

Setting up Attenuator Connections in LANforge

Goal: Configure the connections between chambers in Chamber View to match the physical cables connecting RF chambers in actuality.

This Chamber View setup will replicate the physical cabled attenuator setup configuration. The Chamber View connections created with this cookbook will allow accurate frequency attenuation in the physical multi-chamber setup during tests such as TR-398, Mesh and other LANforge tests. The physical chamber used in the example below is a 4-RF Chamber setup.



 If the final testbed to be setup has multiple LANforges, check if they need to be clustered and cluster them. Please contact *support@candelatech.com* to help configure the cluster. Example below is the status tab of the manager of a set of clustered systems.

Realm 10					
	Manager/Resource 1				
		Resource 2	Resource 3	Resource 4	
				•• ••	
			•• ==	•••	
		Netsmith	Netsmith	Netsmith	
	Netsmith				
gged in to: localhost:4002 as: Admin					

2. Create chambers in Chamber View that match your testbed setup. The example below is for 4 chambers. If your Chamber View scenario is all setup and ready for attenuator connection setup, skip to step 3.

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. Right-click in Chamber View to create various objects (and the chambers for this example).

0				Chamb	er View	(5.4.5)				\odot	\odot	×
(C)-	ration .			- Scenario Configuratio	on					Manage	è	
	0			Create/I	Modify	Chamber				Scenari	×	
	Chamber Connec	tions										-
		App	pearance								-	
ſ		Name	: Roo	ot		Managed By:	None	-				
		Width:	150	0		Height:	150					
Ιų		Cha	amber									-
		Chaml	ber <u>T</u> ype Un	nknown (0)	-	Isolation	80					
		SMA C	Count: De	efault (16)	-							
				Virtual	Open	🔲 Hide						
		Tur	ntable									rt
		Turnta	able Type NO	DNE (-1)	-							
		Turnta	able			Speed (rpm)						
		Positio	on (deg)			Tilt (deg)						
		Sta	tus									
		DU.	т									
		DUT-1			-	DUT-2		-				
		DUT-3	; [-	DUT-4		-				
		LAN	Nforge Resou	urces								
		LANfo	rge-1 Nor	ne	-	LANforge-2	None	-				
		LANfo	rge-3 Nor	ne	-	LANforge-4	None	-			-	
				Sync Apply		<u>ок</u>	Cancel					
4		_	_	I					•			
🖌 Sh	ow External CX	Show LANforge	Show RSSI	I								
🖌 Sh	ow Attenuators	Show Dut	Ionore Att	tenuation	Info	Print	Sync	Apply	Build Scenario	Close	2	
🖌 Sh	ow WiFi Connections	Show Device Profiles	Apply Mot	tion								
✓ Sh	ow Hidden Chambers	Show Traffic Profiles						Pause Path				

B. Once the 4 chambers are created, the Chamber View window should look similar to below.

	Scenario Configuration		_
upstream	Scenario Configuration	Mobile-Chamber	

- 3. Add LANforge(s) and DUT(s) in their appropriate chambers.
 - A. Create a Device Under Test (DUT) Profile that matches your AP. The BSSID is important to configured so that LANforge knows when it is connected to the correct AP.

•	Create/Modify	/ DUT	\odot \otimes \otimes
Name	APUT	Image file	
SW Info	v5.62.1	HW Info	
Model Number	AP640	Serial Number	234-23-sd-35
Serial port		WAN	
LAN		API version	0
SSID-1	labap	Password-1	Lanforge12345!
SSID-2		Password-2	
SSID-3		Password-3	
Mgt IP	0.0.0.0	Ant-1	0
Ant-2	0	Ant-3	0
BSSID-1	78:d2:94:bf:16:43	BSSID-2	00:00:00:00:00:00
BSSID-3	00:00:00:00:00	Active	AP DUT
STA DUT	WEP	WPA	WPA2
WPA3	Provides DHCP on LAN	Provides DHCP on WAN	
Notes			
	<u>A</u> pply <u>O</u> K	<u>C</u> ancel	

B. Add the DUT to the chamber object by double-clicking the specified chamber that requires the DUT and selecting the DUT from the dropdown under the *DUT* section of the window. If there are no chambers, a fake chamber a chamber can be made, but the test will not be isolated and may not function as desired.

•		c	reate/Modify Cham	ber		×
Name:	DUT	Width:	150	Height:	150	
Chamber Type	TOJOIN-MED (1)	Isolation	80]		
		Pha	antom 🗌 Virtual [Open		
DUT-1	APUT -	DUT-2	SurfacePro4 💌			
DUT-3		DUT-4	-]		
LANforge-1	None	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
•				-	-	Long Cable (100) 🔻
-		•		-	-	Long Cable (100) 🔻
•		•	-	-	-	Long Cable (100) 🔻
•		~		-	-	Long Cable (100) 🔻
•	•	•		~	-	Long Cable (100) 🔻
•		-	•	-	•	Long Cable (100) 🔻
•		-	•	-	•	Long Cable (100) 🔻
-		-	-	-	-	Long Cable (100) 👻
-		-	-	-	-	Long Cable (100) 🔻
		-		-	-	Long Cable (100) 🔻
		-	-	-	-	Long Cable (100) 🔻
		-	-	-	-	Long Cable (100) 🔻
•		-	-	-		Long Cable (100) 🔻
		-		-		Long Cable (100) 👻
		-				Long Cable (100) 🔻
					· · · · · · · · · · · · · · · · · · ·	Long Cable (100)
			OK Cancel]		

C. Add the LANforge to a chamber object. Double-click the specified chamber that requires the LANforge and select the hostname from the dropdown under the *LANforge Resources* tab.

•		Ci	reate/Modify Chamb	er		×
Name:	Tester	Width:	150	Height:	150	
Chamber Type	TOJOIN-MED (1)	Isolation	80			
		Pha	ntom 🗌 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
			Chamber.Tester.0	Chamber.DUT.0	▼ 1.1.71.0 ▼	OTA (0) 🔻
	-	-	Chamber.Tester.1	Chamber.DUT.1	• 1.1.71.1 •	OTA (0) 🔻
•		-	Chamber.Tester.2	Chamber.DUT.2	• 1.1.71.2 •	OTA (0)
			Chamber.Tester.3	Chamber.DUT.3	• 1.1.71.3 💌	OTA (0)
			•	·	-	Long Cable (100) 🛛 👻
	-	-	•	·	-	Long Cable (100) 🛛 👻
	-		•	·	-	Long Cable (100) 👻
			•	·	-	Long Cable (100) 🔻
		-		·	-	Long Cable (100) 🛛 🔻
	-	-	•	·	-	Long Cable (100) 🛛 👻
	-	-		·	-	Long Cable (100) 🛛 👻
	-	-		·	-	Long Cable (100) 🛛 👻
				·	· ·	Long Cable (100) 🛛 👻
	-	-		·	-	Long Cable (100) 🔻
•		•		·	·	Long Cable (100) 👻
•				·	·	Long Cable (100) 👻
			OK Cancel			

- 4. Gather notes for your attenuator connections.
 - A. Looking at the attenuator diagram of the testbed setup, identify where each attenuator goes to. Below is an example of an attenuator diagram of a 4-chamber setup. Another name for the *Node-3* Chamber is the *Root* chamber.



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



C. Gather the serial numbers of the attenuators on the stack and make sure the attenuators are stacked in the same order as on the paper.



D. Trace each attenuator out to the end chambers. In this example, the attenuators are stacked in the same order as the diagram, so we can assume that each name on the diagram (such a B3) corresponds to the according attenuator in the physical stack. On the diagram, B3 is both in Node 2 and Node 3/Root. On the sticky note, B3 has lines to both Root and Node 2.



5. Create all the connections for each chamber.

A. Pick the first attenuator to start connections on. For example, we are first starting with attenuator *A1*, which goes to both *Node-1* Chamber and *Mobile Clients* Chamber. In order to create the lines between those 2 chambers in Chamber View, the connections can be placed in either chamber (but not both). In this example, the connections will be placed in the *Mobile Stations* chamber, under the *Connections* tab.

0					C	Create/Mo	odify	C	hamber						×
Cham	ber Connections														
	Ext CX A		Ext CX B		Ext A	tten			Atten Floor		Zer RSS	ro-Atten SI 2.4Ghz		Zero-Atten RSSI 5Ghz	^
	None	•	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	•
	None	Ŧ	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	Ŧ	None (0 ddB)	·
	None	Ŧ	None	-				•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	·
	None	•	None	•				•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	. =
	None	•	None	•			·	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	•	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	•
	None	Ŧ	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	·
	None	•	None	•			•	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	. H
	None	Ŧ	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	•	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	Ŧ	None	-			·	•	Cable (100 ddB)	-	No	one (0 ddB)	Ŧ	None (0 ddB)	
	None	Ŧ	None	-				•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	•	None	-				•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	•	None	-				•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	•	None	-			•	•	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	
	None	•	None	-				-	Cable (100 ddB)	-	No	one (0 ddB)	•	None (0 ddB)	•
				<u>S</u> ync		Apply		<u>c</u>	OK Cance						

B. Determine the number of SMA cables used for each chamber. For A1, all 8 of the attenuator SMA ports are used, 4 on *Mobile Stations*, 4 on *Node-1*. Add those ports to the connections tab. A side is Mobile Client since it is the chamber open for editing, B is Node-1. First, the port number at the end after the chamber name (Chamber.Mobile-Chamber.0), as long as that port is only used once in any of the connections. Our 4 ports on both A and B sides are 0-3, because those are the first 4 ports that haven't been used yet. None of the attenuator ports haven't been used yet either, so those are 0-3 (serial no 3280, attenuator A1). The atten floor is 0db (OTA) because at some point in thse connections, there is 1 over the air connection. If the attenuator and chambers are strictly cables only, then the atten floor would be cabled. Click *Apply* to save data and *OK* to save data only and close window.

0						Create/Modi	fy C	hamber						×
Chamber	Connections													
		Ext CX A		Ext CX B		Ext Atten		Atten Floor		Zero-Atten RSSI 2.4Ghz		Zero-Atten RSSI 5Ghz		1
		Chamber.Mobile-Chamber.0	•	Chamber.Node-1.0	•	1.1.3280.0	•	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		Chamber.Mobile-Chamber.1	•	Chamber.Node-1.1	•	1.1.3280.1	•	OTA (0 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	
		Chamber.Mobile-Chamber.2	•	Chamber.Node-1.2	•	1.1.3280.2	-	OTA (0 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	
		Chamber.Mobile-Chamber.3	-	Chamber.Node-1.3	-	1.1.3280.3	-	OTA (0 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	
		None	•	None	•		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	•	None	•		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	=
		None	•	None	•		•	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	·	
		None	-	None	•		-	Cable (100 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	
		None	•	None	•		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	•	None	•		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	•	None	•		•	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	·	
		None	-	None	-		-	Cable (100 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	F
		None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	•	None	•		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	-	None	-		-	Cable (100 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	
		None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	
		None	-	None	-		-	Cable (100 ddB)	-	None (0 ddB)	•	None (0 ddB)	•	
		None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	•	-
				<u>S</u>)	/nc	Apply	9	<u>OK</u> ancel	T	1			7	

C. Once the first set of ports are used for a chamber, do not reuse those ports (ports 0-3 were used above for Mobile Stations, Node 1 and Attenuator A1). Attenuator A2 (serial 3281) is the next attenuator to be entered in. In the notes gathered, A2 is between Mobile-Stations and Node 2. Each of the chambers has 4 connections to the attenuator, so those are also added to 'Connections' tab within the Mobile Stations chamber. Those connections can also be added to the Node 2 chamber instead, (but not in both). Notice on the A-side, the next port added was Chamber.Mobile-Chamber.4, since 0-3 are already used up. Since none of the SMA ports are used in Node-2, the SMA ports start at 0 and go til 3. None of the attenuator 3281's SMA ports are used so far, ports 0 to 3 are used. Click *Apply* to save data and *OK* to save data only and close window.

				Create/Mod	ify C	hamber						(\mathbf{x})
Chamber Connections												
Ext CX A		Ext CX B		Ext Atten		Atten Floor		Zero-Atten RSSI 2.4Ghz		Zero-Atten RSSI 5Ghz		^
Chamber.Mobile-Chamber.0	•	Chamber.Node-1.0	-	1.1.3280.0	•	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Mobile-Chamber.1	•	Chamber.Node-1.1	-	1.1.3280.1	Ŧ	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Mobile-Chamber.2	•	Chamber.Node-1.2	-	1.1.3280.2	•	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Mobile-Chamber.3	-	Chamber.Node-1.3	-	1.1.3280.3	-	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	=
Chamber.Mobile-Chamber.4	-	Chamber.Node-2.0	-	1.1.3281.0	-	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Mobile-Chamber.5	•	Chamber.Node-2.1	-	1.1.3281.1	-	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Mobile-Chamber.6	•	Chamber.Node-2.2	-	1.1.3281.2	-	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Mobile-Chamber.7	-	Chamber.Node-2.3	-	1.1.3281.3	-	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	H
None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
None	•	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
None	•	None	-		•	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
None	•	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
None	-	None	-		-	Cable (100 ddB)	•	None (0 ddB)	-	None (0 ddB)	-	
None	-	None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	-	None	-		-	Cable (100 ddB)	T	None (0 ddB)	Ŧ	None (0 ddB)	-	-
		2	ync	Apply	1	OK <u>C</u> ancel						

D. Last example is connections for attenuator A3/T1, which goes from root to mobile chamber. These connections are being added in the Root chamber now. Since no ports (in all chambers of all connections) are used from the Root chamber, ports 0-3 are used on A side. B side (mobile) already has 0-7 ports used in the Mobile chamber, so this example starts with port 8. Click *Apply* to save data and *OK* to save data only and close window.

			Create/Mo	lify	Chamber						
mber Connections											
Ext CX A	Ext CX B		Ext Atten		Atten Floor		Zero-Atten RSSI 2.4Ghz		Zero-Atten RSSI 5Ghz		
Chamber.Root.0	 Chamber.Mobile-Chamber 	r.8 🔻	1.1.3284.0	•	OTA (0 ddB)	•	None (0 ddB)	•	None (0 ddB)	-	
Chamber.Root.1	Chamber.Mobile-Chamber	.9 🔻	1.1.3284.1	-	OTA (0 ddB)	•	None (0 ddB)	-	None (0 ddB)	-	
Chamber.Root.2	Chamber.Mobile-Chamber	r.10 💌	1.1.3284.2	-	OTA (0 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
Chamber.Root.3	Chamber.Mobile-Chamber	c11 💌	1.1.3282.3	-	OTA (0 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	
None	▼ None	-		-	Cable (100 ddB)	-	None (0 ddB)	-	None (0 ddB)	-	

Candela Technologies, Inc., 2417 Main Street, Suite 201, Ferndale, WA 98248, USA www.candelatech.com | sales@candelatech.com | +1.360.380.1618