- 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).

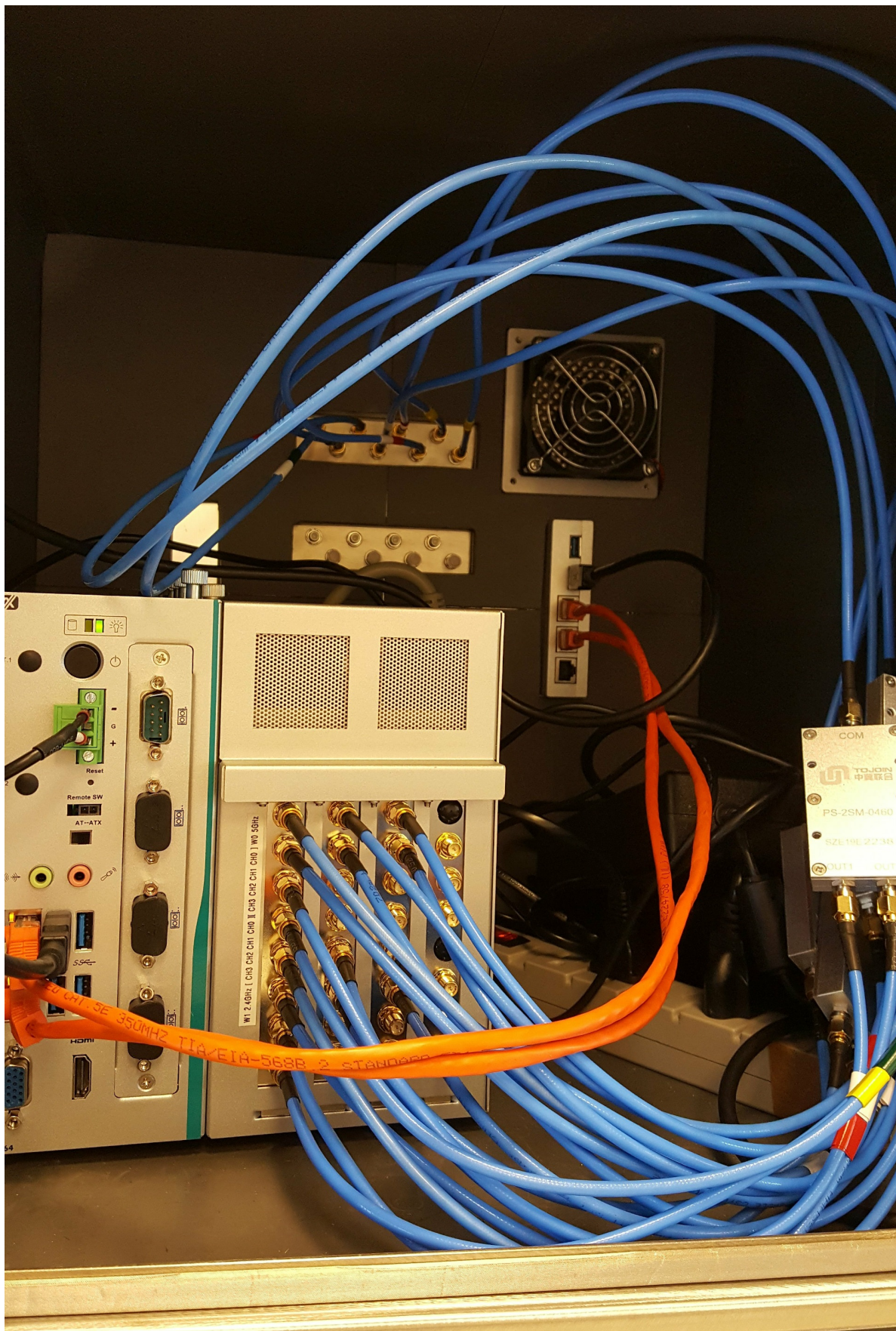
Del	Resource Profile	Amount	Uses-1	Uses-2	Frequency	Maps To
X	1.1 STA: STA-AC	1 (1)	wiphy0	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT Radio-1
X	1.1 STA: STA-AC	1 (1)	wiphy1	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT Radio-2
X	1.1 STA: STA-AC	1 (1)	wiphy2	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT Radio-1
X	1.1 STA: STA-AC	1 (1)	wiphy3	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT Radio-2
X	1.1 STA: STA-AC	1 (1)	wiphy4	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT Radio-1
X	1.1 STA: STA-AC	1 (1)	wiphy5	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT Radio-2
X	1.1 Upstream: upstream	1 (1)	eth1	AUTO	AUTO (-1 Mhz)	DUT: TR398-DUT LAN

2. Use Chamber View for TR-398 test.

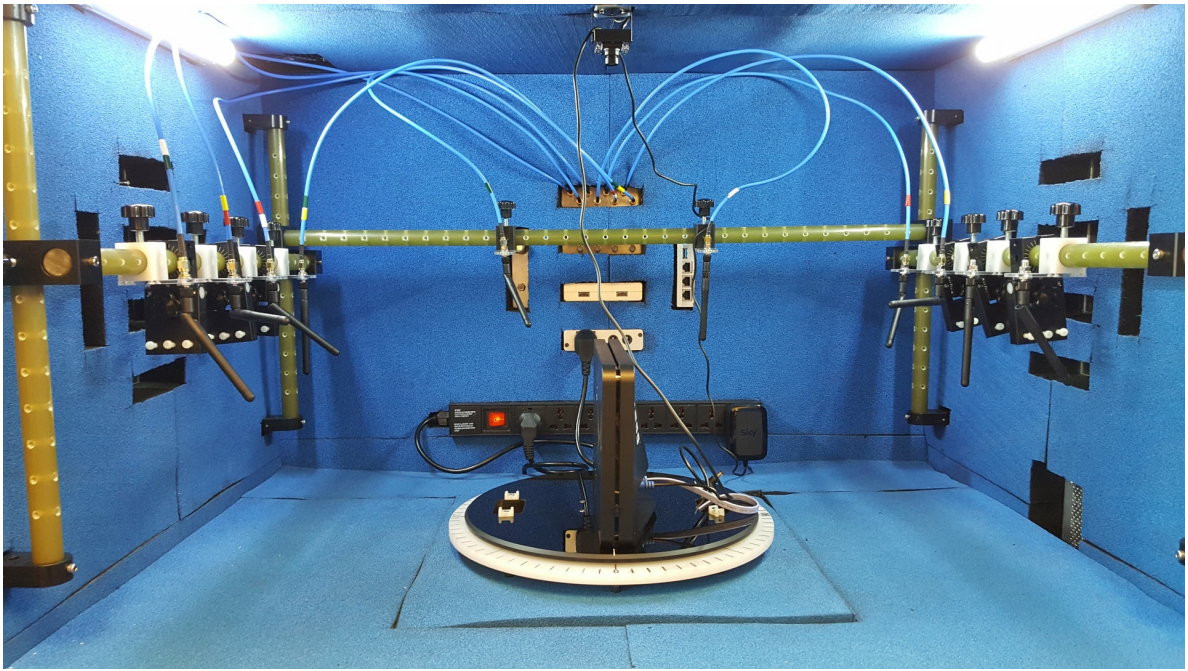
- A. Open Chamber View by clicking on the 'Chamber View' button in the LANforge-GUI. Load appropriate scenario. Apply the Scenario, then Build the scenario.



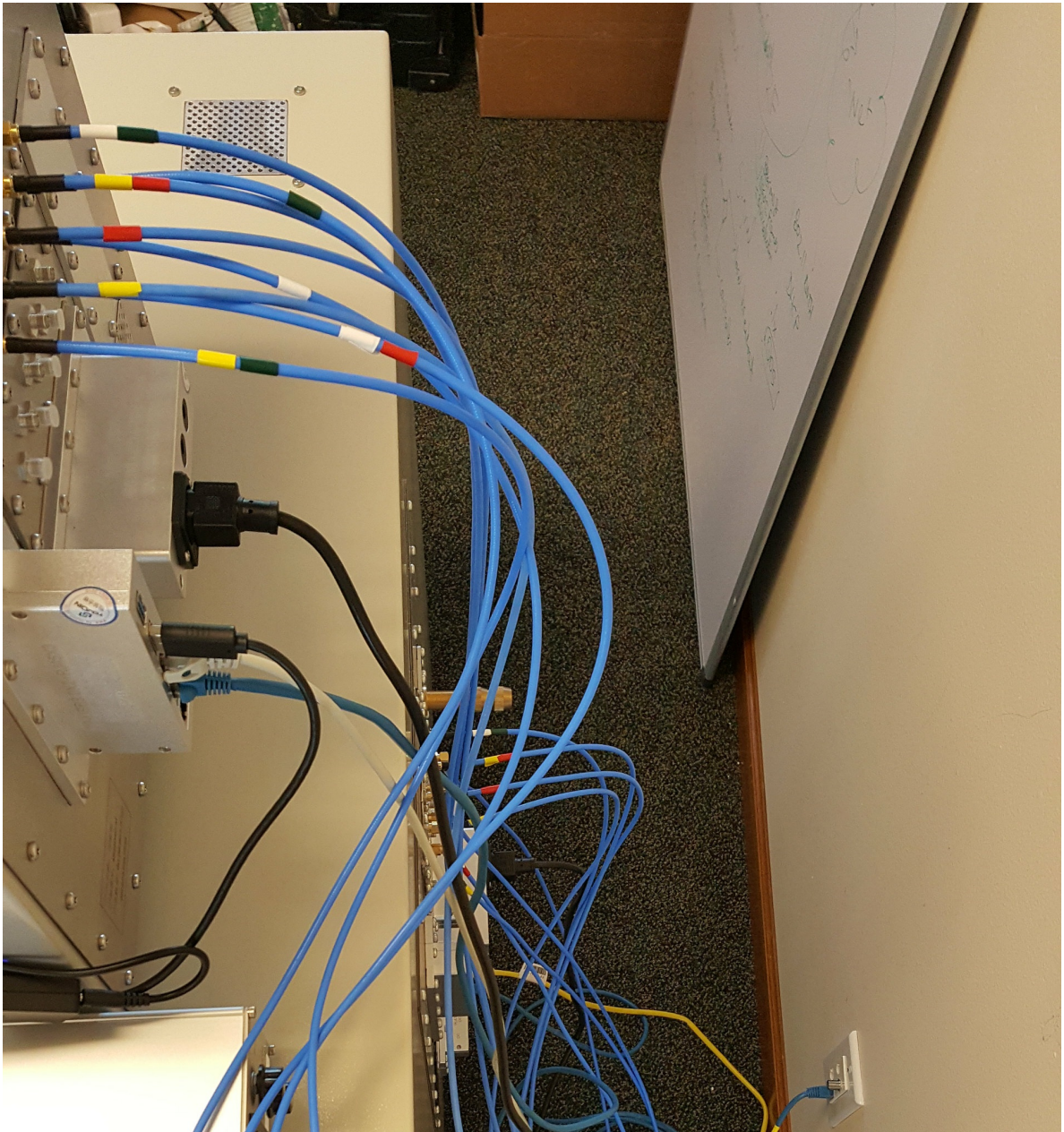
- B. To help make the cable routing easier to understand, you may wish to color-code the cables with tape or other similar markings.. Inside of the LANforge chamber:

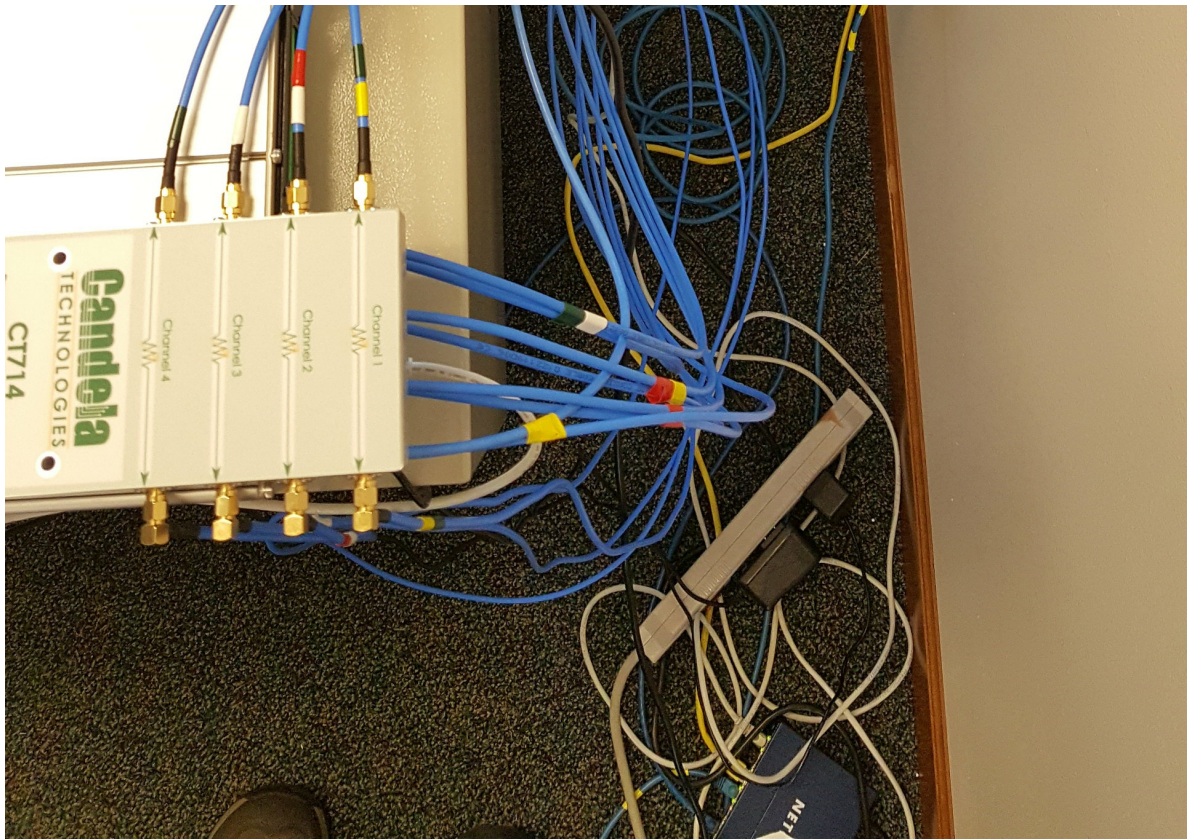


C. Inside of the DUT chamber:

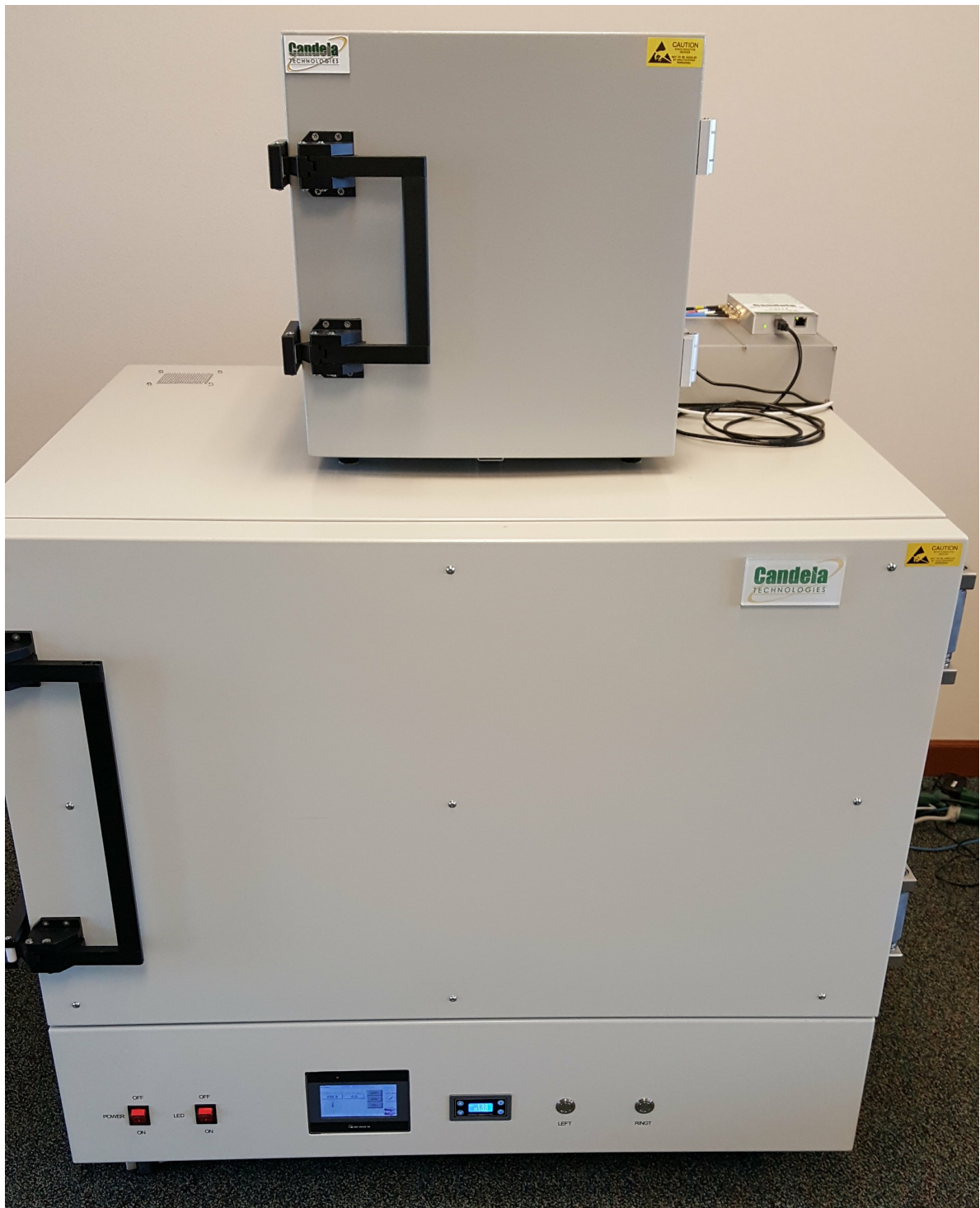


D. Outside, back view:





E. Front view, all closed up and ready to test:



- F. Select the **TR-398** test and click **Run Test**. You should see the TR-398 Test configuration window pop up. It will remember the last configuration for most fields. Select the 2.4 and 5Ghz DUT, turn-table chamber, and carefully associate the radios with correct attenuator modules. For the first run, we will just run the calibration test to auto-configure the path loss by adjusting the attenuators and testing RSSI:

TR-398 Automated Test

Settings

Advanced Configuration

Report Configuration

Selected DUT 5G:

TR398-DUT s-lanforge5

Selected DUT 2G:

TR398-DUT s-lanforge2

2.4Ghz 2m RSSI

-24

Extra Download Path-loss

3

Upstream Port:

1.1.1 eth1

Turn-Table-Chamber:

TR-398

5Ghz 2m RSSI

-32

	Radio	2.4Ghz RSSI 0 Atten	5Ghz RSSI 0 Atten	Attenuator Modules
Group: 0				
5Ghz	1.1.2 wiphy0	-28	-20	1.1.85.3
2.4Ghz	1.1.3 wiphy1	-28	-20	1.1.85.2
		-28	-20	1.1.1002.1
		-28	-20	1.1.1002.0
Group: 1				
5Ghz	1.1.4 wiphy2	-20	-42	1.1.85.1
2.4Ghz	1.1.5 wiphy3	-20	-42	1.1.85.0
		-20	-42	
		-20	-42	
Group: 2				
5Ghz	1.1.6 wiphy4	-38	-44	1.1.1002.3
2.4Ghz	1.1.7 wiphy5	-38	-44	1.1.1002.2
		-38	-44	
		-38	-44	

TR-398 tests to run:

Estimated Test Duration: 10 m

☒ Calibrate Attenuators

☐ Receiver Sensitivity

☐ Range Versus Rate

☐ Downlink MU-MIMO

☐ Maximum Connection

☐ Spatial Consistency

☐ AP Coexistence

☐ Maximum Throughput

☐ Multiple STAs Performance

☐ Long Term Stability

☐ Airtime Fairness

☐ Multiple Assoc Stability

Start

☐ Another Iteration

☐ Pause

Cancel

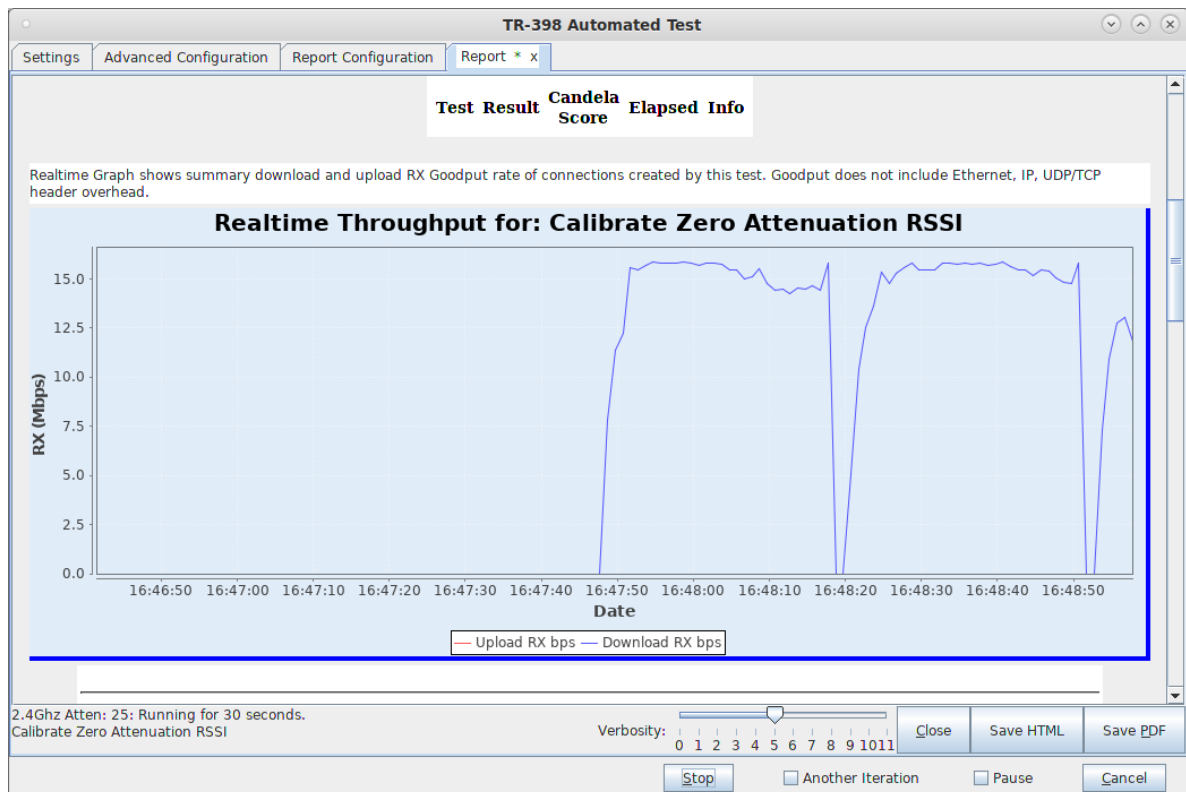
- G. Go to the Advanced Configuration tab and make sure the channels are configured properly, and tune any other settings that you wish to modify.:

The screenshot shows the 'Advanced Configuration' tab of the 'TR-398 Automated Test' window. It contains various settings for the test, including IP ToS, 2.4GHz and 5GHz channels, duration, attenuation, and interferer settings. The 'Start' button is visible at the bottom.

Setting	Value
Save	DEFAULT
Load	DEFAULT
Delete	DEFAULT
IP ToS:	Best Effort (0)
2.4GHz Channel	11 (2462 Mhz)
5GHz Channel	36 (5180 Mhz)
Skip 2.4GHz Tests	☐
Skip 5GHz Tests	☐
Duration-60:	20
Duration-120:	30
Attenuation Adjustment	0
Test Retries:	0
Stop RX-Sens at pass	☒
RxSens-Rate:	65%
RxSens Rotation Degrees:	45
RxSens Start Step:	2
Auto-Calibrate Interferer	☒
Interferer 5G-40Mhz:	Default (90 Mbps)
Interferer 5G-80Mhz:	Default (195 Mbps)
Interferer 2.4G-20Mhz:	Default (32 Mbps)
Spatial Rotation Degrees:	30
Assoc/Disassoc Traffic %:	99
Duration-180:	1-min (1 min)
Stability UDP Duration:	5-min (5 min)
Stability Iterations:	5

Buttons: Start, Another Iteration, Pause, Cancel

- H. When the configuration is complete, click the **Start** button (which will change to 'Stop' once start is clicked) to start the test. An interactive report tab will be created and will be updated as the test runs. For the first run, we will just run the calibration test to auto-configure the path loss by adjusting the attenuators and testing RSSI. If the calibration was acceptable, click Start again to save the calculated zero-RSSI attenuation values for future test runs in which you may decide to skip re-running the attenuation:



- I. After the calibration step is complete, select the desired set of test cases and click Start. The test may run for many hours. If you have the webcam configured, you can watch the rotational tests happen using the 'camorama' program (in Linux), or your own preferred USB webcam program. If using the LANforge machine to view camarama, please set the size to small so that it uses less CPU. When you click start, the Report tab is created, you can view that tab to watch the progress.
- J. 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. You can also click 'Save PDF' and the browser will be directed to open the pdf file directly. Please see this [example TR-398 Test Report](#).