Cambium Networks™

PMP 450m cnMedusa Demonstration Guide

The PMP 450m is the first fixed wireless broadband access platform with cnMedusa™ technology that provides Massive Multi-User MIMO (Multiple-Input, Multiple-Output) technology in a commercially available cost-effective solution. cnMedusa Massive MU-MIMO technology delivers ground breaking spectral efficiency in a highly integrated package.

For many network operators, seeing is believing. A live demonstration of this capability is required.

This document describes how to set up a Medusa demonstration which will show over 550 Mb/s downlink performance.

The document assumes that the reader is familiar with Canopy and Medusa products.

The high level steps are as follows:

1. Ordering equipment - Equipment List
2. Identifying a suitable location
3. Physically installing the Access Point (AP) and Subscriber Modules (SM)
4. Ensuring configuration parameters are correctly set at the AP
5. Powering up the system
6. Fine adjustment of SM locations
7. Executing a throughput test

If you have difficulty or questions about performing this demonstration, please contact our technical support team at support@cambiumnetworks.com.

1 EQUIPMENT LIST

PART #	DESCRIPTION	QUANTITY	NOTES
C050045A101A C050045A102A C050045A103A C050045A105A	5 GHz PMP 450m Integrated Access Point, 90 Degree ROW) 5 GHz PMP 450m Integrated Access Point, 90 Degree (FCC) 5 GHz PMP 450m Integrated Access Point, 90 Degree (EU) 5 GHz PMP 450m Integrated Access Point, 90 Degree (IC)	1	Medusa AP. Part number depends on region.
C054045C004B	5 GHz PMP 450 Integrated Subscriber Module, Uncapped	7	Use PMP 450 SMs rather than PMP 450i. Better signal handling at short range and lower gain antenna.
C000065L002C	AC+DC Enhanced Power Injector	1	For powering AP
N000900L001B N000900L007A N000900L008A N000900L009A N000900L010A	Gigabit Enet Capable Power Supply - 30VDC, 15W • Cable, UL Power Supply Cord Set, US / IC • Cable, UL Power Supply Cord Set, EU • Cable, UL Power Supply Cord Set, UK • Cable, UL Power Supply Cord Set, Brazil	7	For powering SMs. Line cord part number depends on region.
Recommend Gorilla tripod GSS-200	60 kg rated tripod (any tripod that can support 18.2 kg (40 lbs.) or more will suffice)	1	For mounting AP
Recommend Gorilla GSS-kit	Suitable tripod Recommend 50kg rated pair of tripods and carry bag.	7	For mounting SMs. Quantity of 4 pairs if recommendation of GSS kit chosen
	Suitable Mains Power Generator	1	For powering equipment outdoors
	Suitable laptop	1	For configuring and monitoring the AP and SMs
	3 m length Ethernet cables	8	Between SMs and power supplies and between AP and power supply
	10 m length Ethernet cable	1	For Laptop to AP. This needs to be long as it will be necessary to move between AP and SMs.
	Suitable Mains power extenders	As required	For powering AP, SMs, laptop etc.

Table 1 - Equipment List

2 SELECT THE LOCATION

The demonstration needs to be performed outdoors with no immediate clutter. See the photo below for an example location. Testing indoors does not achieve the desired performance unless conducted in an anechoic chamber.

The distance from the AP to the center SM needs to be 11 feet (3.35 m).

3 INITIAL PHYSICAL INSTALLATION

Install 7 SMs on tri-pods where the antenna face of the center SM is 11 feet from the antenna face of the AP. This is shown in Figure 1.

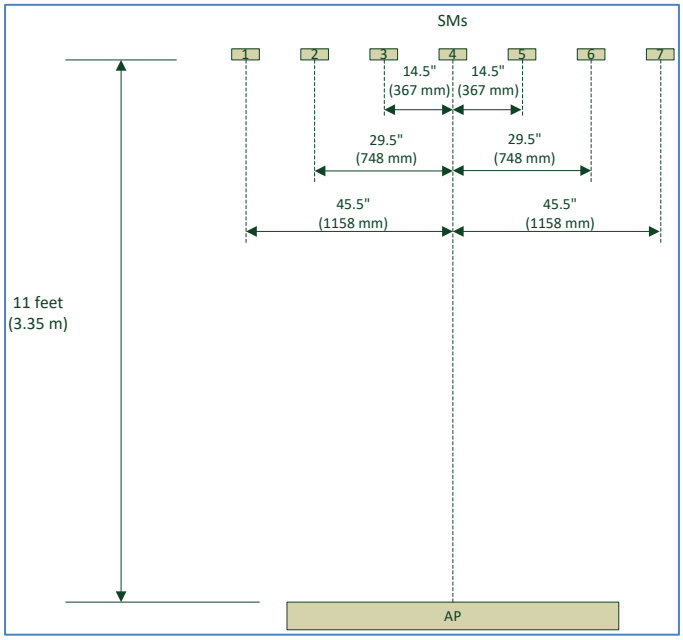

Figure 1 - Birds Eye view of Installation

As a first approximation, position the SMs relative to the center SM with the dimensions shown in Figure 1.

Make sure the center of the AP antenna is at least 5.5 feet (1.67 m) above the ground.

Ensure that the center of the SMs are the same height above the ground as the center of the AP.

Align the AP with a 2° up-tilt. This is required as the AP has an electrical down-tilt of 2°.

4 ACCESS POINT (AP) CONFIGURATION SETTINGS

On the radio configuration page, ensure the AP is configured as follows:

Channel Bandwidth	20 MHz
Max Range:	1 mile
EIRP:	22 dBm
Downlink Data:	85 %
Force Channel Reassessment:	Enabled
Near Field Operation:	Enabled
Near Field Range:	11 feet

Near Field Operation is required to compensate for near field effects.

Force Channel Reassessment is a feature which aids the fine adjustment of SM locations relative to the AP. This should always be disabled for normal operation.

Note that the Force Channel Reassessment, Near Field Operation and Near Field Range attributes only become visible when the radio is transmitting at an EIRP of 22 dBm, the lowest setting. If adjusting the EIRP to 22 dBm from a different value, the AP will need to be rebooted for these attributes to become visible.

5 POWERING UP

The first step is to power up the SMs in a logical order such that Virtual Circuits map sequentially to the physical location of the SM. This is not necessary to make the system work but makes fine adjustments of the SMs much easier. To do this, use the following procedure.

1. Without any of the SMs powered up, power up the AP and ensure that it can be managed from a browser.
2. Power up SM-1 (the far left SM looking from the back of the Medusa).
3. Wait at least 20s and power up SM-2.
4. Wait at least 20s and power up SM-3.
5. Continue this process until SM-7 is finally powered and registered.
6. Check that all SMs are registered and in sequence, i.e. SM-1 is VC 18, SM-2 is VC 19 etc.

Any time the AP is rebooted, it is advised that this procedure is followed.

6 SYSTEM FINE ADJUSTMENT

Fine adjustment is the process of adjusting the locations of the SMs to their optimum position in order to provide a spatial frequency group of 7 SMs. The spatial frequency of each SM can be viewed on the AP Web Interface by selecting Statistics and then the Radio Tab. This is shown in Figure 2 where the bottom of the page shows the spatial frequency, or reference_SF.

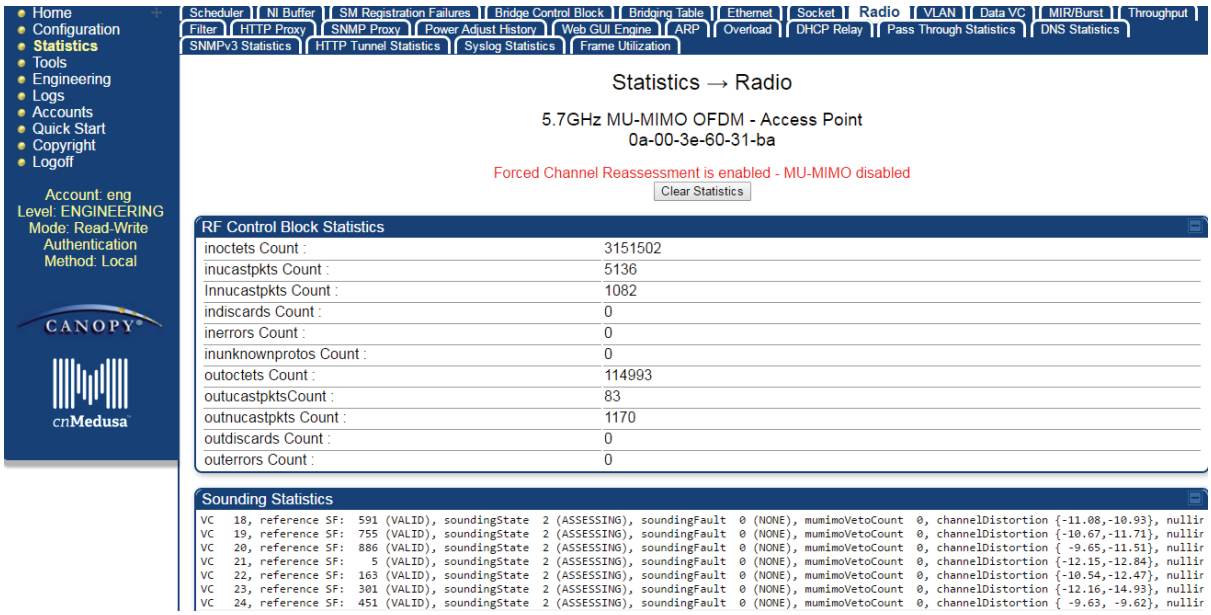

Figure 2 – Viewing Spatial Frequencies

Initially align the center SM (SM-4 or VC-21 if the powering up procedure has been followed) to a reference_SF as close as possible to 0. The value updates every couple of seconds whilst in Forced Reassessment mode.

Note that the values above 0 are 1,2,3,4,5 etc. whereas the values below 0 are 1023,1022,1021,1020, 119 etc. Ensure that the center SM is within this range.

Now adjust the other SMs until their reference_SF values are as shown in Table 2. This depends on the value of the center SM which is shown highlighted in the middle row. For example, if the center SM has a reference_SF of 1023, SM-3 should be adjusted until its reference_SF is 877. Aim to get the reference_SF of each SM within at least +/- 2 of the value specified in the Table 2.

REFERENCE SF											
SM-1	581	582	583	584	585	586	587	588	589	590	591
SM-2	727	728	729	730	731	732	733	734	735	736	737
SM-3	873	874	875	876	877	878	879	880	881	882	883
Center SM-4	1019	1020	1021	1022	1023	0	1	2	3	4	5
SM-5	141	142	143	144	145	146	147	148	149	150	151
SM-6	287	288	289	290	291	292	293	294	295	296	297
SM-7	433	434	435	436	437	438	439	440	441	442	443

Table 2 – reference SF vs SM

7 THROUGHPUT TEST

Prior to the throughput test, ensure that Force Channel Reassessment is disabled.

Monitoring the reference SFs again on the Statistics Radio tab, wait until the sounding state goes to Tracking.

Now perform a link test with the following configuration:

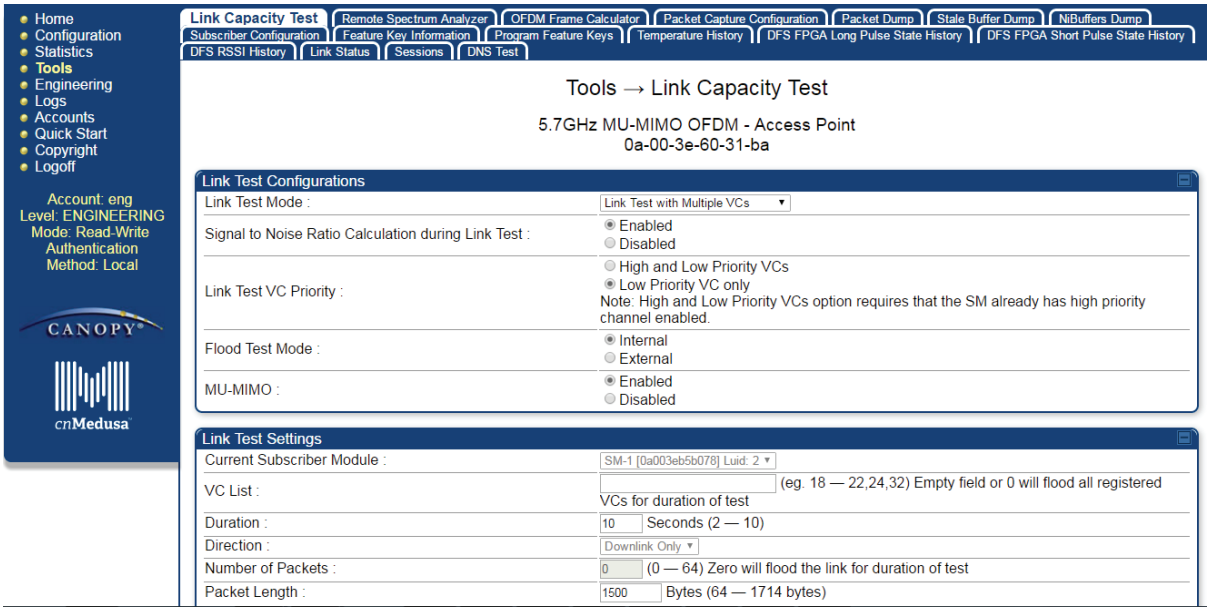

Figure 3 - Link Capacity Test

Current Results Status

Test Duration: 10 Pkt Length: 1500 Test Direction Downlink

Link Test with Multiple VCs

VC	Rate	Efficiency	Fragments		Downlink Rate	
			Transmit	Received	SU-MIMO	MU-MIMO
Total VCs	**566.44 Mbps**	**98**	**11227264**	**11063403**		
18 (Low Priority)	80.52 Mbps	98	1603266	1572753	8X/8X MIMO-B	8X/6X MIMO-B
19 (Low Priority)	82.02 Mbps	99	1604234	1601994	8X/8X MIMO-B	8X/6X MIMO-B
20 (Low Priority)	81.57 Mbps	99	1604294	1593305	8X/8X MIMO-B	8X/6X MIMO-B
21 (Low Priority)	81.89 Mbps	99	1604234	1599551	8X/8X MIMO-B	8X/6X MIMO-B
22 (Low Priority)	81.97 Mbps	99	1604234	1601062	8X/8X MIMO-B	8X/6X MIMO-B
23 (Low Priority)	81.23 Mbps	98	1603701	1586697	8X/6X MIMO-B	8X/6X MIMO-B
24 (Low Priority)	77.21 Mbps	94	1603301	1508041	8X/8X MIMO-B	8X/6X MIMO-B

Slot Grouping

Group Size	% Distribution	Average Slot Count
1	0.0	0
2	0.0	0
3	0.0	0
4	0.0	0
5	0.0	0
6	0.0	0
7	100.0	66

SUMMARY

This demonstration should convey the performance of the PMP 450m. Cambium Networks appreciates your feedback and sharing your experience. We invite you to share images, screen shots, and comments on your demonstrations by posting your experiences to our online Community at **http://community.cambiumnetworks.com** .

Cambium Networks™

Cambium Networks, Ltd.
3800 Golf Road, Suite 360,
Rolling Meadows, IL 60008